European Semiconductor Industry Service Newsletters 1985–1987

Dataquest

a company of The Dun & Bradstreet Corporation

1290 Ridder Park Drive
San Jose, California 95131-2398
(408) 437-8000
Telex: 171973
Fax: (408) 437-0292

Sales/Service Offices:

UNITED KINGDOM
Dataquest UK Limited
13th Floor, Centrepoint
103 New Oxford Street
London WC1A 1DD
England
01-379-6257
Telex: 266195
Fax: 01-240-3653

FRANCE
Dataquest SARL
Tour Gallieni 2
36, avenue Gallieni
93175 Bagnolet Cedex
France
(1)48 97 31 00
Telex: 233 263
Fax: (1)48 97 34 00

EASTERN U.S.
Dataquest Boston
1740 Massachusetts Ave.
Boxborough, MA 01719-2209
(508) 264-4373
Telex: 171973
Fax: (508) 635-0183

GERMANY
Dataquest GmbH
Rosenkavalierplatz 17
D-8000 Munich 81
West Germany
(089)91 10 64
Telex: 5218070
Fax: (089)91 21 89

JAPAN
Dataquest Japan, Ltd.
Taiyo Ginza Building/2nd Floor
7-14-16 Ginza, Chuo-ku
Tokyo 104 Japan
(03)546-3191
Telex: 32768
Fax: (03)546-3198

KOREA
Dataquest Korea
63-1 Chungjung-ro, 3Ka
Seodaemun-ku
Seoul, Korea
(02)392-7273-5
Telex: 27926
Fax: (02)745-3199

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I.C. EUROPE

A Monthly Report on European High Technology Industries

season's greetings

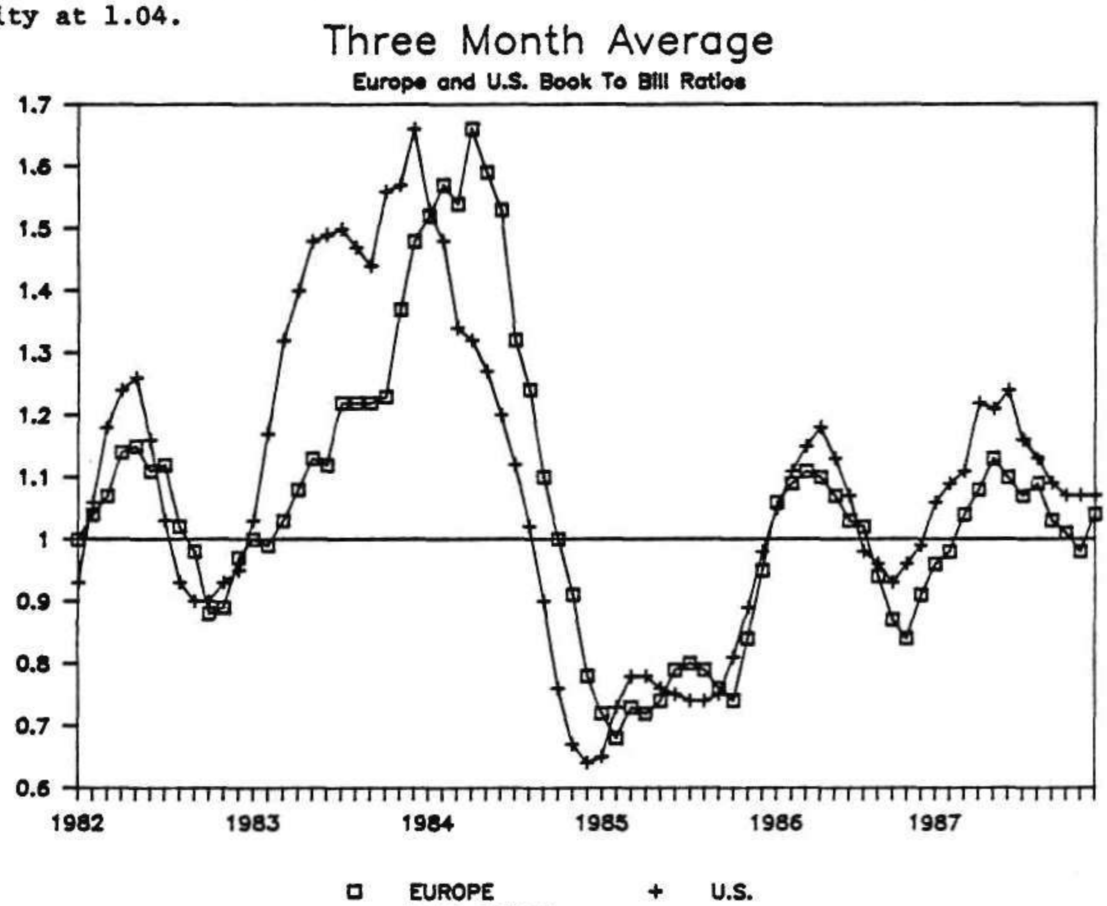
ESIS Code: Vol. IV, Newsletters

EUROPEAN SEMICONDUCTOR DIVISION

NOVEMBER AND DECEMBER MONTHLY REPORT

STOP PRESS

November's European three months average book to bill ratio was back above unity at 1.04.



IN THIS ISSUE

STATE OF THE INDUSTRY

The European three month average book to bill ratio dropped below unity in October, it was 0.98. This was based on slightly increased 3 month average bookings and billings. Three month average billings were $530.6m and bookings were $520.6m, up 6% and 4% respectively on September. This is the first time the book to bill has been below 1 since January 1987.

Undoubtedly this is the result of a rather slow pickup in orders from the summer months. The graph below showing Europe and U.S. book to bill ratios does show a positive sign. The U.S. book to bill for October increased to 1.06 over Septembers 1.04. If the traditional lead-lag phenomenon between the U.S. and Europe comes into play, then the book to bill might have bottomed out.

The other market indicators of price and lead time still tend to favour the buyer. The exception is in the area of MOS memory and some microprocessors. FMV's continue to drive DRAM AND EPROM prices up, and the 1 Mbit DRAM is hard to get hold of. Some 32-bit CPU's are also on long lead times.

The Semi-Custom gate array market continues to be aggressive as vendors try to increase their share of designs. NRE (Non Recurring Engineering costs) which were fairly stable in the first half of 1987, are coming under price pressure with some vendors offering away free NRE and workstation software in order to maintain or increase their existing marketshare.

Reports from various purchasing locations highlight concern about continuity of supply, and customer service support recently merged merging semiconductor vendors. Rationalization of manufacturing facilities, products and process taking place in the newly merged companies, together with changes in sales and customer service personnel can lead to glitches in supply. Special concern is shown for sole-sourced including like ASICs and special VLSI functions like Graphics, LAN and DSP chips.

As more vendors join the list of standard cell suppliers, we expect a similar trend in both NRE and product pricing as more vendors try to get to critical mass in number of designs and revenue base.

INDUSTRY HIGHLIGHTS

Japanese exports win European Community tariffs reprieve in bid to extract better compensation for Japanese trade gains in Spain and Portugal. The EC members are demanding generous market-opening measures from Japan for Spanish and Portuguese exports in return for reduced tariff access to their markets when they joined the community last year. The main products singled out for retaliation include CD players, DAT recorders, video recorders, amplifiers, electric organs, and microwave ovens.

Plessey Purchases Ferranti's Semiconductor Operation
At the end of November The Plessey Company completed purchase of Ferranti's Semiconductor division for $49 million in cash. Ferranti Semiconductors in 1986 had assets valued at $64 million. The company which has no debts and is projected to break even over 1987, had total worldwide semiconductor revenues of $96 million in 1986. Plessey's 1986 Semiconductor revenues were $112 million, making it the sixth largest semiconductor manufacturer in Europe.

European Photocopying Industry presses for Anti-Dumping Investigation against alleged dumping by seven Japanese manufacturers using a new trade law passed in June, designed to prevent Japanese companies avoiding anti-dumping duties by setting up assembly-only plants which allow duties to be extended to imported components. The Committee of European Copier Manufacturers representing Rank Xerox(UK), Olivetti(Italy), Oce(Netherlands) and Tetras(France) have now asked the Commission to launch an investigation of Japanese companies using this law - Canon(France/Germany); Ricoh(UK/France); Minolta, Konica, and Panasonic(Germany)
Toshiba(France) and Sharp(UK).

Plessey wins £7 million System X contract with China Railways following the sale of a £17 million System X exchange to Columbia six months ago. The China contract was awarded as part of the Zhengzhou-Baoji Railway Electrification Project and delivery of the 26 exchanges is scheduled for 1989. Plessey sources say the exchanges will have a capacity of 24,000 lines, indicating a £250 cost per line for each Chinese customer. Other new markets where Plessey is trying to breakthrough with System X include Bulgaria and the Soviet Union.

West Germany and the Soviet Union set to cooperate on reactors as they sign cooperation accord involving Kraftwerk Union (KWU) of Siemens on advanced nuclear reactors. KWU and the Soviet Union will for the next 11 months be focusing on concepts for high temperature reactors (HTR) of 200 to 250MW capacity. The Soviet Union is searching to capitalize on foreign nuclear expertise following the Chernobyl disaster, and is also exploring HTR technologies with rival Brown-Boveri, also a West German industrial group.

GEC set for major phone deal in Ecuador for System X digital telephone exchange. The order estimated at around £17 million for 60,000 lines of exchanges, is expected to be delivered over the next 18 months. The deal which follows GEC's St. Vincent order could lead to substantial follow-up orders. GEC admit they have "put in a highly competitive bid to Ecuador on technical and price grounds" but declined to comment further.

GEC and Plessey plan £600 million merger of telecom businesses in an attempt to create a powerful new force in world markets. The plan is to cover the range of private exchanges, transmission and data communications as well as Stromberg-Carlson, Plessey's Florida based exchange subsidiary. The merger is expected to attract sales of £1.2bn. Operating profits are believed to be about £160 million, its assets will be about £600 million and the entire workforce will be about 23,000, although this is expected to be reduced by rationalization.

Air Liquide in Japanese joint gas venture for the production of Monosilane gas used in the production of semiconductors, solar batteries, LCD's and the sensitive drums of copying machines. The joint venture adopting a new process developed by the Japanese firm Denki Kagaku, for making the gas, allows for increased purity with a relatively low cost of production and will make solar batteries more attractive to consumers. The 51% Japanese interest will be capitalized at Y1.5bn, and production at the plant is scheduled to commence January 1989.

Northern Telecom pays £450 million for 27.8% of STC. The deal requires STC to acquire 40% of Northern's UK subsidiary for a small sum to demonstrate its commitment to the new partnership. Northern will buy the 24% stake held by ITT at £445 million in cash and has already acquired 3.8% on the open market. The two companies plan to collaborate on developing transmission products. Northern were forced to reduce their original stake on STC due to concern shown by Fujitsu which supply key semiconductor technology to ICL who is owned by STC.

European Commission drops Digital Audio Tape move scheduled for next month. The European music industry had lobbied for legislation requiring manufacturers to include an anti-copying device in the system's hardware. The EC intends to produce a green paper on the subject. Following Sony's announcement to launch DAT recorders in Europe next month, added urgency has been given to the industry's lobbying. The Vice-President of the EC, Lord Cockfield, has ruled out calls for interim measures, explaining to the European Parliament that there was no consensus yet on how to stop DAT being used for unauthorized copying.

U.S. snatches ISDN initiative as strong market forces its implementation. ISDN is a concept for using existing telephone systems to a greater advantage - the same lines can be used for voice/non voice communications. DATAQUEST estimates the ISDN market will boom from $370 million to $5.2 billion by 1991. However, not everyone agrees that the US is very far ahead in ISDN. UK's British Telecom already offers a pilot commercial ISDN product. BT has 38 large company customers using 90 ISDN lines, with orders for 80 more lines. Customers pay $820 to $920 connection fees and over $800 in annual rental charges. In addition customers pay regular line usage charges. France and Germany now offer a new trial service after the world standards were set.

EUROPEAN COMPONENTS GROUP ACTIVITY REPORT - NOVEMBER

Dataquest staff presented at the Salon des Composants Electroniques de Paris in mid-November. Malcolm Penn chaired the International Panel Discussion entitled "The Western Semiconductor Industries Face the Japanese Challenge". Jim Eastlake presented information on the status and dynamics of the European ASIC market. One of the key issues to emerge from the panel discussion was the delta between average work hours between the East and the West: 1500 productive hours per person per year in Europe vs. 2000 productive hours per person per year in Japan. Another was the fact that industry leaders must not underestimate the importance of all market members being ale to play by the same rules so that companies can and flourish. Salient points from the ASIC speech were that in 1987 gate array devices were dominant in the European ASIC, arena overtaking full custom for the first time. The fastest growing segment, however, is cell based integrated circuits.

As part of the European Semiconductor Applications Markets (ESAM) activity, a procurement survey was completed. Forty major European users of semiconductors were asked to delineate their purchases of integrated circuits, opto-electronic devices, and discrete devices in 1986 and 1987 in the following categories: data processing, industrial, consumer, transportation, and military. Clients of this segment will receive a newsletter compiling the results and outlining purchasing trends for the near future. Two items that are now in the mail to ESAM subscribers are a service section which gives an overview of the European Robotics Market and a newsletter entitled "The Emerging Strength in European PC Production Capability". Dataquest and its wholly owned subsidiary, Intelligent Electronics Europe, share the prospective of a strengthening committment by PC manufacturers to produce in Europe. Dataquest estimates that PC production in Europe grew, in unit terms, by 12 percent in 1987, reaching an estimated 2 million units. Details on manufacturers of PCs in Europe, plant locations, and product range are contained in the newsletter.

THOUGHT FOR THE MONTH

When the term Dynamic Ram was coined back in the late (60's) I very much doubt as to whether the designers appreciated just how appropriate the term Dynamic was to become. As well as being renowned as a process driver the device and the market pace it has created are now regarded as the architypical volatile semiconductor commodity product. Since the 1K DRAM started volume shipments back in 1972, the price per bit for the device has eratically trended downwards in the direction of the 70 percent learning curve.

1987 was no exception to this being characterised by a positive excursion from the selfsame curve. The volume part; the 256K DRAM moving form a low band of $1.70-$1.90 during the first quarter of the year to the present situation where devices are almost impossible to obtain for less than $3. The initial upwards price movement was a direct result of the U.S./Japan trade agreement. The capacity/price control exercised by the producers in Japan during Q2 this year proved very effective and the price almost overnight moved up to the agreed $2.30 F.M.V. At this point a combination of slowing shipments due to export controls in Japan exacerbated by a number of greedy users applying a J.I.C. (just in case) mentally resulted in prices and leadtimes moving upwards and outwards to the present level.

There are no signs that the 256K is likely to reduce in price in the near future in fact to the contrary. Since all available resources and increases in capacity are being channelled towards the 1 Mbit, I believe that the price per bit crossover point will be driven by the 256K moving up in price. Traditionally the point has been reached by the higher density varient moving down in price. This is projected to occur Q288

<u>The Japanese</u> continue to dominate the DRAM market. Competition amongst the Japanese suppliers is intense. Amongst the Japanese suppliers there is great kudos attached to being first to develop a product and bring it to the marketplace. Toshiba has won the honour over the past two years by beating archrivals Hitachi and NEC to the marketplace with the 256K and 1Mbit respectively. Rest assured that the latter two companies are doing their utmost to ensure it doesn't happen a third time.

Expect 4Mbit samples Q2 next year.

<u>Americans.</u> Texas Instruments and Motorola have regrouped since the 1985 bloodletting and are currently ramping up 1Mbit Production. Motorola being ably assisted by Toshiba processing and engineering expertise. The trade agreement has in effect given these companies a breathing space on the 1Mbit introduction.

<u>In Europe</u> Siemens are promoting their portion of the Megaproject by moving into volume production with a 1Mbit of Toshiba parentage. Whilst R&D activities are increasingly focussed on 4Mbit prototyping.

<u>The Korean companies</u> are in the present capacity limited environment, undergoing a period of consolidation. The massive growth they have enjoyed over the past few years has understandably stretched their organisation and support systems.

It takes a special breed of company and management to successfully chart a course through this roller coaster of a marketplace. The companies manufacturing DRAMS aren't in the marketplace enjoyment. They realise that the devices are a very effective process driver and moreover key part of the future systems on a chip.

Jim Beveridge

Dataquest

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EUROPEAN MONTHLY REPORT

ESIS Code: Vol. IV, Newsletters

EUROPEAN SEMICONDUCTOR DIVISION

SEPTEMBER MONTHLY REPORT

STOP PRESS

EUROPEAN SEMICONDUCTOR INDUSTRY SEMINARS - "IC OUTLOOK 1988"

- 12 October--Paris
- 13 October--Milan
- 14 October--Munich
- 15 October--Frankfurt
- 16 October--Stockholm
- 19 October--London
- 20 October--Edinburgh

The topics which will be covered include:

- Worldwide Technology and Business Trends
- European Semiconductor Industry Update
- Semicustom Technology and Market Overview
- MOS Memory, Microprocessor, Microcontroller and DSP Update
- IC Packaging Review
- European Telecommunications Update

Meetings start at 8.30 am and finish at 4.45pm

EARLY REGISTRATION IS ESSENTIAL TO AVOID DISAPPOINTMENT

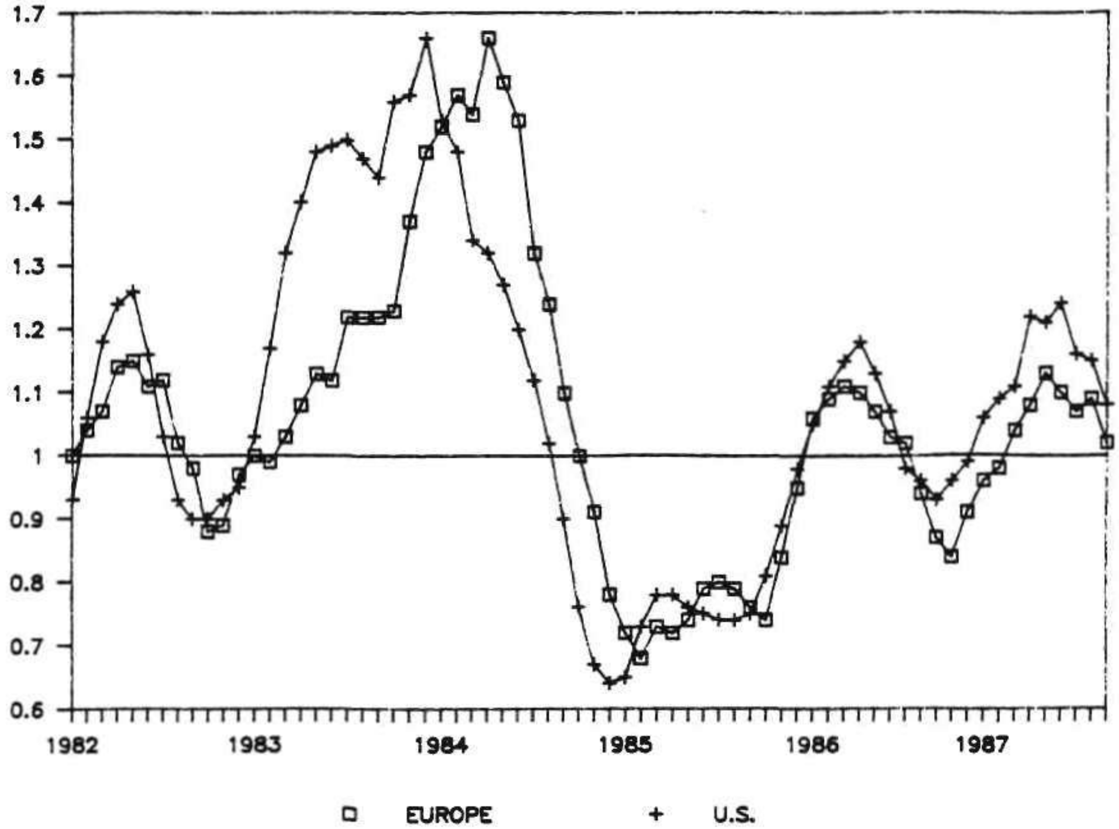
For registration or further details use the reply card in the enclosed IC Outlook '88 brochure, or phone your local Dataquest office.

IN THIS ISSUE

13th Floor, Centre Point, 103 New Oxford Street, London WC1A 1DD ☎ (01) 379-6257 Telex 266195 Fax 01 240-3653

1290 Ridder Park Drive / San Jose, CA 95131 / (408) 971-9000 / Telex 171973

EUROPE AND U.S. BOOK TO BILL RATIOS



STATE OF THE INDUSTRY

August proved to be a typical European holiday month, with bookings in shorter supply (the 3 month average for orders booked dropping from $557.1 million to $497.5 million) and billings struggling to keep up with last months run rate ($467.3 million in July dropping to $453.9 million in September). Overall the book to bill ratio, as reported by WSTS, dropped to 1.02 in Europe from 1.09 and in the U.S. dropped from 1.15 to 1.08.

The graph depicted above shows the US and European Book to Bill ratios from the beginning of 1982 up until August 1987, and reveals a close synchronisation between the perturbations affecting the individual regions. What is interesting is that at present the two markets are in step with one another. An analysis of the dynamics occuring at the product line level shows that product availability and pricing is at present very similar on both sides of the Atlantic. Dataquest believes that overall a reasonable balance is being achieved between on stream capacity and demand. The shortages that are occurring lie mainly in the MOS Memory area with EPROMs and DRAMs continuing to be sought after.

Even here the leading players are continually monitoring capacity versus demand and anxious to keep the situation in balance. No one wishes to experience another 83 - 85 oscillation, and inputs from industry executives give us some confidence that through capacity and inventory monitoring systems, feedback is being applied to damp the cycles.

AUGUST INDUSTRY HIGHLIGHTS

NEC moves to set up production in Scotland--NEC of Japan has decided to manufacture the latest generation of high-powered semiconducter memory products at its plant in Livingston, Scotland. The scale of NEC's commitment at Livingston is large. Tokyo is now quoting £127 million for the upgrading investment in its Scottish plant, 50 percent up on the £80 million cited when 256K manufacturing was announced.

Sony surprises industry with tape launch date--Sony announced plans to launch a revolutionary sound system, the Digital Audio Tape (DAT), in Europe in October. The audio industry is lobbying the European Commission and the U.S. Government for legislation requiring manufacturers to include, in the system's hardware and software, an anti-copying device.

European chipmakers plan lobby on imports--The European semiconductor industry is planning a coordinated lobbying campaign, this autumn, to persuade national governments and the European Commission to take tougher action against some imports.

Ferguson launching pocket-sized colour TV--Ferguson's first significant announcement since it was sold to Thomson of France last month. Ferguson has developed the pocket colour television in conjunction with Seiko Epson, the Japanese electronics group. Ferguson is hoping to achieve 20 to 30 percent of the pocket colour television market, believing that they will not be competing alone in the market for long.

NEC to invest £17 million in U.K. electronics plant--NEC is to build an additional factory at Telford, Shropshire, at a cost of £17 million. The factory will manufacture electronic 24-pin dot-matrix printers. Ninety jobs will be created initially, but the total figure may increase to 200 jobs over five years.

Philips to buy minority share-holding of North American off-shoot--Philips plans to buy out the 42 percent minority share-holding in its North American subsidiary for about $600 million. Mr Cornelius Van der Klugt, Chairman of Philips, felt the move would allow Philips to be more effective in meeting competition in the increasingly global markets.

EC's ambition to create barrier-free internal market--by 1992 is inspiring countries outside the community to reconsider the pros and cons of membership and to rethink their relationship with the EC. In 15 years the number of member states in the EC has doubled from 6 to 12, the Community has established itself as the unchallenged economic and political unit of Europe. With Turkey and Morocco adding their names to the application list, many countries including Norway, Cyprus, Malta, Switzerland and Sweden have been reconsidering their position.

Japan adapts its manufacturing industry--to deal with stong yen. In key international industries, such as cars, consumer and industrial electronics, and office equipment, the Japanese look set to defuse their huge trade surplus. More and more companies have been reviewing profit forecasts upwards. The drive by many Japanese companies to set up factories and develop component sources abroad is beginning to pay off.

Thorn EMI in £16 million Swedish acquisition--Thorn EMI is acquiring Jarkonst, a Swedish-based lighting company, a subsidary of Asea. This is Thorn's third acquisition this month and is a key element in Thorn's strategy to participate in global markets.

Mitsubishi plans £12 million investment in the U.K.--with a plastics components plant at Bridgend in Wales. The factory will come on stream in mid-1988.

Asea to acquire majority stake in Electrisk Bureau (EB)--the Norwegian electrical engineering and telecommunications group, in a deal worth $203 million. As a by-product of the EB takeover, Asea will also acquire a stake in the Norwegian telecommunications market where EB represents Ericsson of Sweden and is a supplier of Ericsson's AXE digitial public switches to the Norwegian PTT.

APT, the telecommunications venure to expand--APT the telecommunications venture between AT&T and Philips has plans to expand in the U.K. with a £17 million investment at its site near Malmesbury, Wiltshire. The investment will go in transmission products and in research and development operation chiefly in adapting AT&T switches to European requirements.

Asea and Brown Boveri plan £2.9 billion merger--Plans were unveiled to combine most of their operations in Europe's biggest ever cross border merger. The new concern will be named Asea-Brown Boveri, will take a world lead in heavy electrical engineering. The new company, which will be owned 50/50 by Asea and Brown Boveri, will have a turnover of about Skr100 billion and approximately 160,000 employees.

Agfa and Philips Du Pont in magnetic tape deal--forming a new European magnetic tape manufacturing consortium in preparation to enter the digital audio tape business. Philips will have a 20 percent stake, Du pont a 20 percent stake, and Agfa-Gevaert, a subsidary of BASF, will hold the remaining 60 percent stake in the consortium. The three partners plan to pool their resources in a rationalisation move aimed at counteracting Far Eastern competition.

U.K. offers for U.S. companies top $18.5 billion--as the wave of British buying across the Atlantic gathers pace.

Racal proposes big expansion in mobile communications--In the 1990's to provide extra competition to British Telecom and Mercury Communications, the key condition for this is giving extra frequencies to cellular communications so cellular phones can penetrate the residential market.

Intel suit against Hyundai--Intel could spark a new chip trade battle between the U.S. and South Korea. Intel has charged Hyundai with "unfair trade acts involving patent infringements". Intel is seeking an exclusion order that would prevent Hyundai EPROMs or any electronic equipment containing Hyundai EPROMs from being sold in the U.S.

EUROPEAN SEMICONDUCTOR DIVISION ACTIVITY REPORT—AUGUST

August was a particularly busy month for the group. From a client care perspective, Kathleen Killian traveled in Germany presenting information on the current state of the industry, and gathering data in preparation for a new product in development. Ms Killian is expanding Dataquest's European database of equipment and materials used for manufacturing semiconductors. The first key area to be completed will be the Wafer Fabrication Data Base, containing details of location, capacity and products for merchant and captive front-ends in the region.

Byron Harding is supporting the growing user-base in Europe of Dataquest's Semiconductor On-Line Services. The On-Line Sevices provides 24 hour/day access to frequently up-dated databases for all the semiconductor services. The service also provides the DQ Monday Report, which is a comprehensive pricing information database for six regional world markets, updated bi-monthly, with Dataquest analysis of pricing trends and weekly news in the industry.
In addition, On-Line Services offer clients the facility for submitting inquiries and receiving replies via e-mail.

The following publications were completed in August

- European Personal Computer Market--Overview (ESAM).
  This service section gives an overview of the European PC market, using information researched by Dataquest's European Personal Computer industry services. Throughout every European country, the Personal Computer market grew dramatically during 1986. In dollars, the European PC market grew 43 percent in 1986 over 1985. In local currency, the market grew 23 percent.

- European Manufacturing Automatic Status--Summer 1987 (ESAM).
  Development and installation of manufacturing automation in Europe is continuing on an aggressive scale, relative to the rest of the world. Dataquest believes that Europe is currently leading the rest of the world in implementation of the relative positions of Western Europe, Asia, and the United States as of early 1987.

- Nixdorf Computer AG--Reaching for the World (ESAM).
  The rise of Nixdorf Computers AG can be considered a success by any standard. This newsletter discusses Nixdor's growth, examines its overall product line and its position as a of intetgrated office systems, and evaluates its marketing strategy in the light of changing end-user requirements.

- European Semiconductor Division News Digest--August (ESIS).
  As an integral part of its European data base, Dataquest maintains an extensive library and information retrieval system covering all information pertinant to the European Semiconductor Industry and the market it serves. The monthly News Digest provides a summary of the items added to the data files during the previous month together with a reference to their services. Clients who have further interest in the data can use their ongoing inqury privileges for assistance.

THOUGHT FOR THE MONTH - THE CHALLENGE FACING DISTRIBUTION

ASICs and Distribution

The semiconductor market has always shown a changing face to the world. Its latest metamorphosis is that of Applications Specific Integrated Circuits (ASICs). As manufacturers wrestle with the complexities of technology and manufacturing involved in bringing devices to production, distributors are trying to come to terms with the new disciplines and support required to bring semicustom products to the mass market.

When the dual-in-line package heralded the introduction of commodity ICs, doubts were voiced regarding the distributor's ability to market complex circuits. Surely comprehension of a component with more than 3 pins was beyond the distribution channel?

Distribution proved the pundits wrong and today offers a first class service to semicondustor users of all sizes, whilst at the same time paring the manufacturer's cost of sales to the bone.

But what of the future of ASICs in distribution? A pool of viewpoints from the industry shows that solutions to the challenge are plentiful--like opinions on advertising, everyone is an expert on what to do in distribution.

On one hand we have a number of distributors willing to embark on a period of investment. To use ASICs, customers must now sit at a workstation and design their own device. To participate in the ASIC market, these distributors envisage playing a very active service role in the design arena. They are putting in place state-of-the-art workstations and software design tools, and in order to help clients make use of them, providing customer training. They are looking to earn their revenues and make their margins in new areas. In the longer term, they expect to profit more from selling services such as training and workstation time, than from selling silicon.

On the other hand a growing number of distributors have chosen not to follow the workstation route. After making an analysis of the potential market relative to their position and resourcing, they have chosen the programmable logic route. They are pinning their hopes on the belief that technology will soon allow them to offer cost effective solutions in the key 1 to 5K gate area.

In both cases, the distributors have to be congratulated in that they have been pragmatic enough to choose a direction and put in the structure and resources to support it. Our concern is for the large number of European distributors who have not yet confronted the opportunity and are sitting still, hoping the issue of system solution trends will either go away or solve itself. It is not going to go away, and pressure from users and manufacturers will ultimately force out a solution. What is becoming increasingly clear is that the procrastinators won't be part of that solution.

Jim Beveridge

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Research Newsletter

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1987-20

PLESSEY BUYS FERRANTI SEMICONDUCTOR

THE FACTS

The Plessey Company acquired Ferranti's Semiconductor operations in November for $49 million in cash.

In 1986, Ferranti Semiconductors had assets valued at $64 million. The company, which has no debt and is projected to break even this year, had total worldwide semiconductor sales of $96 million in 1986. Ferranti employs 2,000 people in its semiconductor operation. The majority of personnel are employed at its manufacturing headquarters in Oldham, England.

Plessey, which achieved worldwide semiconductor revenue of $112 million in 1986, employs 1,200 people. Plessey manufactures semiconductors in Roborough, England.

Of Plessey's total sales, 17 percent are captive, whereas only 7 percent of Ferranti's revenue is derived from its parent.

THE TECHNOLOGY

Some technological/product duplication does exist between the companies, but only to a limited extent. Both companies have been investing heavily in CAD, and both are hoping to penetrate the digital signal-processing (DSP) market. Putting these overlapping efforts to one side, the remainder is a technologically complementary mixture of niche-oriented gate array and cell-based ASIC parts. The products offered by each company are listed in Table 1.

Dataquest Incorporated, 1290 Ridder Park Drive, San Jose, CA 95131-2398, (408) 437-8000, Telex 171973, Fax (408) 437-0292

Table 1

Respective Products of Plessey and Ferranti

Plessey	Ferranti
CMOS gate array	Bipolar gate array
CMOS megacell	Mixed digital/analog gate array
ECL megacell	Mixed digital/analog standard cell
Telecommunications ICs	Discretes
Data conversion	DSP
DSP	
Satellite communication ICs	

Source: Dataquest
December 1987

DATAQUEST ANALYSIS

With combined 1986 revenue of $208 million, Plessey/Ferranti would rank fifth in the new consolidated league of European semiconductor manufacturers. In 1986 individual revenue, Plessey and Ferranti ranked sixth and seventh, respectively, in Europe. Table 2 lists 1986 European semiconductor sales by company.

Table 2

European Companies' 1986 Semiconductor Sales
(Millions of Dollars)

Philips	$1,258
STM*	$ 806
Siemens	$ 442
Telefunken	$ 219
Plessey/Ferranti	$ 208

*SGS Thomson Micro Electronics

Source: Dataquest
December 1987

Dataquest believes that acquiring Ferranti is clearly a step in the right direction for Plessey. The purchase of Ferranti will help Plessey considerably in its efforts to penetrate the European and North American markets. Ferranti has a markedly higher marketing profile in North America than Plessey. The increased revenue will help support Plessey's R&D activities in the ASIC product range. Plessey will also benefit from Ferranti's technology and existing customer base.

The emerging company looks decidedly ASIC in nature. But a closer inspection shows that the useful technology that Ferranti brings to the party is its mixed analog/digital expertise. The resulting ASIC capability would be enhanced with a core CPU and high-density memory cells. This may well lead Plessey to look for other acquisitions, and with $380 million in cash at the bank, there may be more in the pipeline.

Tables 3 and 4 show Dataquest's estimate of Plessey and Ferranti's 1986 European and worldwide semiconductor revenue.

Jim Eastlake

Table 3

Plessey and Ferranti
Estimated 1986 European Semiconductor Revenue
(Millions of Dollars)

	Plessey	Ferranti	Plessey/Ferranti
Total Semiconductor	$78	$66	$144
Total Integrated Circuit	$65	$53	$118
Bipolar Digital	16	28	44
MOS	30	5	35
Linear	19	20	39
Total Discrete	$ 0	$13	$ 13
Transistor	0	6	6
Diode	0	7	7
Thyristor	0	0	0
Other	0	0	0
Total Optoelectronic	$13	$ 0	$ 13

Source: Dataquest
December 1987

Table 4

Plessey and Ferranti
Estimated 1986 Worldwide Semiconductor Revenue
(Millions of Dollars)

	Plessey	Ferranti	Plessey/Ferranti
Total Semiconductor	$112	$96	$208
Total Integrated Circuit	$ 98	$79	$177
Bipolar Digital	30	44	74
MOS	39	11	50
Linear	29	24	53
Total Discrete	$ 0	$17	$ 17
Transistor	0	8	8
Diode	0	9	9
Thyristor	0	0	0
Other	0	0	0
Total Optoelectronic	$ 14	$ 0	$ 14

Source: Dataquest
December 1987

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Research Newsletter

ESIS Code: Vol. IV, Newsletters
1987-19

STOCK MARKET CRASH LOWERS LEVEL OF OPTIMISM

SEMICONDUCTOR MARKET OUTLOOK

At the Dataquest Semiconductor Conference on October 19, we presented our 1988 outlook for the worldwide semiconductor market by projecting 24 percent growth. The worldwide stock market crash that began the same day, however, has prompted us to reevaluate our assumptions and monitor the market for any change in conditions. Although we have seen no signs of major revisions in business plans, the caution that we hear in response to our surveys leads us to consider it critical that we articulate a downside to our original forecast. Given these current cautionary consumer and business expectations, we project the downside to be only 17 percent growth in 1988, as shown in Table 1.

Table 1

Worldwide Semiconductor Market—Downside Estimate
(Percent Change in U.S. Dollars)

	1987	Q1'88	Q2'88	Q3'88	Q4'88	1988
North America	22.6%	1.5%	4.0%	2.2%	1.0%	15.0%
Japan	17.9%	1.5%	2.3%	3.4%	0.3%	17.1%
Europe	22.6%	2.9%	1.9%	0.1%	2.5%	10.7%
Rest of World	65.7%	3.8%	8.8%	7.8%	1.7%	30.2%
Worldwide	24.8%	2.0%	3.6%	3.1%	1.2%	17.0%
Japan (in Yen)	1.8%	1.5%	2.3%	3.4%	0.3%	12.0%
Europe (in ECU)	6.8%	2.9%	1.9%	0.1%	2.5%	10.4%

Source: Dataquest
December 1987

We see a window of opportunity in 1988 for the world semiconductor market in the 17 percent to 24 percent range, as shown in Table 2. Should the caution escalate to panic, resulting in order cancellations and rescheduling, we will modify this bandwidth. No evidence of any such actions exists as yet. Our next scheduled Quarterly Industry Forecast will be issued on January 15, 1988, showing the customary product details for the next eight quarters.

Dataquest Incorporated, 1290 Ridder Park Drive, San Jose, CA 95131-2398, (408) 437-8000, Telex 171973, Fax (408) 437-0292

Table 2

Worldwide Semiconductor Market—Forecast Range
(Percent Change in U.S. Dollars)

	1987	1988
North America	21%-23%	15%-23%
Japan	18%-20%	17%-20%
Europe	20%-23%	11%-17%
Rest of World	65%-68%	30%-41%
Worldwide	24%-25%	17%-24%
Japan (in Yen)	2%-3%	12%-18%
Europe (in ECU)	5%-7%	10%-12%

Source: Dataquest
December 1987

ANALYSIS

A survey of leading economists projects 1988 gross national product (GNP) growth at least one full percentage point lower than the estimates before the crash in both the United States and Japan. The Dun & Bradstreet chief economist, in particular, has lowered his estimate of 1988 real GNP growth in the U.S. from 3.3 percent to 2.8 percent. It is significant to note the deceleration of growth from 3.1 percent in 1987 to 2.8 percent in 1988. Dataquest's own estimate for real gross domestic product (GDP) growth in Japan is for a mild acceleration from 2.5 percent in 1987 to 3.0 percent in 1988, contrasted with our previous estimate of 4.0 percent. We are continually monitoring the impact of the yen appreciation on Japanese electronics exports. We expect the European economy to continue to stagnate at 2 percent growth in 1988.

Dataquest projects that U.S. electronic equipment production will grow 6 to 7 percent in 1988. We had projected earlier that computer and communications equipment production would accelerate into 1988, topping 15 percent growth next year. This accelerated growth would have caused significant inventory build-up and price increases in semiconductors. We now expect 1988 communications equipment production to grow only 6 to 7 percent and computer equipment production to grow 8 to 9 percent. The lower growth ramps, coupled with tightening control over inventories and costs would lower the growth rate in the U.S. semiconductor market by as much as 7 to 8 percent, to only 15 percent.

While the demand should continue to exceed supply in the leading-edge products such as 1Mb DRAMs and high-end microprocessors, we should begin to see softening demand and price erosion for commodity products in 1988.

Japanese electronic equipment production should grow only 6 to 7 percent in 1988; this estimate is lower than our earlier estimate of 10 percent. While we expect the telecom sector to continue to be strong locally, the sharp yen appreciation to the ¥135 level should limit equipment exports and production. The net result is a 12 percent growth in the Japanese semiconductor market, measured in yen.

Electronic equipment production in Europe is expected to be very soft, with only 3 to 5 percent growth in 1988. This lowers the European semiconductor market growth rate to only 10 percent in 1988, measured in local currency.

The Rest of World market, including Asia/Pacific, is most sensitive to the U.S. economy; we anticipate softness here, compared with the high growth in 1987. The saving grace is that the Korean Olympics should bolster local demand.

In summary, we are presenting a downside to our 1988 worldwide semiconductor market estimate, anticipating cautionary consumer and business expectations as a result of the less optimistic investor expectations evidenced by the recent stock market crash. At the downside, our level of optimism is lowered to 17 percent growth in the worldwide semiconductor market in 1988.

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Jim Beveridge
Joseph Borgia

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Research Newsletter

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SUPERCONDUCTIVITY—THE OPPORTUNITIES, IMPLICATIONS, AND APPLICATIONS

SUMMARY

International Business Communications (IBC) in conjunction with The Advanced Energy Research Institute and The Watt Committee on Energy held a one-day conference on superconductors in London on October 19, 1987. The timeliness of and interest in this conference can be judged from the fact that 190 delegates attended, drawn from government departments; universities; and manufacturing, finance, and research and development (R&D) establishments.

The recurring theme at the conference was that, before the field of application can be greatly widened, considerable R&D is needed for a fuller understanding of the phenomenon of superconductivity and the materials to be used. While great strides have been made, room-temperature superconductivity may still be many years away. Meanwhile, the worldwide market for superconductors is growing rapidly, and it is estimated that in the next ten years this market could grow some twenty-fold, to U.S.$21 billion.

There are important implications for the semiconductor industry. As a result of diminished feature size, the demand for X-ray lithography in the manufacture of logic and mass memory devices will increase significantly in the 1990s. The advent of true room-temperature superconductors will lead to a complete upheaval in the electrical equipment industry as new designs will be required across the board, leading to the creation and growth of new industries.

The message was clearly that scientists (pure and applied), industrialists, and providers of finance should be brought together at an early stage in order to successfully exploit the opportunities offered by what could be called the start of the "Superconductor Age."

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SPEAKER HIGHLIGHTS

The following are highlights of the conference presentations:

- "What Will It Require to Take Industrial Advantage of the New Superconductors?"—Dr. George Keyworth, Chairman of The Keyworth Company, Former Chief Scientific Advisor to the President of the United States

  - Recently there has been considerable excitement caused by reports that certain mixtures of ceramic compounds demonstrate zero resistance at relatively high temperatures. While important strides have been made in raising the temperature at which superconductors operate, from about 23 Kelvin (liquid helium boiling point) to 77 Kelvin (liquid nitrogen boiling point), cryogenic systems are still required. In order to put these temperatures in perspective, the conversion from centigrade to Kelvin is: $0^{o}C = 273^{o}K$. How far and on what time scale it is going to be possible to push temperature limits is not known, as critical current density, which is a limiting factor in performance, is highly temperature-dependent. This is not a permanent limitation but the problem has to be solved, and will be, as the entire phenomenon of superconductivity is more fully understood.

  - The widening of applications depends not only on understanding the chemical characteristics of superconducting materials but also on their mechanical properties. Because they are ceramic they are brittle, and pose formidable problems in the fabrication of useful devices that have to withstand stresses caused by the intense magnetic fields that many superconducting applications impose.

  - In the United States, the government has made superconductivity R&D a high priority. In the current fiscal year, there are estimates that the U.S. government will support about US$100 million in R&D (up from US$30 million last year) and that U.S. private industry may approach that same level of expenditure in its own programs.

  - Industry faces tough decisions about what paths to follow. One approach in the United States is to form a trade group organized not around an industry, but around a technology that cuts across different business sectors. This group, known as the Council on Superconductivity for American Competitiveness, is, in part, an information exchange capable of merging technical expertise with business interests—a forum for business, government, and academics, as well as a place for smaller companies to keep in touch with developments in superconductivity that could affect them in the years ahead.

  - Meanwhile, work is, and should continue to be, concentrated on understanding and improving the group 1-2-3 materials; but at the same time, attention should be focused on how to apply superconductivity to meet today's needs. An early applications opportunity is in thin-film superconductors in microelectronics, where critical current densities may not be a serious problem. This should lead to superconductors being used in diverse areas such as high-speed switching, information storage, sensors, and novel analog devices.

- "The Development of Metallic Superconductors in the UK"—A.C. Barber and Dr. T.W. Farthing, IMI Titanium Limited, Birmingham, England

  - The historical development of superconductors is traced from earliest days using pure metals—Type I superconductors showing a critical temperature of about 3 Kelvin to 1-2-3 high-temperature materials based on $YBa_2Cu_3O_7$ showing a critical temperature of 90 Kelvin. IMI's work on niobium and titanium for gas turbines has led to the use of NbTi alloys in metallic superconductors.

  - Recent studies have been directed at nonstoichiometric forms of titanium dioxide, TiO_2. By reducing the oxygen content of TiO_2, which has an extremely high electrical resistivity, to make the composition Ti_4O_7, the substance known as "Ebonex" changes not only from brilliant white to black, but, more importantly, its resistivity is reduced by about 20 orders of magnitude to approximately that of graphite. Major property changes are therefore possible by small changes in composition and structure to produce "defect lattices."

  - IMI takes the view that because of the highly complex nature of these ceramic substances, the close cooperation of R&D personnel, end users, and producers of both materials and devices will be essential if the optimum design characeristics of components—both electrical and mechanical—are to be realized.

- "From Discovery to Delivery"—Sir Kenneth Corfield, Director Midland Bank, Britoil and Octagon Group

  - Scientists all too often have little understanding of the commercial and financial processes that are needed to initiate steps to protect and develop their discoveries. Conversely, those concerned with commerce and finance invariably lack the appropriate technological background to sustain the discovery in its post-natal days. It is vital to enlist the support of a sponsor at an early stage; one who is capable of bridging the gaps of understanding between science, commerce, and finance and of bringing about mutual confidence.

  - The various ways in which an invention may be protected need to be detailed. It is all too often assumed that coverage of an invention by a national patent gives worldwide protection. This is not necessarily the case, and the rules applying in different countries must be studied. An alternative worth considering may be the use of copyright. There is also the option of total secrecy, which may be the best course of action if there is a low probability of the invention being discovered by others.

  - If, as a result of limited resources, exploitation of the invention is hindered, then licensing is worth considering. The use of competitors in partnership for rapid exploitation is also a possibility.

- "Superconductivity: The Opportunities, Implications, and Applications—A Government View"—J. Howarth, Department of Trade and Industry (DTI)

  - The DTI estimates that the potential worldwide market for superconductors is approximately three quarters of a billion U.S. dollars. Medical and instrumentation applications account for US$500 million and US$200 million, respectively, with the electronics industry accounting for the rest. It is estimated that by 1992, half the market for superconductors will be in the electronics industry. Within ten years, the worldwide market for superconductors is forecast to rise to some US$21 billion.

  - The time scale for the development of diverse applications will vary. Power lines, power generation, and storage applications are probably 12 to 15 years away. Within 4 to 5 years, it is likely that the expansion of superconductors will be seen in toys and kits, magnetic shielding, interconnectors, and superconducting quantum interference devices (SQUIDS).

  - Substantial work has yet to be done to overcome technical and process problems. International competition will be fierce to gain technological leadership and secure market niches. Major efforts will be required to ensure that companies are able to exploit new opportunities as these arise.

- "Applications to Electrical Machinery and Power Generation"—Dr. A. Appelton, Technical Director, N.E.I. International Research and Development Co. Ltd., Treasurer, The British Cryogenics Council

  - Superconductors have considerable future applications such as: DC motors and generators, AC generators, power transformers, power cables (which could be a major application), fault current limiters (developed by NEI), and magnetic energy storage.

  - As and when room-temperature superconductors become available, it may be necessary to redesign every piece of electrical equipment extant, thus creating massive opportunities for new industrial development. The impact would be so significant in the electronics industry and the ramifications for companies so far reaching, that early consideration should be given to the consequences of the change and the market position to be adopted to meet the challenge.

- "Applications of Superconductors in Medicine and Research"—Dr. P. Williams, Chief Executive, Oxford Instruments

  - Nuclear magnetic resonance, currently the widest area in which the technology of superconductivity is used, focuses on the production of homogeneous high-magnetic fields up to 15 Telsa. Spectroscopic analysis in the chemical and pharmaceutical industries, and tomographic scanning as a diagnostic imaging modality in medicine are two important future applications.

- Accelerators in high-energy physics, prototype levitated trains, and SQUIDS used in submarine detection or biomagnetic studies are also promising areas of application.

- In the 1990s, logic and mass memory manufacturers will use X-ray lithography to produce the minute line widths necessary for ultra large-scale integration of semiconductor devices. Superconductors will be used in the manufacture of X-ray lithographic equipment, thus reducing the size of the machinery, giving a smaller "footprint", and reducing the cost of the machine due to the use of cheaper refrigerants (liquid nitrogen rather than liquid helium).

- "Opportunities and Fallacies in Superconducting Engineering"—Professor W. Gosling, Technical Director, Plessey

  - The potential of superconductivity will be most striking in the electrical power industry. Superconductors will have to carry much higher current densities than at present, and this may depend on developing suitable new materials, possibly of a monocrystalline type. R&D should be targeted toward using current technology (requiring liquid nitrogen cooling) rather than losing time and expending resources in the development of room-temperature superconductors, which would have a technology with characteristics unique to themselves and thus require radical alterations to standard equipment design.

- "Superconductors—From Science to Business"—Sir Martin Wood, Deputy Chairman, Oxford Instruments

  - Application of the results of scientific research in industry can lead to successful growth of businesses that recognize the opportunities and measure up to the challenge. Since government funding is not getting any easier, universities and research institutes are becoming increasingly keen to cooperate with industry. This takes time to implement. Superconductivity is considered to hold immense opportunity for those capable of recognizing its commercial exploitation.

DATAQUEST ANALYSIS

While great strides have recently taken place in the development of so-called "high-temperature" superconductors (albeit still operating at quite low temperatures), there remains a great deal of research to be undertaken before true room-temperature superconductors are a reality. Clearly, the race is now on, with many research groups throughout the world expending a great deal of money and time in pursuit of this goal. The development of room-temperature superconductors would open up a whole new world of applications (hitherto almost undreamed of) for the late 1990s and twenty-first century.

The successful exploitation of superconductivity will have a profound impact on the electronics and electrical industries. For example, superconductors are being proposed as board and chip interconnects in computers, the resulting decrease in resistance thus reducing switching time and lowering heat generation. In the heavy electrical and power industry, superconductors hold the promise of cheaper transmission costs. All these developments will require a new approach on the part of equipment and raw material suppliers, and new industries will spring up to support the new technology. Accepting that there is still much to be done, the prospects for the Superconductor Age are exciting.

Kathleen Killian

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EXCHANGE RATE QUARTERLY NEWSLETTER

SECOND QUARTER 1987

Dataquest exchange rate tables involve data from many countries, each of which has different and variable exchange rates against the U.S. dollar. As much as possible, Dataquest estimates are prepared in terms of local currencies before conversion (when necessary) to U.S. dollars. Dataquest uses International Monetary Fund (IMF) average foreign exchange rates for historical data.

All forecasts are prepared assuming no changes in any exchange rate from the last complete historical year—in this case, 1986. During the course of the current year, as local currency exchange rates vary, the appropriate U.S. dollar value changes accordingly. To maintain consistency across all its analyses, Dataquest does not make ongoing adjustments to its forecasts for these currency changes during the current year. As a result of this policy, as the year progresses the forecast numbers could become distorted, in dollars, should the European currencies deviate substantially from the previous year's rates.

Dataquest monitors the exchange rates on a weekly basis using IMF exchange rates, supported by Financial Times exchange rates when IMF data are not yet available. (Financial Times is the accepted U.K. newspaper giving daily updates.) Effective exchange rates for the current year are calculated each month. This information is then used to assess the local currency's impact on U.S. dollar forecasts.

The purpose of this newsletter, which will be updated quarterly, is to record these changes, and thus allow the reader to make any necessary adjustments when interpreting regional data. For each European region, Table 1 gives the local currency per U.S. dollar for 1986, first quarter 1987, and second quarter 1987, together with the latest estimate for the whole of 1987. Also shown, for reference purposes, are the same figures for the Japanese yen. As can be seen from this table, the weighted average for all the European currencies for 1987 has decreased 14.8 percent with respect to the U.S. dollar, compared with 1986. This represents an increase of 2.0 percent in the exchange rate from first quarter 1987 to second quarter 1987. Table 2 shows the 1987 quarterly values for the same regions.

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Table 3 illustrates how to interpret the effect of the currency shifts on the Dataquest forecast numbers. For example, the table shows that the constant dollar forecast of $5,906 million for the 1987 total European semiconductor market becomes $6,780 million when adjusted for changes in European currencies.

Table 4 shows the 1987 monthly values of local currency per U.S. dollar for each European region and Japan.

Byron Harding

Table 1

European Currencies—1986 to 1987
(Local Currency per U.S. Dollar)

Region	1986	Q1 1987	Percent Change Q1-Q2	Q2 1987	Latest Estimate 1987	Percent Change 1986-1987
Austria	15.26	12.93	(1.9%)	12.69	12.79	(19.3%)
Belgium	44.66	37.13	0.6%	37.37	37.46	(19.2%)
Denmark	8.09	6.95	(2.4%)	6.79	6.84	(18.3%)
Finland	5.07	4.56	(3.9%)	4.39	4.45	(13.9%)
France	6.92	6.12	(1.7%)	6.02	6.08	(13.8%)
Ireland	0.75	0.69	(1.5%)	0.68	0.68	(10.3%)
Italy	1,490.00	1,306.20	(0.6%)	1,298.10	1,309.83	(13.8%)
Luxembourg	44.66	38.13	(12.0%)	34.04	37.71	(18.4%)
Netherlands	2.45	2.08	(2.5%)	2.03	2.05	(19.5%)
Norway	7.39	7.04	(5.1%)	6.70	6.79	(8.8%)
Portugal	149.54	141.65	(1.1%)	140.06	141.37	(5.8%)
Spain	139.97	128.94	(2.2%)	126.12	126.87	(10.3%)
Sweden	7.12	6.51	(3.3%)	6.30	6.37	(11.8%)
Switzerland	1.80	1.55	(4.0%)	1.49	1.51	(19.2%)
United Kingdom	0.68	0.65	(6.6%)	0.61	0.62	(9.7%)
West Germany	2.17	1.84	(2.2%)	1.80	1.82	9.6%
Weighted Average (Base 1980 = 100)	145.89	129.23	(2.0)	126.75	127.08	(14.8%)
Japan	168.49	153.17	(7.4%)	142.57	146.27	(15.2)

Source: IMF
Dataquest
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Table 2

European Currencies—1987 by Quarter
(Local Currency per U.S. Dollar)

Region	Q1	Q2	Q3*	Q4*	Total Year*
Austria	12.93	12.69	12.69	12.69	12.79
Belgium	37.13	37.37	37.37	37.37	37.46
Denmark	6.95	6.79	6.79	6.79	6.84
Finland	4.56	4.39	4.39	4.39	4.45
France	6.12	6.02	6.02	6.02	6.08
Ireland	0.69	0.68	0.68	0.68	0.68
Italy	1,306.20	1,298.10	1,298.10	1,298.10	1,309.83
Luxembourg	38.13	34.04	34.04	34.04	37.71
Netherlands	2.08	2.03	2.03	2.03	2.05
Norway	7.04	6.70	6.70	6.70	6.79
Portugal	141.65	140.06	140.06	140.06	140.06
Spain	128.94	126.12	126.12	126.12	126.12
Sweden	6.51	6.30	6.30	6.30	6.30
Switzerland	1.55	1.49	1.49	1.49	1.51
United Kingdom	0.65	0.61	0.61	0.61	0.62
West Germany	1.84	1.80	1.80	1.80	1.82
Weighted Average (Base 1980 = 100)	129.23	126.75	126.75	126.75	127.08
Japan	153.17	142.57	142.57	142.57	146.27

*Forecast

Source: IMF
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Table 3

Effect of Changes in European Currencies per U.S. Dollar On Dataquest Forecasts—1986 versus 1987 (Millions of Dollars)

	1986	1987	Percent Change 1986-1987
European Semiconductor Consumption (At constant 1986 exchange rates)	$5,532.00	$5,906.00	6.8%
Weighted European Currency (Assumed) (Base 1980 = 100)	145.89	145.89	N/M
Weighted European Currency (Latest estimates)	145.89	127.08	(12.9%)
Effective Consumption (At June YTD exchange rates)	$5,532.00	$6,780.00	22.6%

N/M = Not Meaningful

Source: IMF
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Table 4

European Currencies—1987 by Month
(Local Currency per U.S. Dollar)

Region	Jan.	Feb.	Mar.	Apr.	May
Austria	13.05	12.85	12.89	12.73	12.55
Belgium	35.59	37.82	37.99	37.53	36.93
Denmark	7.05	6.90	6.90	6.83	6.71
Finland	4.63	4.55	4.50	4.42	4.34
France	6.19	6.08	6.10	6.03	5.95
Ireland	0.69	0.68	0.69	0.68	0.67
Italy	1,314.70	1,299.30	1,304.60	1,292.20	1,284.70
Luxembourg	38.59	37.82	37.99	37.53	36.93
Netherlands	2.10	2.06	2.07	2.04	2.01
Norway	7.17	7.01	6.93	6.77	6.64
Portugal	142.38	141.35	141.23	139.92	138.38
Spain	129.40	128.70	128.73	126.95	125.20
Sweden	6.60	6.51	6.41	6.31	6.24
Switzerland	1.56	1.54	1.54	1.50	1.46
United Kingdom	0.66	0.65	0.63	0.61	0.60
West Germany	1.86	1.83	1.83	1.81	1.78
Weighted Average (Base 1980 = 100)	-	-	-	-	-
Japan	154.48	153.48	151.54	142.98	140.04

(Continued)

Table 4 (Continued)

European Currencies—1987 by Month
(Local Currency per U.S. Dollar)

Region	June	July*	Aug.*	Sept.*	Oct.*
Austria	12.78	12.78	12.78	12.78	12.78
Belgium	37.66	37.66	37.66	37.66	37.66
Denmark	6.82	6.82	6.82	6.82	6.82
Finland	4.42	4.42	4.42	4.42	4.42
France	6.08	6.08	6.08	6.08	6.08
Ireland	0.68	0.68	0.68	0.68	0.68
Italy	1,317.50	1,317.50	1,317.50	1,317.50	1,317.50
Luxembourg	37.66	37.66	37.66	37.66	37.66
Netherlands	2.05	2.05	2.05	2.05	2.05
Norway	6.70	6.70	6.70	6.70	6.70
Portugal	141.88	141.88	141.88	141.88	141.88
Spain	126.20	126.20	126.20	126.20	126.20
Sweden	6.34	6.34	6.34	6.34	6.34
Switzerland	1.51	1.51	1.51	1.51	1.51
United Kingdom	0.61	0.61	0.61	0.61	0.61
West Germany	1.82	1.82	1.82	1.82	1.82
Weighted Average (Base 1980 = 100)	-	-	-	-	-
Japan	144.68	144.68	144.68	144.68	144.68

*Forecast

(Continued)

Table 4 (Continued)

European Currencies—1987 by Month
(Local Currency per U.S. Dollar)

Region	Nov.*	Dec.*	1987*	1986	Percent Change 1986-1987
Austria	12.78	12.78	12.79	15.26	16.2
Belgium	37.66	37.66	37.46	44.66	16.1
Denmark	6.82	6.82	6.84	8.09	15.5
Finland	4.42	4.42	4.45	5.07	12.2
France	6.08	6.08	6.08	6.92	12.1
Ireland	0.68	0.68	0.68	0.75	9.3
Italy	1,317.50	1,317.50	1,309.83	1,490.00	12.1
Luxembourg	37.66	37.66	37.71	44.66	15.6
Netherlands	2.05	2.05	2.05	2.45	16.3
Norway	6.70	6.70	6.79	7.39	8.1
Portugal	141.88	141.88	141.37	149.54	5.5
Spain	126.20	126.20	126.87	139.97	9.4
Sweden	6.34	6.34	6.37	7.12	10.5
Switzerland	1.51	1.51	1.51	1.80	16.1
United Kingdom	0.61	0.61	0.62	0.68	8.8
West Germany	1.82	1.82	1.82	2.17	16.1
Weighted Average (Base 1980 = 100)	-	-	127.08	145.89	12.9
Japan	144.68	144.68	146.27	168.49	13.2

*Forecast

Source: IMF
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SECOND QUARTER START-UP UPDATE

The second-quarter update on start-up companies includes information on new company formations, acquisitions, and company announcements made in the second quarter. It also includes information on financing raised and agreements made in the first half of 1987.

HIGHLIGHTS

Second-quarter highlights include the following:

- Four companies were formed in 1987.
- European Silicon Structures and Microwave Technology have made acquisitions.
- VTC became a wholly owned subsidiary of Control Data Corporation.
- Approximately $238.3 million was raised in new and additional funding in the first half.
- Twenty-six agreements were signed by start-up companies in the first half.
- Significant management announcements were made.
- International Microelectronic Products went public.
- VLSI Technology broke ground on a 25,000-square-foot wafer fab in Texas.

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NEW COMPANIES

GL Micro Devices

GL Micro Devices was formed in February 1987 to develop high-performance, advanced CMOS products. The company was founded by Norman Godinho and Frank Lee, both formerly with Integrated Device Technology. Glenwood Management and El Dorado Ventures participated in $2.4 million seed financing, which was completed in April of this year.

Mr. Godinho served as vice president and general manager of IDT's digital signal processing division, and Mr. Lee was codirector of IDT's corporate research and development group.

LOGICSTAR Inc.

LOGICSTAR was formed in 1987 to design, manufacture, and sell high-performance PC AT logic, VLSI graphics, and local area network chips. The company is addressing the PC AT market and is using a VLSI design methodology to bring products to market quickly.

LOGICSTAR was formed by Mark Kaleem, who was formerly president of OSM Computer and Unilogic. Vice president of marketing is Saeed Kazmi, who was formerly with VLSI Technology Inc. in technical sales support.

LOGICSTAR's initial products are a five-chip PC AT chip set that is pin-for-pin compatible with Chips & Technologies' chip set, a monographics controller, a dual-channel NRZI encoder/decoder, and a STARLAN interface chip. Future products will include a VGA chip, PS/2 chip, 386 chip sets, additional data communication chips, and disk controllers.

Foundry services are being provided by companies in the United States and Japan.

Ramax Limited

Ramax Limited is an Australian-based company that is being formed through a $45 million joint venture between Australia's state of Victoria and other investors. A development company owned by the state of Victoria is providing $850,000, for which the state will receive between 7 and 13 percent equity in the company, with the balance in first-round equity coming from both U.S. and Australian investors. The financing should be complete by September 30.

Peter J. Solomon is executive director of Ramax, and Dr. Bruce Godfrey is manager of product and technology development. Dr. Godfrey has been an adjunct assistant professor at the University of Colorado and one of the researchers involved in developing technology the company will be using.

Ramax has licensed high-speed, nonvolatile memory technology using a ferroelectric semiconductor process and a companion technology that uses a thin-film process from Ramtron, an Australian R&D company located in Colorado Springs, Colorado. Ramax acquired a 12 percent stake in Ramtron for $8.0 million and paid $6.9 million in licensing fees.

Initially, the company will produce prototype silicon-based circuits using Ramtron's technology. Future plans include the manufacture of GaAs circuits using the ferroelectric thin-film technology under terms of a license that gives Ramax exclusive worldwide rights to use the Ramtron technology on GaAs.

SIMTEK Corporation

On May 15, 1987, Dr. Richard L. Petritz and Dr. Gary F. Derbenwick announced the formation of SIMTEK Corporation, which will develop, manufacture, and market a broad range of advanced semiconductor products. The company will initially focus on new memory components for consumer, commercial, and government markets.

Dr. Petritz, a founder of Mostek and Inmos, will serve as chairman and chief executive officer of the company. Dr. Derbenwick, who was formerly product technology manager at Inmos, will serve as president and chief operating officer.

The initial capitalization for SIMTEK is from Nippon Steel Corporation of Japan, which will own about 20 percent of the company and have a seat on the board. Nippon Steel produced 28 million tons of steel products in 1986, with sales of $15 billion. The investment by Nippon Steel is part of a diversification plan to expand into other business areas.

SIMTEK's headquarters are located in Colorado Springs, Colorado. During the next three months, the company will be conducting studies for its permanent U.S. facilities, which will include a substantial manufacturing capability. The company plans to begin manufacturing within the next 18 months.

MERGERS AND ACQUISITIONS

European Silicon Structures

European Silicon Structures (ES2) is negotiating to acquire Lattice Logic Ltd., an Edinburgh-based silicon compiler software house. ES2 has been marketing Lattice Logic's compilers in Europe since 1985. The merger should give Lattice Logic financial security and the finances to develop software with ES2.

Microwave Technology, Inc.

Microwave Technology, Inc. (MwT), completed the acquisition of Monolithic Microsystems, Inc., of Santa Cruz, California, in June 1987. Monolithic Microsystems makes detector log video amplifiers (DLVAs), logarithmic video amplifiers (LVAs), and threshold detectors, based on its proprietary monolithic silicon LVA ICs. Monolithic Microsystems is manufacturing devices used in various electronic warfare systems and other defense electronic applications.

MwT designs, manufactures, and sells GaAs epitaxial materials, GaAs field-effect transistor devices and monolithic circuits, hybrid microwave ICs, and microwave subassemblies.

Monolithic Microsystems will operate as a wholly owned subsidiary of MwT and will continue its manufacturing operations in its 8,200-square-foot Santa Cruz facility.

VTC, Inc.

VTC has signed a merger agreement under which it will become a wholly owned subsidiary of Control Data Corporation, its largest investor and major customer. The companies declined to disclose the terms of the proposed purchase. Control Data has invested $56 million in VTC since it was founded and holds nonvoting preferred shares in the company that are convertible to 49 percent of the company's voting stock.

The arrangement provides VTC with revenue and financial support. VTC's founders, Thomas E. Hendrickson and John R. Hodgson, will continue to manage the company.

Table 1 lists financing raised by start-up companies in the first half of 1987.

Table 1

FINANCING RAISED BY START-UP COMPANIES
FIRST HALF 1987

Company	Month	Round	Amount ($M)	Investors
Dallas Semiconductor	April 1987	3	$ 5.0	Abingworth; Alex Brown & Sons Emerging Growth Stocks; British Petroleum BP Ventures; HLM Partners; Merifin N.V.; New Enterprise Associates; Southwest Enterprise Associates; T. Rowe Price; Threshold Fund; Ventech Partners
Gigabit Logic	May 1987	3	$ 15.0	Analog Devices; Cray Research; Digital Equipment; First Interstate Capital; General Electric Venture; Interfirst Venture; New Enterprises Associates II; Riodan Venture; Union Venture
GL Micro Devices	April 1987	Seed	$ 2.4	Glenwood Management; El Dorado Ventures
International CMOS Technology	June 1987	3	$ 2.0	Undisclosed institutional investors
LSI Logic	April 1987	Eurobond Offer	$125.0	Convertible subordinated debentures offered on London's Unlisted Securities Market
Ramax Limited	June 1987	1	$ 0.8	State of Victoria, Australia

(Continued)

Table 1 (Continued)

FINANCING RAISED BY START-UP COMPANIES
FIRST HALF 1987

Company	Month	Round	Amount ($M)	Investors
Saratoga Semiconductor	March 1987	3	$ 11.5	Initial investors: Berry Cash Southwest Partners; Dougery, Jones & Wilder; Interwest Partners; Matrix Partners; MBW Venture Partners; Merrill, Pickard, Anderson & Eyre; Sierra Ventures; Sigma Partners; Weiss Peck & Greer Venture Partners
			$ 7.6	New investors: Bank of America Capital; HLM Management; John Hancock Venture Capital; New York Life Insurance; Security Pacific Capital; T. Rowe Price Associates
Vitesse Semiconductor	Feb. 1987	2	$ 10.0	Bryan & Edwards; J.H. Whitney; New Enterprises Associates; Oxford Venture Corporation; Robertson, Colman & Stephens; Sequoia Capital; Suez Technology Fund; Walden Capital
VLSI Technology	April 1987	Bond Offer	$ 48.75	Offered convertible subordinated debentures

(Continued)

Table 1 (Continued)

FINANCING RAISED BY START-UP COMPANIES
FIRST HALF 1987

Company	Month	Round	Amount ($M)	Investors
Xilinx	Jan. 1987	3	$ 3.4	Fleming Ventures Ltd.; Hambrecht & Quist; Kleiner, Perkins, Caufield & Byers; Interfirst Venture; Interwest Perkins; Matrix Partners; Morgan Stanley; Rainier Venture Partners; Security Pacific Venture Capital; J.H. Whitney
Zoran	April 1987	4	$ 6.8	Adler & Company; Concorde Partners; Elron Electronics; Grace Ventures Corp.; Kleiner, Perkins, Caufield & Byers; Mitsui & Company; Montgomery Securities; Vista Ventures; Welsh, Anderson & Stowe

Source: Dataquest
September 1987

Table 2 lists agreements start-up companies formed in the first half of 1987.

Table 2

AGREEMENTS WITH START-UP COMPANIES
FIRST HALF 1987

Company	Date	Comments
Altera WaferScale Sharp	Jan. 1987	Altera and WSI agree to a five-year technology exchange focused on developing new user-configurable logic products. Sharp will manufacture the products using WSI's process.
Altera Cypress	June 1987	Cypress Semiconductor Corporation and Altera Corporation announced a five-year technology development agreement focused on new high-performance, high-density, user-configurable logic products. Altera will provide the architecture, circuit design, and software support. Cypress will provide its CMOS process and EPROM device development and manufacturing capacity from its new Austin, Texas fab. The first devices, designated MAX (for Multiple Array Matrix), promise to extend the EPLD density capability up to 5,000 equivalent gates.
Catalyst Oki Electric	March 1987	Catalyst and Oki Electric agreed to a second-source agreement covering a wide range of CMOS EEPROMs. This is another phase of their continuing CMOS memory technology partnership, which was signed in July 1986. The two companies will jointly introduce a 1K serial EEPROM, which will be followed with 256-bit and 512-bit serial EEPROMs, 16K and 64K CMOS EEPROMs, and a 256K CMOS EEPROM that will be introduced at the end of the year.
CDI IST	April 1987	California Devices Inc. (CDI) and Innovative Silicon Technology (IST) have reached an agreement that provides for joint product development and second-sourcing of two families of ASICs using channelless ASIC architectures. The first family will be based on a 2-micron, double-metal layer CMOS and will have a complexity of up to 24,000 gates. The second family, which is slated for introduction in 1988, will be based on 1.5-micron technology and will have more than 100,000 gates.

(Continued)

Table 2 (Continued)

AGREEMENTS WITH START-UP COMPANIES
FIRST HALF 1987

Company	Date	Comments
Crystal Asahi Chemical	Jan. 1987	Asahi Chemical has acquired an 8 percent share in Crystal Semiconductor for about $4 million. Asahi will provide foundry services in exchange for a license to all of Crystal's existing products and for principle distribution rights in the Far East. Both companies will develop new products.
Custom Silicon NCR	Feb. 1987	NCR has licensed CSi's standard cell library, that includes 342 TTL macrocells and microcomputer building blocks of up to 5,863-gates. CSi's library was built from NCR's existing library, which CSi licensed.
Dallas Xecom	May 1987	Dallas Semiconductor Corporation and Xecom Inc. signed a second-source agreement giving both companies marketing rights for several of their existing products. In addition, the companies will cooperate on developing, manufacturing, and marketing future modem-related products--the area of Xecom's expertise. As part of the agreement, Dallas will alternate-source two of Xecom's modem components--the XE1251 and XE1253 modem development kits and the standalone XE0002 Data Access Arrangement unit, which is registered by the FCC. Xecom will second-source Dallas' SmartSocket and the SmartWatch families of products.
ES2 N.V. Philips TI	Feb. 1987	Texas Instruments Ltd. of England and Philips International N.V. will offer accelerated prototyping for the SystemCell Library of standard cells in cooperation with ES2. The SystemCell Library is the result of a collaborative relationship between TI and Philips, which provides high-volume manufacturing and standard prototyping.

(Continued)

Table 2 (Continued)

AGREEMENTS WITH START-UP COMPANIES
FIRST HALF 1987

Company	Date	Comments
GigaBit Logic Seattle Silicon WTC	April 1987	GigaBit Logic, Seattle Silicon Corp., and the Washington Technology Center (WTC) announced that a joint design project has resulted in the fabrication of a functional compiler-based GaAs IC design. The design is based on GigaBit's standard cell library and uses Seattle Silicon's Concorde Blue Chip Compiler. WTC provided design and engineering support and will be involved in the packaging and testing of the ICs. The device is equivalent to the 100K ECL 4-bit ALU (100181).
ICT Asahi Chemical	Jan. 1987	Asahi Chemical Industry will receive technology from International CMOS Technology (ICT) and will also market its EEPROMs.
IDT VTC	Jan. 1987	VTC will second-source Integrated Device Technology's FCT product line of TTL-compatible CMOS logic devices.
IST SDA Systems	May 1987	Innovative Silicon Technology Corp. (IST), a wholly owned subsidiary of SGS Corp., signed an agreement with SDA Systems Inc. to develop CAD systems based on SDA technology for use by IST customers.
Lattice SGS	Feb. 1987	Lattice Semiconductor signed a technology agreement with SGS Semiconductor, giving SGS a license to second-source Lattice's Generic Array Logic (GAL) products. SGS will manufacture GAL products for Lattice, and both companies will cooperate on the design of future PLD products.
Lattice National	May 1987	National Semiconductor Corporation made a minority capital investment in Lattice Semiconductor Corporation and licensed its Generic Array Logic (GAL) technology. The five-year agreement includes codevelopment of denser architectures of both standard and in-system programmable GALs, as well as a new line of FPLAs and sequencer devices.

(Continued)

Table 2 (Continued)

AGREEMENTS WITH START-UP COMPANIES
FIRST HALF 1987

Company	Date	Comments
LTC TI	March 1987	Linear Technology Corporation (LTC) and Texas Instruments Inc. (TI) agreed to a five-year alliance for advanced linear ICs. TI will select six products each six months from LTC's line to manufacture and market as TI parts. TI will pay LTC $500,000 and undisclosed royalties on a descending scale for a 10-year period and will directly purchase a number of products for resale. In addition, TI will invest approximately $1 million for warrants to purchase 735,000 shares of LTC stock at $17.50 per share over a four-year period. TI is also free to add the LTC parts to its standard cell library in exchange for specific royalty payments outlined by the agreement. LTC designers are to gain access to TI's CAD system and will also be able to design parts, thereby taking advantage of TI's advanced processes. The two companies plan joint designs in the near future. LTC will be able to situate its own test systems at TI assembly facilities.
LSI Logic Case Technology	March 1987	Case Technology Inc. and LSI Logic have completed a joint development effort that allows LSI Logic's LL5000, LL8000, and LL9000 schematic libraries to be designed on Case Technology's PC-based workstations.
LSI Logic Logic Automation	May 1987	LSI Logic Corporation and Logic Automation Inc. have signed a joint development agreement to make available LSI Logic's LL5000, LL7000, LL8000, and LL9000 channeled gate arrays on Logic Automation's Mentor Graphics workstations.
LSI Logic ASIX Systems	June 1987	LSI Logic Corporation will license design verification software to ASIX Systems Corporation of Fremont.

(Continued)

Table 2 (Continued)

AGREEMENTS WITH START-UP COMPANIES
FIRST HALF 1987

Company	Date	Comments
Samsung Intel	June 1987	Samsung Semiconductor will supply Intel with 64K, 256K, and 1Mb DRAMs, which Intel will sell to its customers in the United States. Shipments will begin from Korea in July.
Tachonics CMD	March 1987	California Micro Devices Corporation (CMD) signed an agreement with Tachonics for the production of gallium arsenide (GaAs) based ICs. Tachonics will manufacture the commercial and military products, and CMD will provide cell design and tools in the 0.5- to 1.0-micron range. Initial products will be a series of GaAs gate arrays with 500 to 2,500 gates and with radiation-hardened capabilities.
TriQuint TRW	June 1987	TRW Components and TriQuint Semiconductor have agreed to jointly supply gallium arsenide devices for space applications. Both companies are working together on procedures for producing Class S-level GaAs components. TriQuint will provide microwave and digital GaAs technology in addition to foundry services.
Vitesse Ford	June 1987	Vitesse Semiconductor Corporation and Ford Microelectronics are close to a second-source agreement involving gallium arsenide (GaAs) IC foundry services. The two companies have an agreement in principle to develop common design rules. Vitesse and Ford each use an enhancement/depletion mode, self-aligned gate technology. Initially, the agreement involves custom and semicustom circuits but may be extended to standard products.

(Continued)

Table 2 (Continued)

AGREEMENTS WITH START-UP COMPANIES
FIRST HALF 1987

Company	Date	Comments
VLSI Technology TCMC	March 1987	VLSI Technology Inc. and Thomson Components-Mostek Corporation (TCMC) have signed a comprehensive agreement for mutual second-sourcing and future new product development in specialized memory products. Each company will provide five existing memory designs for immediate second-sourcing. Both companies will incorporate the devices into megacells for use in their respective ASIC product families and plan to develop future products. Products covered include FIFOs, dual-ported RAMs, cache-tag RAMs, and lithium cell-powered nonvolatile SRAMs.
VLSI Technology Zilog	May 1987	Zilog signed VLSI Technology Inc. as a second source for its Super8 microcontroller. Included in the agreement are the Super8, the Z8038 FIFO I/O interface unit, and the Z8060 FIFO buffer unit and FIFO expander.
VTC Inc. TRW Components	March 1987	VTC and TRW Components International have signed a three-year agreement to cross sample space-quality Class S devices. VTC will supply TRW with unpackaged, high-performance ICs that meet the military Class S specifications. The devices include radiation-hardened CMOS SRAMs and high-speed comparators, op amps, and transceivers that are manufactured with VTC's radiation-hardened bipolar technology. TRW will assemble, test, qualify, and market these devices to customers that require Class S products, including radiation lot qualification where required.
Weitek Hewlett-Packard	May 1987	Weitek Corporation and Hewlett-Packard (HP) have formed a supplier/end-user agreement involving product and manufacturing exchanges. HP will incorporate the Weitek model 2264/65 chip set for high-performance, floating-point computation in current and future HP Precision Architecture computers. HP will also manufacture the chip set using its 1.2-micron CMOS process.

Source: Dataquest
September 1987

COMPANY ANNOUNCEMENTS

Altera Corporation

Altera and Monolithic Memories Incorporated (MMI) have settled the patent infringement suit brought against Altera by MMI. Altera agreed to entry of a consent of judgment, and the parties have agreed to license each other under certain patents in the programmable logic field.

Catalyst Semiconductor

Stephen Michael, one-time vice president of GE Semiconductor's Custom Integrated Circuit department, joined Catalyst as executive vice president and chief operations officer. He will have responsibility for all day-to-day operations at Catalyst, reporting directly to B.K. Marya, president and chief executive.

Dallas Semiconductor

Dallas Semiconductor began producing chips in a newly constructed $10 million wafer fabrication facility adjacent to its Dallas headquarters. The Class 1 facility produces CMOS chips with geometries down to 0.7 microns.

GigaBit Logic

GigaBit Logic named president and chief executive John Heightly chairman of the board. Mr. Heightly takes over the chairman's post from Henrich Krabbe, who will remain on GigaBit's board as director. Mr. Krabbe is vice president of new business development for Analog Devices, an investor in GigaBit.

GigaBit Logic announced that Cray Research, Inc., has increased its 1987 order to $5.5 million from $3.2 million. Cray will use the logic and memory device procured under this order to enter the next phase of development of a GaAs-based parallel processor supercomputer.

Integrated Device Technology (IDT)

IDT has established a company in Japan named Integrated Device Technology K.K. It is capitalized at $142,857 and plans to begin contract assembly in Japan, by Japanese semiconductor makers, sometime this year.

International Microelectronic Products (IMP)

IMP made an initial public offering of 6.5 million shares of common stock on June 10, 1987. The company provided 4.5 million shares and 2 million were from certain shareholders. The offering was underwritten by Shearson Lehman Brothers and Montgomery Securities. Proceeds will be used to acquire capital equipment, make leasehold improvements, redeem Series A preferred stock, and provide working capital for general corporate purposes. The company will have about 25 million shares outstanding after the offering.

IXYS Corporation

IXYS has relocated into a new 53,000-square-foot facility in San Jose. The facility, which is six-times larger than its former one, will be occupied by a highly automated assembly line and custom-packaging facility. The automated manufacturing line for commercial products is expected to be operational in eighteen months. IXYS plans to invest $2 million to $3 million in this line over the next two years.

Laserpath

Jim Hively, formerly general manager of Monolithic Memories Inc. semicustom division, has joined Laserpath as president and chief executive officer. Mr. Hively replaces former Laserpath president Michael Watts, who resigned last summer to participate in venture financing. He will report to Laserpath chairman John Mumford.

Lattice Semiconductor Corporation

Lattice filed for Chapter 11 protection to ensure that new funding will be applied only toward financing the company's ongoing operations.

LSI Logic Corporation

LSI Logic announced that it will take its Canadian affiliate, LSI Logic Corporation of Canada Inc., public and offer 4 million newly issued shares. The company plans to raise more than $20 million in the offering.

LSI Logic and Sun Microsystems Inc. announced that they are joining forces to support San Jose State University with the establishment of an ASIC laboratory (ASIC Laboratory Project) at the university. LSI will contribute instructional versions of its LDS-III logic design and verification software and instructional versions of a macrocell library to develop ASICs. Sun Microsystems will donate the SUN-3/160C color workstation and three SUN-3/50 monochrome workstations, as well as the operating system (SunOS) and networking software.

NMB Semiconductor Corporation

William C. Connell, vice president of NMB (USA) Inc., is acting president of NMB Semiconductor. Gary Ater, who was vice president and general manager of U.S. Operations, has left NMB Semiconductor to join Vitelic Corporation as vice president of Sales and Worldwide Marketing.

NMB Semiconductor relocated its domestic headquarters to Garden Grove, California, in April. NMB will share existing facilities with HI-TEK Corporation, another subsidiary company of NMB (USA) Inc. The new location provides additional space for engineering and test and evaluation functions. The existing Santa Clara, California, facility will be maintained as a regional office for the northwestern United States.

The new location is:

11621 Monarch Street
Garden Grove, CA 92641
(714) 897-6272; fax: (714) 891-0895; Telex: 67-8486

Samsung Semiconductor Inc.

Samsung Semiconductor, Goldstar Semiconductor Inc., and Hyundai Electrical Engineering Co. announced that they are preparing to launch full-scale production of a 1Mb DRAM chip jointly developed by the three South Korean firms last year.

Samsung Semiconductor formally opened its national headquarters in San Jose. The new $36 million facility will be used for administration, including sales, marketing, and product support, as well as for chip manufacturing. The company employs 250 people at the site and expects to increase that number to 400 within a year.

Silicon Systems Inc.

Chairman Carmelo J. Santoro retook operational control of Silicon Systems in May 1987, after Stephen E. Cooper, president and chief operating officer, and John V. Crosby, senior vice president, resigned.

Mr. Santoro said the reason for the change was to move toward a leaner, more efficient organization to "substantially improve profitability."

Taiwan Semiconductor Manufacturing Company (TSMC)

Dr. Morris Chang, former president and chief executive officer of General Instrument Corporation and president of the Industrial Technology Research Institute (ITRI) in Hsinchu, was made chairman of TSMC. Dr. Chang is also chairman of United Microelectronics Corporation.

Jim Dykes, who set up General Electric Company's Semiconductor Division, will join TSMC as president and chief executive officer.

Stephen L. Pletcher, who had been vice president of sales and marketing for GE Semiconductor, was named director of the new North American and European marketing and sales operation of TSMC.

TSMC, formed in late 1986, has already made its first wafer shipment from its 6-inch CMOS fab line in Hsinchu, Taiwan.

Three-Five Semiconductor Corp.

Three-Five Semiconductor has closed down its gallium arsenide facility in Troy, Michigan, idling about 50 workers.

United Microelectronics Corporation (UMC)

Dr. Morris Chang has been elected chairman of UMC. Dr. Chang is also chairman of the newly established Taiwan Semiconductor Manufacturing Corporation (TSMC) and president of the Industrial Technology Research Institute (ITRI) in Hsinchu. Formerly, Dr. Chang was a vice president at Texas Instruments and president and chief executive officer of General Instrument Corporation.

Vitesse Semiconductor

Vitesse has elected Pierre R. Lamond, cofounder of National Semiconductor and a general partner of Sequoia Capital, as chairman of the board. Mr. Lamond recently organized a $10 million financing of Vitesse and also serves on the boards of Cypress Semiconductor, Convex Computer, and several private companies.

VLSI Technology Inc.

VLSI Technology has broken ground on a 25,000-square-foot 6-inch wafer fabrication facility in San Antonio, Texas. Initially, the plant, equipped with a Class 1 clean room, will fabricate CMOS ASIC devices with minimum feature sizes down to 1.2 microns. The company plans features below 1.0 micron. The facility is expected to begin operation with 100 employees in late 1988.

VLSI Technology Inc.

VLSI Technology sold $48.75 million worth of 7 percent subordinated debentures convertible to common stock in an issue managed by Goldman Sachs & Co., Hambrecht & Quist, and Cowen & Co. VLSI plans to use money to fund new ASIC designs and defray expenses incurred by acquiring Visic Inc. and finance the new fab under construction in San Antonio, Texas.

In April, VLSI Technology repurchased a $7.6 million warrant that had been issued to Bendix Corporation six years ago.

VTC Inc.

VTC announced that it was awarded a $7.5 million contract from Control Data Corp., Government Systems Division, to supply chips for the U.S. Navy's AN/AYK-14(V) standard airborne computer. The contract calls for the production of five VLSI chip types designed with VTC's 1-micron CMOS standard cell library.

Xicor, Inc.

In April 1987, Xicor announced a public offering of 2.1 million shares of common stock at a price of $11.50 with Montgomery Securities and Smith Barney, Harris Upham & Co. Incorporated acting as underwriters. Net proceeds will be used for repayment of a bank debt of approximately $1.5 million and the balance will be added to working capital.

Intel Corporation has terminated a contract worth more than $7 million with Xicor on EEPROM technology and has begun end-of-life procedures on 64K and 256K ICs.

Zoran Corporation

John Ekiss resigned as president and chief executive officer of Zoran. Before joining Zoran in mid-1985, Mr. Ekiss was general manager of Intel's special components division. Terry Martin, vice president of operations, is acting president and chief executive.

ZyMOS Corporation

David Handorf has joined ZyMOS as president and chief executive officer from VLSI Technology Inc., where he was general manager of application-specific memories. He replaces the president's office of Haller Moyers, B.J. Chang, and Alex Young, who were appointed to serve until a successor was named.

Jim Beveridge
Penny Sur

Dataquest

Product Offerings

Industry Services

Asian Semiconductor and Electronics Technology

Business Computer Systems

CAD/CAM
- Electronic Design Automation Applications
- Facilities Design and Mapping Applications
- Mechanical Applications

CIO Adviser

Computer Storage
- Flexible Disk
- Optical
- Rigid Disk
- Subsystems
- Tape Drives

Copying and Duplicating

Display Terminal

Electronic Printer

Electronic Publishing

Electronic Typewriter

Electronic Whiteboard

European Semiconductor

European Telecommunications

Graphics and Imaging

Imaging Supplies

Japanese Semiconductor

Manufacturing Automation

Office Systems

Personal Computer

Personal Computer—Worldwide Shipments and Forecasts

Semiconductor
- Products, Markets, and Technology
- ASIC and Standard Logic
- Digital Signal Processing
- Gallium Arsenide
- Memory
- Microcomponents

Semiconductor Application Markets

Semiconductor Equipment and Materials

Semiconductor User Information

Software
- Artificial Intelligence
- Personal Computer
- UNIX

Technical Computer Systems

Technical Computer Systems—Minisupercomputers

Telecommunications

Western European Printer

Executive and Financial Programs

Corporate Technology Program

Financial Services Program

Strategic Executive Service

Newsletters

European Monitor

First Copy

Home Row

I.C. ASIA

I.C. USA

Focus Reports

PC Home Survey—1987

The European PC Market 1987-1993

PC Software Markets in Europe

PC Local Area Networking Markets in Europe

Japanese Corporations in the European PC Markets

The IBM 3270 Market: 1987 and Beyond

Imaging Supplies Distribution Survey

Competitive Guides

SpecCheck—Competitive Copier Guide

SpecCheck—Competitive Electronic Typewriter Guide

SpecCheck—Competitive Electronic Whiteboard Guide

SpecCheck—Competitive Facsimile Guide

Other Products

I.C. Start-Ups—1987

The DQ Monday Report

CAD/CAM Industry Directory—1987

For further information about these products, please contact your Dataquest sales representative or the Direct Marketing Group at (408) 971-9661.

Dataquest

Conference Schedule

1987

Western European Printer	September 9-11	Palace Hotel Madrid, Spain
Computer Products	September 21-22	The Westford Regency Inn Westford, Massachusetts
Asian Information Systems	October 5-9	Tokyo American Club Tokyo, Japan
Technical Computers	October 5-7	Hyatt Regency Monterey Monterey, California
Semiconductor	October 19-21	The Pointe at Squaw Peak Phoenix, Arizona
Office Equipment Dealers	November 5-6	Hyatt Regency Monterey Monterey, California
Electronic Typewriter	November 6	Hyatt Regency Monterey Monterey, California
Electronic Publishing	November 16-17	Stouffer Hotel Bedford, Massachusetts
Asian Semiconductor and Electronics Technology	December 7	Asiaworld Hotel Taipei, Taiwan, ROC

1988

Semiconductor Users/ Semiconductor Application Markets	February 22-24	Westin St. Francis Hotel San Francisco, California
Copying and Duplicating	March 7-9	The Pointe at Squaw Peak Phoenix, Arizona
Imaging Supplies	March 9-10	The Pointe at Squaw Peak Phoenix, Arizona
Telecommunications	March 16-18	Pier 66 Hotel and Marina Fort Lauderdale, Florida
Electronic Printer	April 5-7	Hyatt Regency Monterey Monterey, California
Imaging Supplies	April 7-8	Hyatt Regency Monterey Monterey, California
Japanese Semiconductor	April 11-12	Tokyo, Japan
Computer Storage	April 18-20	Silverado Country Club Napa, California
European Semiconductor	June 8-10	Gleneagles Hotel Auchterarder, Scotland
Display Terminals/Graphics and Imaging	June 13-15	Hyatt Regency Monterey Monterey, California

Dataquest

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EUROPEAN SEMICONDUCTOR DIVISION

AUGUST MONTHLY REPORT

STATE OF THE INDUSTRY

It is six months now since the SIA European book-to-bill 'ratio' went positive. July looks set to be 1.10. Summer 'shut-down' and still positive!!

Whilst European Semiconductor billings dropped 13 percent on June's $528.7m to $467.3m, bookings remained strong, increasing the three month rolling average above June's $547.4m to $557.1m for July.

In the U.S. July's projected book-to-bill of 1.15 makes it eight months continued growth for them.

Little much has changed in the way of prices and leadtimes. Dataquest notes that memory pricing is strictly adhering to FMV, with the possible exception of Korean sourced product. We see this quoted some 10% below FMV. Logic and Linear pricing is low but firm. We see semicustom gate array as a most aggressive market place currently. A 2K gate in 2µ CMOS, at around 25K units per year, is being offered at below $0.0018 per gate by some vendors keen for business.

All in all the July result continuing the positive trend of 1987, supports the 22 percent dollar growth Dataquest is forecasting for 1987. This will make 1987 the strongest year for the European semiconductor industry since 1984.

IN THIS ISSUE

13th Floor, Centre Point, 103 New Oxford Street, London WC1A 1DD ☎ (01) 379-6257 Telex 266195 Fax 01 240-3653
1290 Ridder Park Drive / San Jose, CA 95131 / (408) 971-9000 / Telex 171973

In July Dataquest updated its European quarterly forecast for 1987 and 1988. The table is given below. The forecast shows a 21.4% growth 1987 on 1986, and a 20.1% growth 1988 on 1987. This is the same as Aprils forecast. However the ECU has strengthend compared to the $. Thus the forecast represents a 5% reduction in real growth.

Table 1

ESTIMATED SEMICONDUCTOR SHIPMENTS TO EUROPE
(Millions of US Dollars)

	1986	Q1/87	Q2/87	Q3/87	Q4/87	1987	% Chg. 1987
Total Semiconductor	$5,532	1,551	1,667	1,709	1,789	$6,716	21.4%
Total IC	$4,088	1,159	1,246	1,296	1,361	$5,062	23.8%
Bipolar Digital	$782	212	230	236	244	$922	17.9%
Memory	172	47	50	49	47	193	12.2%
Logic	610	165	180	187	197	729	19.5%
MOS Digital	$2,280	660	717	753	804	$2,934	28.7%
Memory	822	242	254	265	282	1,043	26.9%
Micro	578	164	178	185	191	718	24.2%
Logic	880	254	285	303	331	1,173	33.3%
Linear	$1,026	287	299	307	313	$1,206	17.5%
Discrete	$1,153	314	334	329	337	$1,314	14.0%
Optoelectronic	$291	78	87	84	91	$340	16.8%
Exchange Rate ECU/$	145.9	129.3	124.7	124.7	124.7	125.9	-13.7%

	1987	Q1/88	Q2/88	Q3/88	Q4/88	1988	% Chg. 1988
Total Semiconductor	$6,716	1,877	1,987	2,049	2,153	$8,066	20.1%
Total IC	$5,062	1,426	1,528	1,590	1,658	$6,202	22.5%
Bipolar Digital	$922	256	271	284	300	$1,111	20.5%
Memory	193	48	51	54	57	210	8.8%
Logic	729	208	220	230	243	901	23.6%
MOS Digital	$2,934	853	932	980	1,028	$3,793	29.3%
Memory	1,043	303	333	349	359	1,344	28.9%
Micro	718	205	228	241	255	929	29.4%
Logic	1,173	345	371	390	414	1,520	29.6%
Linear	$1,206	317	325	326	330	$1,298	7.6%
Discrete	$1,314	356	363	361	388	$1,468	11.7%
Optoelectronic	$340	95	96	98	107	$396	16.5%
Exchange Rate ECU/$	125.9	124.7	124.7	124.7	124.7	124.7	-1.0%

Source: Dataquest
July 1987

OTHER INDUSTRY COMMENTS

Texas Instruments and Intel in ASIC Deal--the much rumoured deal has been formally announced. TI and Intel are to jointly develop common cell libraries and common gate array macro libraries. The agreement also established common testing, packaging and design rules. This is all based on the development of compatible ASIC CMOS process technology, to facilitate alternate sourcing.

Following the recent ASIC deal between TI and LM Ericsson, the biggest of its kind in Europe, the Swedish Conglomarate must be well pleased with the Intel news.

British Satellite Broadcasting (BSB)- is talking to semiconductor suppliers to ensure the electronics it needs for Satellite broadcasting will be available on time. BSB is trying to persuade Texas Instruments, ITT, Mullard and Motorola to make the special D-MAC chips needed for reception equipment. Nordic, a Norwegian company is actually designing the chips. But BSB want assured supply and thus is looking for multiple sources.

JULY INDUSTRY HIGHLIGHTS

Thomson buys GE Consumer Electronics Division--Thomson is buying GE's $3 billion consumer electronics business. Part of the deal includes GE taking control of Thomsons medical equipment subsidiary CGR. As a result of this Thomson will hold 23 percent of the U.S. Consumer Electronics market, the major share. This will double Thomson's Consumer Electronics turnover from FFr30 billion to FFr40 billion. However, GE and Thomson will retain 19.9 percent stakes in their respective companies.

The European Commission yesterday approved proposals for changes in indirect taxation in the twelve EEC countries. The intent is to do away with tax barriers at frontiers by 1992.

The European Commission is considering protectionist measures against imports of Japanese telecoms equipment. A large trade deficit is opening up between the EEC and Japan. In 1986, the EC imported ECU 883m ($990m) worth of equipment from Japan, whilst only shipping ECU 20m ($22m) in return.

OKI Electronics is to set up a manufacturing plant in Cumbernauld near Glasgow in Scotland. The plant, part of Burroughs/Unisys facility, will make printers. The plant will cost OKI £20 million and is due to open in January 1988.

Japanese and Korean Compact Disc players are subject of dumping enquiries by the European Commission. They currently account for two thirds of the Communities consumption compared with around half in 1984. The EC estimates that imports from the two countries were worth between $400 million - $45 million in 1986.

On DRAMS the EEC is also looking at claims of product dumping by the Japanese. The EC believes that suppliers such as Fujitsu, NEC and Toshiba are selling product below the cost of manufacture. Japanese producers are estimated to have gained 95 percent of the communities market which in 1986 was worth $400 million and in 1987 has already reached $575 million. The EEC is already investigating Japanese EPROMS.

Rolls Royce is close to go ahead on development of the new big thrust RB-211 engine. This will enable it to remain competitive with General Electric and Pratt and Whitney. Called the "Dash 700" it will be derived from the 524 D4D version of RB-211 increasing power output from 58,000 lbs to 65,000 lbs.

Grundig's 1986 results are the best for three years. Results for year ending March 1987 were DM109.5 million ($59.2m). In year 1985-86 they made a loss of DM49 million and in 1983-84 before Philips took over, the company lost DM286 million. The forecast for next year is good. Production at the Nuernberg video record factory is planed to reach 1 million units for 1987. TV production is expected to top that figure.

Amstrad is to form an Italian Subsidiary to penetrate that market. Currently 45 percent of its sales in 1985-86 came from France, West Germany and Spain. Amstrad estimate that in 1987 Italy will consume 280,000 PC's and word processors for business use, 290,000 for the home and 55,000 for education and scientific purposes. The subsidiary will also market Amstrad's video's and Hi fi equipment.

ITT is considering ways of selling its 24 percent stake in STC which could bring the U.S. group about £450m.

Citizen Watch is to build a £6 million factory in th U.K. It will make computer printers. It will output 30,000 units a month with three quarters of it's output going to Europe. Citizen claim to have 8 percent of the European printer market currently. It forecasts sales in Europe this year of 250,000 units worth about £50 million ($80m).

Lex Services results for the period ending six months to 28 June 1987 showed a 40 percent lift in pre tax profits. Contributing to this was an improved performance from its Electronic Components business. This achieved £200,000 profit on a turnover of £219 million compared with £500,000 loss on £195 million for the same period last year.

The Fiat group of Italy which includes Alfa Romeo, Lancia, Autobianchi and Ferrari displaced Volkswagen at the top of Western European Car sales for the first half of 1987. This is at a time when the market is expanding strongly. Preliminary estimates put growth in consumption up 5.2 percent on the second half of 1986, to 6.49 million vehicles.

WEST EUROPEAN CAR SALES

First half year

	1986	1987
TOTAL MARKET	6.17m	6.49m
	Market shares %	
Fiat-Lanci-Alfa Romeo	14.7	15.0
VW-Audi-Seat	14.6	14.8
Ford	11.6	11.8
Peugeot-Citroen-Talbot	11.2	11.6
General Motors (Opel/Vauxhall)	11.4	10.9
Renault	10.0	10.4
Daimier-Benz (Mercedes)	3.6	3.5
Rover	3.5	3.3
Nissan	2.9	2.8
Toyota	2.9	2.7
BMW	2.6	2.4
Volvo	2.3	2.2
Other Japanese	8.7	8.6

(Industry Estimates)

THOUGHT FOR THE MONTH

The world semiconductor industry seems to be experiencing a mid life crisis. Some forty years on since semiconductor devices were first produced, the industry has grown to $37Bn. Although this is a large amount of money, it is still modest when compared to that of the more traditional sectors of the economy. However, whilst of modest financial size, the SC industry has a major industrial and economic influence, being the material that fuels all of todays high technology industries. Over the past few years industry executives have had precious little time to reflect on the course of an industry growing at a CAGR of 18%, as they used, what at times must have seemed like digital driving techniques to outsiders. One year full steam forward, next, deep recession.

As the industry reaches the maturity associated with middle age, and CAGR's slow from 18% to 12-14%, these executives will have a little more time to reflect on their company's position within the European framework. They will see a market consuming 20 billion SC devices. A market which Dataquest predicts will out pace the other regions over the 1986-91 time frame, with a CAGR of 14.4% compared to 12.2% and 13% for North America and Japan respectively. An environment in which SC manufacturers spent $764m on capital investment in 1986, a 14% increase on 1985, whilst its market averaged a modest 9.8% growth. A market underpinned by local home producing giants Philips, Siemans and Thomson/SGS. and, of course, a market that is still only half the size of North America, despite having the same population.

So What Of This Mid Life Crisis?

There are too many players in the market. There are over 200 S/C manufacturers in the world, and only 43 have revenues over $100m. To build a state-of-the-art wafer fab, now costs an absolute minimum of $100m. Financial investors are increasingly unable, or unwilling, to fund such outlay for start up's. There is also increasing pressure from users to reduce costs by limiting the number of suppliers they have. As one of the major producing regions, Europe cannot escape this. However, Europe is showing signs of restructuring and reorganising for the challenge of the 90's. Take for example the mega project of Siemans and Philips, a project specifically designed to keep Siemans ahead in the telecoms market and Philips ahead in the consumer market; or the rationalisation of Thomson and Mostek, and now Thomson and SGS.

These examples show that European management is able to face the challenge of the next decade. The European semiconductor industry and its executives should bear in mind that - life begins at 40!

DATAQUEST ACQUISITION OF INTELLIGENT ELECTRONICS EUROPE

We are very pleased to announce that Intelligent Electronics Europe (I.E.E.) is now a member of the Dataquest family. Based in Paris, I.E.E. has provided market research on the European microcomputer market for the past six years. I.E.E. issues reports on personal computer applications, hardware, software, and peripherals, based on field research conducted in 16 Western European countries. Its research covers the business, education, and home markets as well as market share, distribution channels, competition, and company profiles.

Our clients have told us that primary research, gathered at the point of origin, is a key factor for successful decision making in the highly competitive international electronics marketplace. The acquisition of I.E.E., the premier European PC research firm, is evidence of Dataquest's commitment to provide our clients worldwide data and analysis that are both accurate and actionable. With this acquisition, Dataquest now covers a full range of European computer products, with research staffs located in Paris, London and Munich.

Please note the following information for your records:

Address:	Intelligent Electronics Europe 15, rue Buffon 7500 Paris FRANCE
Phone:	011-33-1-45.35.43.83
Texex:	(842) 642138
Key Staff:	Brigitte Morel, Director Gordon Curran, Director

For your information, a summary of current I.E.E. newsletters and reports is included below.

Dataquest Research Publications from Intelligent Electronics - Europe

The European Monitor (Monthly)

A monthly newsletter on the issues, trends, developments, products, and players that are shaping the PC markets in 16 Western European Countries.

The European PC Market 1987-1993--(new (1987 report)

A detailed overview and analysis of historic trends, market projections, and distribution channels for 16 Western European countries.

The PC LAN Market in Europe--(new 1987 report)

An up-to-date examination of the penetration, use, and future of Local Area Networks in European regional markets.

PC Software Markets in Europe (upcoming 1987 report)

A close look at software products, publishers, and user demand in Europe.

Japanese Corporations in the European PC Markets (upcoming 1987 report) their presence in Europe and their performance in the PC and peripherals markets.

The Education Market for PCs in Europe (1986 report)

An analysis of the integration of PCs into European educational systems.

Consulting

Custom quotations for studies on all aspects of personal computers in Europe.

EUROPEAN SEMICONDUCTOR DIVISION ACTIVITY REPORT—JULY

Travel and client care were the key activities of the group in July. Anthea Stratigos and Jennifer Berg made trips to France and Switzerland, while Jim Beveridge and Jim Eastlake covered the U.K. The purpose of these on-site meetings was to present information on the current state of the semiconductor products that have been developed. In particular, the European Semiconductor Applications Markets (ESAM) segment was highlighted and the methodology and definitions used in delineating the segment were explained. ESAM focuses on the demand aspects of the European semiconductor industry, and provides detailed information on semiconductor applications within the European regions as well as insight into major European users electronic equipment needs. For a complete explanation of the segment contact Jennifer Berg, ESAM Product Manager, on London (01) 379-6257.

The following publications were completed in July:

- The finalized Market Share Executive Summary for 1986 which details worldwide market shares of European semiconductor companies by product line; and European market shares of all major European, Japanese, and North American semiconductor companies by product line.

- Newsletters on the ESIS conference held in Madrid--Integrate for the VLSI Era; on the Semiconductor Applications Market Workshop; and on a SEMI Forecast Conference on Equipment and Materials market in Europe.

In the loop for publication in August are:

- ESIS service section on the ASIC Workshop and the ASIC Market in Europe; on the Distribution Market in the U.K.; on 1987 Second Quarter Currency Exchange Rates; and on European Semiconductor End Use Segments.

- New ESAM service sections on the European Personal Computer Market, and Regional End Use tables by technology.

Finally, a brief over-view of the members of the European Semiconductor Division in London:

- Jim Beveridge--Director
- Jennifer Berg--Industry Analyst ESIS/Product Manager ESAM
- Jim Eastlake--Industry Analyst ESIS
- Kathleen Killian--Industry Analyst ESIS
- Byron Harding--Research Associate ESIS

All members of the group are available to answer inquiries on the three main areas of research that Dataquest does in Europe, and worldwide; Semiconductor Users and Applications, Semiconductor Products and Markets, and Semiconductor Equipment and Materials. Please contact any member of the team in the London office (010 441 379 6257) with queries regarding any of the Dataquest Semiconductor Services.

FUTURE EVENTS DIARY

SEMICONDUCTOR CONFERENCES

- SEPTEMBER 9-11, Western European Printer Industry Conference
  Palace Hotel, Madrid, Spain

- OCTOBER 12-20, European Semiconductor Division Industry Seminars
  (Paris, Milan, Munich, Frankfurt, Stockholm, London, Edinburgh)
  ("IC Outlook 1988")

SPECIAL REPORTS

- 1985 News Digest--Available now
- Korean Semiconductor Industry Report--Available now
- IC Update '87--Available now
- GaAs Market Update--Available now
- IC Start ups--Available now
- DSP Market Update--Available second quarter 1987
- Taiwan Semiconductor Industry Report--Available first quarter 1987
- Hong Kong Semiconductor Industry Report--Available first quarter 1987
- China Semiconductor Industry Report--Available first quarter 1987
- 1986 News Digest--Available now

NEWSLETTER SUBSCRIPTIONS

- IC A.S.I.A.
- IC U.S.A (available in English and Japanese)
- European Monthly Report

ON-LINE SERVICES

- Semiconductor Group Database: History, Forecast, Market Share, and Geographical Data
- SIA Database: Bluebook, Flash Report, Forecast
- DQ Monday

For further information on the above items, please call your local Dataquest office.

ABOUT DATAQUEST

Dataquest is the world leader in high-technology market research, offering clients access to a worldwide network of information that provides a critical edge in today's rapidly changing high-technology environments.

Dataquest's research covers an entire generation of high-technology industries, with a primary focus on six broad areas:

- Semiconductors
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- Peripherals
- Office equipment
- Industrial automation
- Telecommunications

Within these primary areas, Dataquest tracks and serves more than 25 separate industries.

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  - Annual conferences
- Executive and Financial Programs - a series of business opportunity and technology advisory programs specifically designed for senior executives involved in high-technology
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- Product Specification Guides
- Who's Who Industry Guide

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Dataquest

a company of The Dun & Bradstreet Corporation

1290 Ridder Park Drive
San Jose, California 95131-2398
(408) 971-9000
Telex: 171973
Fax: (408) 971-9003

Dataquest International Offices:

Dataquest GmbH
Rosenkavalierplatz 17
D-8000 Munich 81
West Germany
Phone: (089)91 10 64
Telex: 5218070
Fax: (089)91 21 89

Dataquest Japan Limited
Taiyo Ginza Building/2nd Floor
7-14-16 Ginza, Chuo-ku
Tokyo 104 Japan
Phone: (03)546-3191
Telex: J32768
Fax: (03)546-3198

Dataquest UK Limited
13th Floor, Centrepoint
103 New Oxford Street
London WC1A 1DD
England
Phone: (01)379-6257
Telex: 266195
Fax: (01)240-3653

Dataquest SARL
100, avenue Charles de Gaulle
92200 Neuilly-sur-Seine
France
Phone: (01)47.38.13.12
Telex: 611982
Fax: (01)47.38.11.23

Dataquest Taiwan
Rm. 801, 8th Fl., Ever Spring Bldg.
147, Sec. 2, Chien Kuo N. Road
Taipei, Taiwan, R. O. C. 104
P. O. Box 52-25, Tienmou 111
Phone: (02)501-7960/501-5592
Telex: 27459
Fax: (02)505-4265

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As a member of the Dun & Bradstreet family of information companies, Dataquest is the world leader in high-technology market research. From semiconductors to systems, Dataquest has been supplying clients with vital information and analyses since 1971.

Dataquest

Conference Schedule

1987

Semiconductor Users/Semiconductor Application Markets	February 4-6	Saddlebrook Resort Tampa, Florida
Copying and Duplicating	February 23-25	San Diego Hilton Resort San Diego, California
Imaging Supplies	February 25-26	San Diego Hilton Resort San Diego, California
Electronic Printer	March 23-25	Silverado Country Club Napa, California
Imaging Supplies	March 25-26	Silverado Country Club Napa, California
Computer Storage	April 6-8	Red Lion Inn San Jose, California
Japanese Semiconductor	April 13-14	The Miyako Kyoto, Japan
Color Conference	April 24	Red Lion Inn San Jose, California
European Telecommunications	April 27-29	The Beach Plaza Hotel Monte Carlo, Monaco
CAD/CAM	May 14-15	Hyatt Regency Monterey Monterey, California
Graphics/Display Terminals	May 20-22	San Diego Hilton Resort San Diego, California
European Semiconductor	June 4-5	Palace Hotel Madrid, Spain
European Copying and Duplicating	June 25-26	The Ritz Hotel Lisbon, Portugal
Telecommunications	June 29-July 1	Silverado Country Club Napa, California
Financial Services	August 17-18	Silverado Country Club Napa, California
Western European Printer	September 9-11	Palace Hotel Madrid, Spain
Manufacturing Automation	September 14-15	San Diego Hilton Resort San Diego, California
Business/Office Systems and Software	September 21-22	Wexford Regency Hotel Littleton, Massachusetts
Asian Peripherals and Office Equipment	October 5-8	Tokyo American Club Tokyo, Japan
Technical Computers	October 5-7	Hyatt Regency Monterey Monterey, California
Semiconductor	October 19-21	The Pointe Resort Phoenix, Arizona
Office Equipment Dealers	November 5-6	Hyatt Regency Monterey Monterey, California
Military IC	November 12	Hotel Meridien Newport Beach, California
Electronic Publishing	November 16-17	Stouffer Hotel Bedford, Massachusetts
Asian Information Systems	November 30-December 4	Tokyo, Japan
CAD/CAM Electronic Design Automation	December 10-11	Santa Clara Marriott Santa Clara, California

Product Offerings

Industry Services

Business Computer Systems
CAD/CAM
Computer Storage—Rigid Disks
Computer Storage—Flexible Disks
Computer Storage—Tape Drives
Copying and Duplicating
Display Terminal
Electronic Printer
Electronic Publishing
Electronic Typewriter
Electronic Whiteboard
European Semiconductor*
European Telecommunications
Gallium Arsenide
Graphics
Imaging Supplies
Japanese Semiconductor*
Office Systems
Personal Computer
Personal Computer—Worldwide Shipments and Forecasts
Robotics
Semiconductor*
Semiconductor Application Markets*
Semiconductor Equipment and Materials*
Semiconductor User Information*
Software—Artificial Intelligence
Software—Personal Computer
Software—UNIX
Technical Computer Systems
Technical Computer Systems—Minisupercomputers
Telecommunications
Western European Printer

Executive and Financial Programs

Corporate Alliance Program
Coporate Technology Program
Financial Services Program
Strategic Executive Service

Newsletters

European PC Monitor
First Copy
Home Row
I.C. ASIA
I.C. USA

Focus Reports

The European PC Market 1985-1992
European PC Retail Pricing
PC Distribution in Europe
PC Software Markets in Europe
PC Local Area Networking Markets in Europe
The Education Market for PCs in Europe
Japanese Corporations in the European PC Markets
Home Markets for PCs in Europe
Integrated Office Systems—The Market and Its Requirements
European Market for Text Processing
Korean Semiconductor Industry Analysis
Diskettes—The Market and Its Requirements

Directory Products

I.C. Start-Ups—1987
SpecCheck—Competitive Copier Guide
SpecCheck—Competitive Electronic Typewriter Guide
SpecCheck—Competitive Whiteboard Guide
Who's Who in CAD/CAM 1986

Future Products

- Industry Services
  - Manufacturing Automation
  - Computer Storage—Optical
  - Computer Storage—Subsystems
- Focus Reports
  - Japanese Printer Strategy
  - Japanese Telecommunications Strategy
  - Canon CX Laser—User Survey
  - Digital Signal Processing
  - PC-based Publishing
  - Taiwan Semiconductor Industry Analysis
  - China Semiconductor Industry Analysis
  - PC Distribution Channels
- Directory Products
  - SpecCheck—Competitive Facsimile Guide
  - SpecCheck—Competitive Electronic Printer Guide

*On-line delivery option available

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EUROPEAN MONTHLY REPORT

ESIS Code: Vol. IV, Newsletters

EUROPEAN SEMICONDUCTOR INDUSTRY

JULY MONTHLY REPORT

STATE OF THE INDUSTRY

The book-to-bill ratio for June looks set to continue the positive trend of the past five months. Preliminary estimates show the semiconductor ratio to be 1.06. The integrated circuit ratio is particularly encouraging at 1.11. Three month average bookings decreased in June, as did billings. But June's billings actual was strong at $528.7M only $2M down on May. OEM demand has started to flatten out ready for summer. However, distribution shows a steady controlled increase in demand.

Lead times are extending on some product lines, but for different reasons. Increased PC build is driving the leadtime on ALS logic out to 10 weeks. PC build rate is also making the Intel 80386 harder to obtain. In the case of DRAMs though the extending lead time is the result of Japanese export controls. On commodity logic and linear integrated circuits, lead times are static at around six to eight weeks.

Pricing is showing signs of positive fluctuation in a number of product areas. DRAM pricing has increased by 10-15 percent in the past six weeks. Commodity logic and linear pricing is firm but continues at a low level. In general some semiconductor manufacturers feel they can justify negotiating up contract pricing where they have an opportunity to.

It is important to remember that what is happening in DRAMs cannot be considered as an indicator to the present market environment. Commodity logic and linear give a clearer picture. Prices are firm but leadtimes are still short.

IN THIS ISSUE

13th Floor, Centre Point, 103 New Oxford Street, London WC1A 1DD ☎ (01) 379-6257 Telex 266195 Fax 01 240-3653
1290 Ridder Park Drive / San Jose, CA 95131 / (408) 971-9000 / Telex 171973

OTHER INDUSTRY COMMENTS

Philips first to market--with it's 1-Mbit CMOS SRAM featuring 25ns access time at 20MHz. Power dissipation is just 150mW at 20 MHz. This outstrips Sony's previous top performer in the 1-Mbit SRAM stakes and presented at the 1987 ISSCC which boasted 100mW power dissipation but only 35ns access time. The Philip's part, which measures 94 square mm in size, features 0.7 micron feature sizes making it the densest SRAM to date. The development is part of the billion-dollar Mega Project, a joint effort by Philips and Siemens to become top VLSI producers. Volume production of the part is expected to begin in mid-1989.

Europe opts for West German Car Guidance System--as major motor manufacturers make a united stand behind common standards and equipment designs. The program, called Prometheus, is being developed under the EEC Eureka research program and should have its first commercial products by 1990.

Prometheus itself comprises a steering committee from 13 European car companies and from which US multinationals, General Motors and Ford are excluded. The 13 are Volkswagon, Mercedes, BMW, Porsche, Rover Group, Jaguar, Rolls-Royce, Peugot, Renault, Matra, Fiat, Volvo, and Saab.

Japan faces new row with US on Toshiba--following the illegal sale of sophisticated machine tool equipment. During a recent visit to Japan, Mr Caspar Weinberger, the US Defence Secretary, made clear that the US will be demanding heavy compensation from Toshiba, or the Japanese Government, for the damage caused to Western security. The US House of Representatives has estimated the damage at $30 billion.

The tools involved are multi-axis machine tools which makes it possible to cut on both sides of a work piece simultaneously. Each tool offsets the stress on the metal caused by the pressure of the other allowing the workpiece to be machined thinner than would otherwise be possible.

The Pentagon has already taken unilateral action against Toshiba stopping a possible order for 30,000 Toshiba lap-top computers for the US Air Force worth $100 million.

JUNE INDUSTRY HIGHLIGHTS

EEC acts to extend anti-dumping duties to the components of products made in the EEC. The measure, agreed at a recent meeting of the Community's 12 foreign ministers, gives the EEC one of the toughest defences against predatory pricing anywhere in the World.

EEC proposes easing curbs on telecoms throughout the European Community, including the removal of all restrictions on the supply of telecommunications equipment and data services provided over the telephone network. The aim is to stimulate new telecommunications services and to create a large unified home market for equipment manufacturers in the EEC.

Bell moves to sell phones in UK following a recent decision by South Western Bell to start selling a range of equipment aimed at the residential and small business markets. The products include telephones, telephone answering machines, cordless phones, and private exchanges for small businesses (key systems).

IBM reshapes telecom operations in Europe in order to give the main operating group greater control over the switching business. Under the new structure, the telecommunications subsidiary, renamed the Integrated Services Switching System, will report directly to IBM Europe officials as opposed to the previous direct reporting line to Rolm, the telephone exchange manufacturer acquired by IBM in 1984.

Daimler-Benz finds a new Japanese niche with plans to launch its commercial vehicles in Japan for the first time at the Tokyo Motor Show in October. The group is the World's largest producer of heavy vehicles (over 6 tonnes gross weight). The first vehicles to be launched by Daimler-Benz in Japan will be medium sized vans fitted out as luxury air-conditioned minibuses.

Hitachi to boost VCR output at its South Wales, UK, facility to 240,000 units a year. The increase in output is due to begin in July and will virtually eliminate the need for the group to import VCR's from Japan into Europe. In addition to the UK plant, Hitachi has a large plant in West Germany which produces around 480,000 units a year.

Olivetti plans to double PC expansion at its Ivrea manufacturing plant. The expansion program coincides with the launch of a range of more powerful personal computers and once completed will raise the manufacturing potential from 500,000 per year at present to around 1 million.

Volkswagon to build Toyota-designed trucks in 1989 under a recently signed co-operation deal. Volkswagon plans to invest around DM90 million to re-equip its underutilized Hannover plant. Local content is expected to be over 50 percent initially, increasing eventually to 70 percent. Initially engines, gearboxes, brakes, and axles will all come from Japan. Volkswagon already has a production agreement with Nissan to build its large Santana model.

Commercial success for UK's Alvey research program with the launch of a new IC chip manufacturing process by STC, the electronics and telecommunications group. Output of the newly-designed products has began at STC's plant at Foots cray, UK and is expected to build up to significant commercial quantities in the third quarter this year. The initial device is a static RAM with very fast processing speeds.

Thom EMI to sell Ferguson TV division to Thomson, the French nationalized electronics and defence group, for £90 million. Ferguson, with sales of £300 million in the year ending March 1987, is the brand leader in the UK with just over 10 percent market share and producing 680,000 TV sets. The sale leaves Fidelity as the only remaining major British owned TV manufacturer with a production last year of 260,000 sets.

EEC pulls down more barriers to internal trade following recent agreements, in particular one proposal to set common frequencies for the next generation of digital mobile phones.

Sweden to open telecoms market now Televerket, the Swedish telecommunations administration, has signalled willingness to accept deregulatory measures in its home market which would end its monopoly in private branch exchanges and modems. The measures would also open up the Swedish market to foreign competitors in 1988.

Ericsson wins order for US telephone exchange, its first commercial order, from South Western Bell, one of the seven regional Bell operating companies. It is to provide a small local central office exchange with 15,000 lines in Sedalia, Missouri and will enter service early in 1988.

Bonn allocates DM 4.9 billion for Airbus Projects over the next nine years to support further development of the European Airbus airliner range. The decison, announced early in June, assures the formal launch of the medium-range twin-engined A-330 and the long-range four-engine A340.

Koreans plan new sports car plant in UK following the takeover by Ssangyong, South Korea's seventh largest industrial group, of the Panther Car Company, a specialist Sports Car Manufacturer. Ssangyong already owns Dong-A-Motor, South Korea's fourth-ranked vehicles producer. As part of the take-over, Panther is to provide engineering services to Dong-A-Motor.

EUROPEAN SEMICONDUCTOR DIVISION ACTIVITY REPORT

The major event in June was the 6th annual European semiconductor industry conference held at the Palace Hotel, Madrid, Spain, June 3-5. The event attracted 150 delegates from around the world. Newsletters reviewing highlights of the conference are currently being published.

The conference theme-"Integrate for the VLSI Era"--was chosen to feature thought provoking presentations by the people and companies that are shaping the future of semiconductors in Europe.

Copies of the proceedings are available at a cost of $350 from Lyn Cooke at our London, U.K. office.

The program for July concentrates on updating the European semiconductor database, both the final 1986 company market share data and the revised market forecasts for 1987 and beyond. The results of these updates will become available from the end of June.

In addition to this we will be researching material for the forthcoming Dataquest IC Outlook 1988 Seminars (see Future Events Diary of this report for list of venues).

The topics which will be covered include:

- Worldwide technology and business trends
- European semiconductor industry update
- Semicustom technology and market overview
- MOS memory, micro device and digital signal processor update
- European telecommunications industry overview

Meetings start at 8:30 a.m. and finish at 4:40 p.m

NOT TO BE MISSED

Finally, June saw the addition of Jim Eastlake to our U.K.-based European semiconductor research staff. Jim joins us as an Industry Analyst to assume responsibility for the extensive products and markets database, with an emphasis on ASIC and linear devices. We are currently recruiting a further senior industry professional to bring the group back up to full strength. In the interim, Anthea Stratigos, Associate Director of our U.S. based Semiconductor Application Markets service, joins us in the U.K. for two months. During her stay, she will be working closely with our European clients and will further support our European semiconductor application market research. Please consider these individuals as additional resource and contact them when the need arises.

THOUGHT FOR THE MONTH

During the recent ESIS annual Industry Conference, a few key themes were repeated over and over in various forms throughout the speeches. Many segments of high technology industry are now entering a more mature phase characterized by approximately 10% CAGRS (rather than 20%), and competitive shake-outs where companies fail or merge. This is happening in the end equipment market (Computer, Consumer goods, etc.), in the device market (memories, standard logic, etc.), and in the markets of equipment and materials used to produce devices. In order to forge tighter links along the chain all parties must provide good service and quality product to the end user, who ultimately is the source of the money that drives the chain. In order to do this, all parties must understand their customer's customers. Companies can then survive and prosper in the present, and in the near and long term future. Trade barriers, in the final analysis, do not act effectively as protection, because users buy the product which is the best value for money.

Malcolm Penn

FUTURE EVENTS DIARY

SEMICONDUCTOR CONFERENCES

- SEPTEMBER 9-11, Western European Printer Industry Conference
  Palace Hotel, Madrid, Spain

- OCTOBER 12-20, European Semiconductor Division Industry Seminars
  (Paris, Milan, Munich, Frankfurt, Stockholm, London, Edinburgh)
  ("IC Outlook 1988")

SPECIAL REPORTS

- 1985 News Digest--Available now
- Korean Semiconductor Industry Report--Available now
- IC Update '87--Available now
- GaAs Market Update--Available now
- IC Start ups--Available now
- DSP Market Update--Available second quarter 1987
- Taiwan Semiconductor Industry Report--Available first quarter 1987
- Hong Kong Semiconductor Industry Report--Available first quarter 1987
- China Semiconductor Industry Report--Available first quarter 1987
- 1986 News Digest--Available now

NEWSLETTER SUBSCRIPTIONS

- IC A.S.I.A.
- IC U.S.A (available in English and Japanese)
- European Monthly Report

ON-LINE SERVICES

- Semiconductor Group Database: History, Forecast, Market Share, and Geographical Data
- SIA Database: Bluebook, Flash Report, Forecast
- DQ Monday

For further information on the above items, please call your local Dataquest office.

ABOUT DATAQUEST

Dataquest is the world leader in high-technology market research, offering clients access to a worldwide network of information that provides a critical edge in today's rapidly changing high-technology environments.

Dataquest's research covers an entire generation of high-technology industries, with a primary focus on six broad areas:

- Semiconductors
- Information systems
- Peripherals
- Office equipment
- Industrial automation
- Telecommunications

Within these primary areas, Dataquest tracks and serves more than 25 separate industries.

Dataquest provides a comprehensive line of products and services designed to meet the varying research and analysis needs of corporate decision makers. These products include:

- Industry Services - comprehensive market research and analysis on specific industries or markets. In-depth decision support is provided in a five part format;

  - Database notebooks
  - Inquiry privileges
  - Research libraries
  - Research bulletins
  - Annual conferences

- Executive and Financial Programs - a series of business opportunity and technology advisory programs specifically designed for senior executives involved in high-technology

- Focus Reports - high detailed landmark publications on specific issues of topical interest

- Newsletters - general overviews and analyses of specific industries or markets

- Product Specification Guides

- Who's Who Industry Guide

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1290 Ridder Park Drive
San Jose, California 95131-2398
(408) 971-9000
Telex: 171973
Fax: (408) 971-9003

Dataquest International Offices:

Dataquest GmbH
Rosenkavalierplatz 17
D-8000 Munich 81
West Germany
Phone: (089)91 10 64
Telex: 5218070
Fax: (089)91 21 89

Dataquest Japan Limited
Taiyo Ginza Building/2nd Floor
7-14-16 Ginza, Chuo-ku
Tokyo 104 Japan
Phone: (03)546-3191
Telex: J32768
Fax: (03)546-3198

Dataquest UK Limited
13th Floor, Centrepoint
103 New Oxford Street
London WC1A 1DD
England
Phone: (01)379-6257
Telex: 266195
Fax: (01)240-3653

Dataquest SARL
100, avenue Charles de Gaulle
92200 Neuilly-sur-Seine
France
Phone: (01)47.38.13.12
Telex: 611982
Fax: (01)47.38.11.23

Dataquest Taiwan
Rm. 801, 8th Fl., Ever Spring Bldg.
147, Sec. 2, Chien Kuo N. Road
Taipei, Taiwan, R. O. C. 104
P. O. Box 52-25, Tienmou 111
Phone: (02)501-7960/501-5592
Telex: 27459
Fax: (02)505-4265

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As a member of the Dun & Bradstreet family of information companies, Dataquest is the world leader in high-technology market research. From semiconductors to systems, Dataquest has been supplying clients with vital information and analyses since 1971.

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Conference Schedule

1987

Semiconductor Users/Semiconductor Application Markets	February 4-6	Saddlebrook Resort Tampa, Florida
Copying and Duplicating	February 23-25	San Diego Hilton Resort San Diego, California
Imaging Supplies	February 25-26	San Diego Hilton Resort San Diego, California
Electronic Printer	March 23-25	Silverado Country Club Napa, California
Imaging Supplies	March 25-26	Silverado Country Club Napa, California
Computer Storage	April 6-8	Red Lion Inn San Jose, California
Japanese Semiconductor	April 13-14	The Miyako Kyoto, Japan
Color Conference	April 24	Red Lion Inn San Jose, California
European Telecommunications	April 27-29	The Beach Plaza Hotel Monte Carlo, Monaco
CAD/CAM	May 14-15	Hyatt Regency Monterey Monterey, California
Graphics/Display Terminals	May 20-22	San Diego Hilton Resort San Diego, California
European Semiconductor	June 4-5	Palace Hotel Madrid, Spain
European Copying and Duplicating	June 25-26	The Ritz Hotel Lisbon, Portugal
Telecommunications	June 29-July 1	Silverado Country Club Napa, California
Financial Services	August 17-18	Silverado Country Club Napa, California
Western European Printer	September 9-11	Palace Hotel Madrid, Spain
Manufacturing Automation	September 14-15	San Diego Hilton Resort San Diego, California
Business/Office Systems and Software	September 21-22	Westford Regency Hotel Littleton, Massachusetts
Asian Peripherals and Office Equipment	October 5-8	Tokyo American Club Tokyo, Japan
Technical Computers	October 5-7	Hyatt Regency Monterey Monterey, California
Semiconductor	October 19-21	The Pointe Resort Phoenix, Arizona
Office Equipment Dealers	November 5-6	Hyatt Regency Monterey Monterey, California
Military IC	November 12	Hotel Meridien Newport Beach, California
Electronic Publishing	November 16-17	Stouffer Hotel Bedford, Massachusetts
Asian Information Systems	November 30-December 4	Tokyo, Japan
CAD/CAM Electronic Design Automation	December 10-11	Santa Clara Marriott Santa Clara, California

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Product Offerings

Industry Services

Business Computer Systems

CAD/CAM

Computer Storage—Rigid Disks

Computer Storage—Flexible Disks

Computer Storage—Tape Drives

Copying and Duplicating

Display Terminal

Electronic Printer

Electronic Publishing

Electronic Typewriter

Electronic Whiteboard

European Semiconductor*

European Telecommunications

Gallium Arsenide

Graphics

Imaging Supplies

Japanese Semiconductor*

Office Systems

Personal Computer

Personal Computer—Worldwide Shipments and Forecasts

Robotics

Semiconductor*

Semiconductor Application Markets*

Semiconductor Equipment and Materials*

Semiconductor User Information*

Software—Artificial Intelligence

Software—Personal Computer

Software—UNIX

Technical Computer Systems

Technical Computer Systems—Minisupercomputers

Telecommunications

Western European Printer

Executive and Financial Programs

Corporate Alliance Program

Coporate Technology Program

Financial Services Program

Strategic Executive Service

Newsletters

European PC Monitor

First Copy

Home Row

I.C. ASIA

I.C. USA

Focus Reports

The European PC Market 1985-1992

European PC Retail Pricing

PC Distribution in Europe

PC Software Markets in Europe

PC Local Area Networking Markets in Europe

The Education Market for PCs in Europe

Japanese Corporations in the European PC Markets

Home Markets for PCs in Europe

Integrated Office Systems—The Market and Its Requirements

European Market for Text Processing

Korean Semiconductor Industry Analysis

Diskettes—The Market and Its Requirements

Directory Products

I.C. Start-Ups—1987

SpecCheck—Competitive Copier Guide

SpecCheck—Competitive Electronic Typewriter Guide

SpecCheck—Competitive Whiteboard Guide

Who's Who in CAD/CAM 1986

Future Products

- Industry Services
  - Manufacturing Automation
  - Computer Storage—Optical
  - Computer Storage—Subsystems
- Focus Reports
  - Japanese Printer Strategy
  - Japanese Telecommunications Strategy
  - Canon CX Laser—User Survey
  - Digital Signal Processing
  - PC-based Publishing
  - Taiwan Semiconductor Industry Analysis
  - China Semiconductor Industry Analysis
  - PC Distribution Channels
- Directory Products
  - SpecCheck—Competitive Facsimile Guide
  - SpecCheck—Competitive Electronic Printer Guide

*On-line delivery option available

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Research Newsletter

ESIS Code: Vol. IV, Newsletters
1987-15

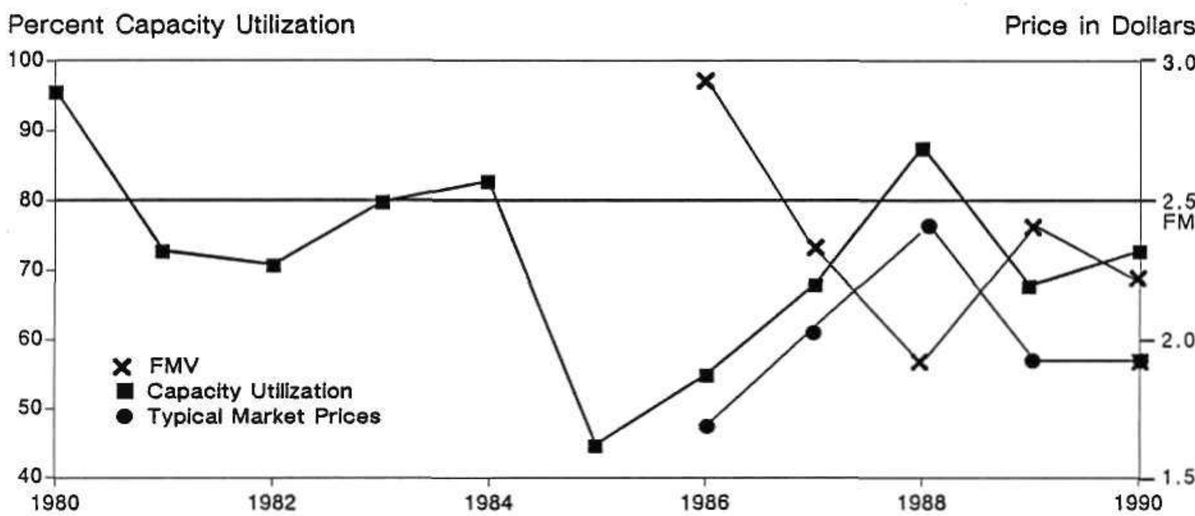
THE FMV SYSTEM AT WORK: PRICE FLOORS LEGITIMIZED

The current semiconductor market illustrates how the Foreign Market Value (FMV) system has impacted the price of DRAM devices. The combination of Japanese shipment restrictions, steady demand, and lack of enough alternative sources have made market pricing predominate over "constructed" FMV pricing. Depending on capacity utilization, the FMV system prevents import pricing from falling below prescribed levels that U.S. producers can take advantage of.

Figure 1 illustrates that, when the majority of the supply is set at constructed higher prices (FMVs), the remaining unmonitored supply will be in higher demand. This, in turn, raises the prices of the unmonitored supply, although not as high as the FMV floor. Low demand corresponds to low capacity utilization, which results in higher costs per unit that must be translated into higher FMV prices, as shown in Table 1. In effect, FMVs prevent the low prices normally experienced in a down market when demand is low.

Figure 1

CAPACITY UTILIZATION



Source: Dataquest
July 1987

Dataquest Incorporated, 1290 Ridder Park Drive, San Jose, CA 95131-2398, (408) 971-9000, Telex 171973

Table 1

CAPACITY UTILIZATION

	100%	75%	50%	25%
256K DRAM FMV	$1.78	$2.25	$2.98	$5.08

Source: Dataquest
July 1987

The result of this program has been to create opportunities for U.S. semiconductor manufacturers to reenter the MOS memory market at an acceptable price, but at a cost to the U.S. electronics industry. This is shown in Table 2, which gives worldwide regional pricing in March and June of this year for the 256K DRAM.

Table 2

256K DRAM PRICES

	United States	Japan	Taiwan	Europe
March 9	$1.95	$1.61	$1.55	$1.90
June 15	$2.40	$1.91	$2.40	$2.50

Source: Dataquest
July 1987

In March, Far East pricing was attractive to U.S. and European companies. By June, the Japanese shipment cutbacks (negative 32 percent) effectively eliminated the gray market for this product, making pricing roughly equal everywhere outside of Japan. Responding to demand and political pressures, incremental shipment increases of Japanese memories should keep prices level through the third and fourth quarters of this year.

The benefits and penalties of the current FMV situation are listed below:

Benefits

- U.S. suppliers regain EPROM market position
- U.S. and European suppliers reenter DRAM market

Penalties

- Competitive disadvantage for non-Japanese electronics manufacturers due to lower prices in Japan
- Product shortages for non-Japanese customers

Ironically, in trying to stabilize the volatile MOS memory market, the customer's supply base has been destabilized, particularly in EPROMs. Down markets "FMV" Japanese suppliers out of the market, and up markets allow them to reenter it. Unfortunately, at that point many Japanese companies would rather manufacture non-FMV products. However, users prefer to procure parts from long-term suppliers. Until the worldwide supply of commodity semiconductors is balanced, this situation will continue.

Jim Beveridge
Mark Giudici

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Research Newsletter

ESIS Code: Vol. IV, Newsletters
1987-14

"A DAY IN THE LIFE" OF SEMI--PERSPECTIVES ON THE EQUIPMENT AND MATERIALS MARKET IN EUROPE

SUMMARY

The Semiconductor Equipment and Materials Institute (SEMI) held its first European Semiconductor Industry forecast conference at the U.S. Embassy in London June 15 through 17. SEMI is an international trade association whose members manufacture the equipment and materials used in producing semiconductors.

SEMI's purpose is to create a productive worldwide business environment for its members. One of the most effective ways that SEMI fulfills this role is by organizing trade shows around the world that display the most advanced equipment and state-of-the-art materials. Seven shows are held annually in Zurich, San Jose, Osaka, Boston, Dallas, Seoul, and Tokyo; an eighth show will be held for the first time in Shanghai in April 1988.

This year's European Industry Services Seminar featured presentations on various aspects of the global semiconductor equipment and materials business. The key topics were market forecasts, technology trends, and the impact of worldwide economies on the long-awaited upturn in equipment and materials sales. Highlights of the speeches are presented below.

SPEAKER HIGHLIGHTS

"Manufacturers and Suppliers Forging Tighter Links"
Willem Maris, IC Business Unit Director
Elcoma Division, Philips NV

Philips Elcoma and Signetics have altered their approaches to purchasing equipment for IC manufacture because of the changes in the way ICs are produced. Large investments in very complicated and sophisticated equipment require that suppliers and manufacturers cooperate during equipment life much more than has happened in the past. Extensive, open exchange of data between Philips and the equipment supplier determines the successful incorporation of a piece of equipment into the production line.

Philips has defined certain conditions that it wants suppliers to meet, in order to be sure that the equipment is operating correctly. The three key categories are start-up time, particulate count, and maintenance. Philips and its equipment suppliers have solved the problems of definition of start-up time, provision of data on particle generation, and training of personnel. Philips understands the true cost of ownership for any item of equipment and can express that cost in terms of the cost per good chip produced during the expected life of the equipment. Philips can then minimize the cost per chip to the end user. Because the buyer of the end product in which the ICs are used is the sole source of money that drives the chain, the better Philips serves the user (and the better the equipment suppliers serve Philips), the easier it is for all links of the chain to stay competitive and to prosper. Philips asks itself and its suppliers, "Do we want to be rich today, or to still be in the running tomorrow?"

"World Semiconductor Industry Overview"
Jack Beedle, Founder
In-Stat Inc.

The historical background of European semiconductor manufacture is characterized by the following factors:

- Small, uncoordinated national markets
- Self-limitation to domestic and European markets by most suppliers
- No special captive market
- Uncoordinated R&D efforts by governments
- Less productive environment
- Lack of engineering clusters and mobility
- Lack of venture capital

Europeans have looked backward, have been proud of their history, and have rested on past achievements. The United States has focused too much on the present, on day-to-day concerns, which has caused U.S. companies to have problems competing effectively in the long term. Japan has excelled in creating and maintaining a strategic overview. Japanese companies do not demand the utmost profit today--they strive to have market share for their products in the future. This is reflected in their increasing success in penetrating worldwide semiconductor device and electronic equipment markets.

"Semiconductor Materials"
Daniel Rose, President
Rose Associates

According to SIA and Rose Associates, semiconductor producers in the European geographic region (regardless of the location of company headquarters) supply approximately 15 percent of devices fabricated worldwide. European consumption of semiconductor materials is dominated by

West Germany, which uses 31 percent of the gases, wet chemicals, photoresists and silicon wafers needed to make devices. The major trend affecting materials suppliers is the user requirement for higher levels of purity. The purity required today is an order of magnitude greater than previously specified. Incremental process improvements, which were the historical methods of purity enhancement, are no longer effective. Rose Associates estimates that the total European semiconductor materials market for 1987 (forecast in constant January 1987 dollars) is $715 million.

"New Directions on Microlithography Equipment Technology"
Gunther Rudenberg, Founder
Rudenberg Associates

Microlithography is probably the largest and most important class of equipment for the production of semiconductors. It has become the pacing technology for submicron VLSI throughout the world. The technological and commercial progress of the semiconductor industry is inextricably linked to advances in microlithography for achieving the smallest, most cost-effective, highest performance device structures. However, the lack of new orders for microlithography equipment has caused severe problems in this area of the industry. Many of the new process requirements for manufacturing integrated circuits can be achieved by relatively minor mechanical and optical upgrades to existing equipment. Sectors such as inspection, repair, and nonoptical lithography (X-ray, E-beam, and laser), will show excellent percentage growth.

"Current Status and Future Trends in Etch and Strip Technology"
Hanns-Ulrich Habermeier, Head of Scientific Services Technology
Max-Planck Institute

Surface modification techniques are the driving forces in semiconductor electronics. The four processes that are key to the manufacture of circuits are lithography, spatially selective doping, selective deposition, and selective removal of material. All four processes have one thing in common: they bombard the surface of the wafer with ions. Current trends in semiconductor electronics, such as the increasing density of circuit elements and shrinkage of lateral and vertical dimensions of devices, pose difficult challenges to the manufacturer. Etch and strip equipment must address particulate contamination and defect problems while providing a fast etch rate, selectivity and anisotrophy, and rapid throughput in order to be successful in today's manufacturing environment. Advanced equipment will have to provide process flexibility, in situ process control, plasma monitoring, and accurate end point detection, and must be fully automated in order to provide the process solutions necessary in the near future.

"The Significance of Equipment Technology in Modern Micro-Electronics"
Ernest Lueder, Director of the Institute of Network and Systems Theory
Stuttgart University

Measurement equipment used in manufacturing microelectronics has changed significantly in the recent past. In situ monitoring of film thickness, optical properties of deposited layers, oxygen and carbon content of substrates, and end point detection for plasma processing are all relatively new technologies. New requirements from processing are that measurements be done without physically contacting the surface of the wafer.

Techniques such as scanning tunneling microscopy and ion-beam analysis are now used frequently. Pattern generation with ion bombardment provides mask-free generation of etchable structures down to 1 micron at this time. The substrate layer is damaged (the depth of the damaged layer depending on the energy of the beam), and that damaged area etches up to 1,000 times faster than the unaffected substrate using conventional plasma etch techniques. Equipment for this type of processing is at the development stage and is still relatively expensive.

"Packaging Trends Through the '80s"
Jeffrey Braden, Vice President of Advanced Technology and Strategic Marketing
Indy Electronics, Inc.

Key factors driving today's integrated circuit packaging trends are higher density and higher performance systems, lower systems packaging costs, and reduced cycle time from device design to market. These factors force higher levels of integration, requiring the following from IC assembly and packaging:

- Much higher pin counts, with greater than 300 input/output pins not an uncommon occurrence
- Much larger chips, with 400 mils on a side being fairly routine
- Surface-mountable lead configurations

Dual-in-line packages (both ceramic and plastic) comprised 95 percent of all packages consumed in Europe in 1985 and will remain the dominant package type through 1990. Surface-mount packages accounted for 5 percent of Europe's consumption in 1985, but their share will increase to 13 percent in 1990. The gullwing is the dominant lead form in surface mount, and it will maintain in this position through 1990. Integrated circuit packaging and printed circuit board assembly are now merging through three key areas: in subsystems (SMD modules), through chip-on-board techniques, and with TAB interlead bonding directly onto the PCB.

"Testing - The '80s and Beyond"
James Healey, President
Trillium

A few years ago, the semiconductor industry was dominated by large captive semiconductor manufacturers that produced devices for internal use, and by small merchant organizations that sold standard products on the open market. Today, new categories of companies increasingly are playing the dominant role in device manufacture. Standard IC makers are targeting niche markets with specialized chips. Vertically integrated companies are moving rapidly into the applications end of the market. Design houses and process specialists are capitalizing on their specific expertise and selling it as a service. The semicustom houses offer advanced design tools combined with fabrication technology. This shift to a customer service focus and market development view offers many opportunities for semiconductor manufacturers to use integrated circuit testing to maintain a continuing dialog with their clients. This capability enables them to solve problems rapidly and provide greater service. Current test equipment requirements include longer CAD-generated test vectors, the capability of testing both linear and digital circuitry, and faster device "debug" and verification times.

"ASIC Technology--System Integration Trends"
Robert Blair, President and Chief Executive
LSI Logic, Europe

ASIC technology as a concept has been with us since the 1960s. However, its ability to provide the system designer with a viable, cost-effective system solution is only recently proven. There are three basic categories of ASIC technology in use today. The first is field-programmable devices, where the final configuration of the chip is achieved by the end user developing his circuit patterns electrically on a special station. The second category comprises, array-based circuits where the final configuration is achieved by vendors customizing the metal layers of the IC according to the user's desired circuit design. The third area consists of cell-based ICs, where the vendor customizes all the circuit layers according to the user's desired circuit design. The focus in the production flow of ASICs is currently on process, CAD, test, and packaging. Almost without exception, the trend is toward more flexibility in manufacturing; more accuracy in design; more complexity in process, test, and manufacturing; and lower system costs. Manufacturing equipment technology must be responsive to the new small-lot world of ASIC, because ASIC houses have become very shy of purchasing the "megadollar" dinosaurs that have haunted factories in recent years.

"The Realities of CAD/CAM in the '80s"
Charles Clarke, Senior Industry Analyst
Dataquest UK Limited

The fortunes of public CAD/CAM companies have changed remarkably over the 1980s, reflecting performance in a maturing industry where the number of competitors increases and a period of shakeout and consolidation occurs. Although eroding hardware prices are a serious problem for the CAD vendor, this is good news for users. Users are demanding better integration and sophistication of both hardware and software. They are not just concerned with saving labor, but want to save costs, decrease time to market, and improve quality. The greatest obstacles to high-quality designs are service related. Successful CAD vendors must strike a strategic balance between domestic and international sales, turn-key and unbundled systems, direct and indirect sales channels, and strategic partnering. Technology opportunities for computer-aided engineering include specialized simulators for ASIC and standard IC design, board verification systems, and logic design and test integration systems. Technology opportunities for IC layout include IC layout automation, silicon compilation, and automated tool integration.

"Integrate for the VLSI Era"
Jim Beveridge, Director of the European Semiconductor Division
Dataquest UK Limited

Both end users of components and component suppliers are being affected by fundamental structural changes in the industry. Mergers, joint ventures, and technology exchange agreements have become an integral part of the operating environment. The new wave of determined, realistic, and courageous

European industrial leaders is driving these deals, not the governments. Over the next decade, the IC industry will wrestle with the problems of high investment cost, increased competition, and a fundamental slowdown in market growth rate, from its historical 17 to 18 percent per year, to around 12 to 13 percent.

Real semiconductor consumption in 1987 will be more than total shipments for the third year in a row. This will lead to a robust shipment year in 1988, but it will not get out of control as it did in 1983/1984. Along with the end to hypergrowth, and the current industry shakeout of players (both indicative of a maturing market), the semiconductor industry will be greatly affected by increasing trends toward protectionism worldwide. Since the 1970s there has been a gradual shift away from reliance on market forces. Rapidly expanding public sectors have been subsidizing industries (particularly services); incentives have been reduced by heavy taxes; companies has been increasingly circumscribed by a labyrinth of red tape; and trade liberalization has faltered and nontariff barriers have multiplied. Any substantial increase in protectionism will reduce demand and stifle growth opportunities. If taken to excess, there is the very real danger of pushing the world into a general economic recession.

"European Perspectives"
Guy de Jonquieres, International Business Editor
Financial Times

The spirit of open competition and survival of the fittest--which once ruled the semiconductor industry--has given way to a new era in which political factors increasingly are intruding into commercial judgements. Despite European governments pouring billions of dollars of taxpayers' money into the electronics industry over the past 20 years, a recent study predicts that on present trends Europe's aggregate deficit on electronics trade will grow to $35 billion by 1995 from $7 billion in 1984. However, there are a number of signs that Europe has reached the bottom of a cycle of relative decline.

The root of Europe's problem lies in its inability to achieve acceptable levels of commercial return on its investment in electronics. On average, the European electronics industry has had to invest twice as much as the Japanese and 50 percent more than the Americans to achieve the same increase in output. The most widely cited explanation is that the small size of the European companies' domestic markets is to blame. This sounds a seductive argument, until one reflects that Philips of the Netherlands, Europe's largest electronics company, has a home market of only 11 million people, and that two of Europe's most internationally successful performers in telecommunications and computers, i.e., Ericsson and Norsk Data, hail respectively from Sweden and Norway.

The real problem has not been the size of the European suppliers' domestic market, but extreme reluctance in many cases to venture beyond them. Safeguarding established positions at home too often has commanded a much higher priority than confronting the risks of international expansion. The growth of American and Japanese multinationals into Europe shows that the barriers to trade are not insurmountable, they may exist more in the minds of

European management than in the market. There is a new awareness among Europeans, that unless they hang together in the face of the American and Japanese challenges in advanced technologies, they all risk hanging separately. Increasing the industrial competitiveness of Europe is the objective. Espirit and Eureka have created an embryonic information network which has never before existed in Europe. There has been a parallel growth of cooperative research ventures by industry:

- The mega project by Philips of the Netherlands and Siemens of Germany
- GEC of Britain and Thomson of France working together on ASICs
- Siemens, Alcatel of France, Plessey of Britain, and Itatel of Italy, cooperating in the field of telecommunications

Cross border mergers and acquisitions by companies in different European countries has increased within the last year, for instance:

- The merger of SGS of Italy and Thomson of France in semiconductors
- The merger of GEC and Philips in medical electronics
- The sale of CGET of France to Ericsson and Matra of France

But simply creating big companies is not the answer. Unless the underlying industrial and commercial logic is sound, just adding one and one ends up producing one and a half. The most important positive change in Europe, however, has been at the management level. Many European electronics companies have been forced to revitalize their top management in the past few years. The attitude of senior management is more international and enterpreneurial than it was ten years ago. There is a much greater awareness at the top of the need to confront the challenges of global competition head-on and a keener appreciation of the opportunities and risks involved. The message that needs to filter down the line is that the complexity of the business environment of the 1980s and 1990s requires a radical break with the corporate attitudes and behavior patterns of the past. This will allow European companies and industries to grasp business opportunities as they occur and to capitalize on them.

DATAQUEST ANALYSIS

A few key themes were repeated over and over in various forms throughout the speeches. Many segments of high-technology industry are entering a more mature phase characterized by approximately 10 percent CAGRs (rather than 20 percent), and competitive shakeouts where companies fail or merge. This is happening in the end-equipment market (computers, Consumer goods, etc.), in the device market (memories, ASICs, etc.), and in the markets for equipment and materials used to produce devices. In order to forge tighter links along the chain, all parties must provide good service and quality products to the end user, who ultimately is the source of the money that drives the chain. To do this, all parties must understand their customers'

customers. With this knowledge, companies can leverage their present situations and implement changes, positioning themselves to achieve increased prosperity in the medium to long term.

The European Semiconductor Industry forecast conference highlighted the new entrepreneurial attitude prevelant among the delegates. This year there was a heightened awareness of global issues and the acknowledgement of the need for greater sensitivity toward customers' requirements. Last but not least, there was an acceptance of the need for radical change, which is the prerequisite to coping with the future business environment.

Kathleen Killian

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Research Newsletter

ESIS Code: Vol. IV, Newsletters
1987-13

HIGHLIGHTS OF DATAQUEST'S EUROPEAN SEMICONDUCTOR INDUSTRY CONFERENCE--INTEGRATE FOR THE VLSI ERA

SUMMARY

Dataquest's sixth annual European Semiconductor Industry Service conference was held at the Palace Hotel in Madrid at the beginning of June. The event attracted senior managers from semiconductor houses, OEMs, and equipment and materials vendors worldwide.

The conference theme, "Integrate for the VLSI Era," was chosen to reflect the thought-provoking presentations made by conference speakers--people representing companies that are shaping the future of semiconductors in Europe. The program consisted of formal presentations, workshops, and informal discussions related to the following topics:

- The latest VLSI component and manufacturing equipment developments and their impact on application markets
- Understanding users' complex performance requirements
- The issues involved in creating an international environment for alliances in Europe
- The latest developments in telecommunications in Europe
- Industry leaders' current opinions regarding the status of the market environment

Dataquest Incorporated, 1290 Ridder Park Drive, San Jose, CA 95131-2398, (408) 971-9000, Telex 171973

SPEAKER HIGHLIGHTS

The following are highlights of the conference presentations:

- "Facing the International Challenge"--Doug Dunn, Managing Director, Plessey Semiconductors, Ltd.

  - The market, competition, people, skills, and equipment related to the IC business are international, impacting captive and merchant IC suppliers equally worldwide. A "Fortress Britain" attitude in the past, which avoided the international challenge, profoundly affected the United Kingdom's ability to compete in international and home markets.

  - Most Western companies seeking growth face the financial constraint of consistent profitability (reported quarter by quarter) to provide annual dividends. In Japan, the tax-free status of capital gains allows investors to focus more on growth and less on profitability.

  - Process technology excellence remains the key to success in the industry. The cost of having first-class processes is difficult to bear for a small company, but it is necessary to continue investment. As the gap between DRAM technology and ASIC technology narrows (and closes by the early 1990s), that investment will be repaid by the small company's ability to compete effectively worldwide in production and technology.

- "The European Semiconductor Industry--A Supplier's Perspective"--Robert Sandfort, Vice President, Europe, Monsanto Electronic Materials Company

  - The geographical shift of semiconductor production from the United States to Japan, coupled with the closed nature of the Japanese market, has destabilized the silicon supply industry. In 1980, the United States accounted for 60 percent of world sales of polished silicon. In 1986, that figure had declined to between 30 and 50 percent.

  - Despite existing overcapacity, five new Japanese vendors of polished silicon are entering the industry, encouraged by MITI. The relaxed attitudes of U.S. and European governments to this potential problem have compounded its seriousness to the point where an extended trade war is mentioned as a viable solution to this problem.

  - Acquisitions, joint ventures, technical exchanges, and R&D collaboration along the lines of Sematech are suggested routes forward for the silicon supply industry.

- "Packaging Considerations for VLSI Components"--Mick Denham, President, Indy Electronics (Scotland) Limited

    - Equipment makers now require higher systems performance with reduced systems packaging cost. This forces chip suppliers to pack more functions onto silicon, leading, in turn, to larger die, higher heat dissipation materials, and more input/output pins. Electronic equipment manufacturers now are more prepared to cut out poorly performing suppliers of ASICs and standard ICs. This has forced a quicker response from IC suppliers right through the entire manufacturing process. As an example, packaging throughput times of one to two days are demanded.

    - The package types most suitable for high-performance VLSI are the ceramic quad flat pack, the plastic leaded chip carrier/ plastic quad flat pack, the pin grid array, and the plastic pin grid array.

    - The goal of zero defects will be achieved by excellence in process design, which is the effective integration of process and materials to best maintain the integrity of the silicon design.

- "Electronic Systems in Automobiles"--Otto Holzinger, Director of Advanced Automotive Engineering, Robert Bosch GmbH

    - Automobiles are still primarily mechanical. The environment for electronics is harsh, with voltages varying from 4.5V to 20V, temperatures varying from -40°C to +150°C, and vibrations reaching up to 200g. Water, salt spray, sand, dust, oil, and gasoline fumes worsen conditions.

    - Electronics offers the possibility of monitoring a large number of inputs more effectively than any other method. In addition, electronic components are small and inexpensive, and they don't wear out. Electronic issues that need to be addressed are finding suitably inexpensive yet rugged sensors, solving electromagnetic interference problems, and centralizing the various control units into one box.

    - Electronic applications in cars will increase in many areas such as fuel economy controls, cleaner exhaust controls, ignition systems, air-bag inflating and seat-belt tightening controls, headlight leveling, antitheft devices, climatic systems, traffic information systems, and voice input/output controls.

- "Towards Optical Computing"--Brian Wherrett, Professor of Physics, Heriot-Watt University, Scotland

  - Parallelism and interconnect freedom are the two main benefits that optics offer. However, optical logic devices have been constructed only in the last three years, and specifications for optical components for use in digital processing have yet to be established. Materials and devices optically doing the job of electronic transistors are now a possibility.

  - Architectures for optical processing favor two-dimensional, parallel, cellular processing schemes with various interconnect configurations. The development of a general-purpose optical computer is unlikely without a breakthrough in the physics of nonlinear phenomena, but the specialist optical devices necessary may be built before the turn of the century.

- "An Integrated Approach to Siliconization"--Jean-Luc Grand-Clement, Managing Director and Chief Executive Officer, European Silicon Structures

  - With a slow-growing discrete market, a Japanese-dominated memory market, and a microprocessor market that has established standards, the new battleground in the semiconductor industry is ASICs. Full-custom devices are the best way of achieving innovative, proprietary, hard-to-clone products. The entry cost is high, however, in terms of NREs, CAD, and training.

  - A traditional industry solution is to make products as standard as possible through PALs, EPLDs, and gate arrays. EPLDs use too much silicon and are insufficiently dense. Gate arrays are becoming less effective in gate utilization terms for high-complexity uses. Full-custom ICs appear to be way ahead.

  - Cost-effective, technology-transparent CAD tools, which systems engineers can learn to use in a week and which allow multiple foundry choice, are being developed at ES2. European educational establishments and industry could show their commitment to custom silicon by buying these tools and others like them.

  - Direct-write e-beam wafer-at-a-time production batches will give a five-day turnaround in the fabrication area, while multidesign wafers will cut costs to the user of the completed integrated circuit.

- "Integrated IC Users"--Bernard Hadley, Managing Director, STACK GmbH

  - STACK was established in 1974 by a group of European IC users who had recently experienced difficulties in using the first types of memory devices. STACK's purpose was to establish a realistic procurement standard for the 4K DRAM.

- STACK's view is that the IC user is not helped, short term or long term, by artificially increasing the market price of ICs. Europe's 14 percent tariff has not produced a virile European IC industry, shown by the fact that Europe had a $2 billion imbalance of trade on semiconductors in 1985.

- STACK believes that fair market value pricing methods give windfall profits to the Japanese and provide low-risk market entry for the Koreans. Cutbacks in Japanese production will result in rising prices in the West and a more competitive Japanese computer systems industry.

- Vendor/user integration needs to be improved by users giving more accurate forecasts of requirements, greater standardization in packaging, the use of optical recognition techniques (like bar coding) on ICs, and second-sourcing for ASICs. All of these recommendations will reduce the cost of ownership of ICs.

• "Integrating Manufacturing into the Marketplace"--Mototaka Kamoshida, Managing Director, NEC Semiconductors (U.K.) Limited

  - Foreign subsidiaries are necessary in order for companies to respond flexibly to markets. To have a thriving foreign subsidiary company, it is necessary to integrate with the local community at as many points of connection as possible (for example, through suppliers, customers, and employees).

  - NEC's view is that the semiconductor industry is moving from a components focus to a systems focus. NEC is moving toward closer relationships with local customers to understand their needs from both the component and the system perspective.

• "Application-Specific Memories--Tomorrow's Standard"--James Koo, Vice President, Engineering Services/Customer Specific Memories, Vitelic Corporation

  - Vitelic believes that from a $350 million market in 1987, smart memory will increase at a 14 percent compound annual growth rate (CAGR) to $1.3 billion in 1991, which will represent 15 percent of the total memory market. In addition to storage, smart memories have on-board logic for purposes like color-palette memory, cache-tag RAM, content-addressable memory and video RAM. They have such features as error correction, FIFO, and dual ports for the most current applications.

- "ICs and the Compact Disc"--Robert van Meurs, General Manager of Hifi/CD Product Group and Managing Director of Consumer Electronics Division, Philips International

  - One of the main forces driving innovation in consumer markets is the move to digital electronics. Companies involved in digital electronics need high investments in ICs and displays, and only vertically integrated companies operating globally can afford such investments. At this time, regional companies must be technological followers; however, Philips already has a wafer scale memory, called a compact disc (CD).

  - Because of the improved quality, price, and performance of the new generations of ICs, it will be necessary to control IC technology involved in manufacturing CDs. This is especially so in new applications for CDs (which Philips plans to introduce soon). These applications will require new VLSI processors to control new functions in improved equipment. Philips expects to reduce the cost of manufacturing CD equipment by a factor of four over the next four years.

- "Electronic Distribution in Europe--The Conflicting Challenges"--Tim Curtis, Director of European Distribution, Unitech plc

  - Once a distributor has signed a franchise, that distributor no longer controls either the buying price or the selling price--both are determined by competitive pressures in the marketplace. In downturns, however, distributors cannot trim overhead costs on their main assets, because those assets are employees in whose training the distributors have invested heavily.

  - Only by holding significant market share can a distributor protect his profitability by having some control over selling prices. Currently, Lex and Diploma/E2000 have a combined 18.5 percent of the European semiconductor distribution market; EBV, Spoerle, Unitech, and ITT have a combined 15.0 percent share.

  - Semiconductor distributors have been slow to take advantage of opportunities offered by systems distribution (boards, boxed systems, and peripherals) and even slower to get into ASIC distribution. Very little of the 1986 European ASIC TAM went through distributors. Distributors haven't decided their approach to the ASIC market and need to resolve such issues as asking a finder's fee, staying with customer-programmable devices, and providing a full semicustom bureau service. Distributor margins on ASIC sales appear to be low, at around 20 percent.

- Current market views state that traditional semiconductor distributors will decline and that smaller, innovative, more focused distributors providing technical support will become more prominent. It is believed that U.S. distributors will stay out of the European scene because European distributors, having learned to support products with a large stretch of ocean between them and the manufacturers, can add more value to the products than can U.S. distributors.

- "Partnerships and Alliances--The Ultimate Synergy"--Graham Shenton, President, IMP Europe

  - Choosing an ASIC partner is fraught with difficulties. An ideal ASIC vendor should have the following:

    - Systems engineering skills relevant to the partner's business and a willingness to provide assistance at the partner's premises

    - The ability to supply all of the partner's ASIC design methodology needs such as analog, digital, and mixed a/d, gate array, or standard cell

    - The willingness to transfer know-how for definition and design to the partner

    - All of the processes needed to support the partner's needs

    - A procedure for controlling design and masking processes so that costs and schedules are predictable

    - A willingness to focus on the partner's needs and become a service organization supporting that partner

  - Key to success are management structures allowing consultation and formal reviews between partners. These should give the systems partners an insight into the use of ICs and their future technological directions. The major benefit of such partnerships is that both partners can invest for the future.

- "Spain--Integrating for the High-Technology Era"--Miguel de Oyarzabel, Deputy Director for Electronics, Spanish Ministry of Industry and Energy

  - The market for semiconductors in Spain is showing growth rates in excess of those for Europe as a whole. The Spanish Ministry of Industry and Energy estimates that Spain's consumption of semiconductors increased by 21 percent in 1985 when the rest of Europe's was static. In 1986, Spain's consumption grew by 22 percent when Europe's increased only 16 percent.

- Spain is putting 2 billion pesetas into a National Center for Microelectronics, which is designed to be a technology generator for the provision of training and services to the microelectronics industry.

- In order to promote the use of ASICs by Spanish industry, the government is providing grants amounting to between 30 percent and 50 percent of the costs of design. In order to encourage high-technology companies to locate in Spain, the government is offering grants amounting to 30 percent of the total value of the investment plus long-term credit at professional rates.

- Corporate tax rates are 35 percent in Spain, but special tax breaks and allowances effectively reduce that to 18 to 20 percent. There is no shortage of qualified electronics engineers in the country.

• "Integrating the Supplier-Customer Loop"--Andre Borrel, Senior Vice President and General Manager, Semiconductor International Group, Motorola Inc.

  - The supplier/customer relationship of the past could be described as two separate worlds without a lot of trust to link them. Characterized by antagonism, opportunism, and multi-ordering, this was a reactive and not a proactive relationship, with minimal dependency and little trust. That condition was magnified by the the boom/bust cycles of the industry.

  - Motorola set up a customer service task force of eight senior managers, all working full-time for two months. This task force interviewed 40 customers and 200 "Motorolans" to develop excellence in all aspects of customer service.

  - The new vendor/customer relationship Motorola has developed is an integrated "win-win" scenario of cooperation and long-term planning, combined with predictability and commitment. Increased communication, quick answers to customers' problems, flexible response to customers' present and anticipated future needs, and a culture of "total customer satisfaction" should allow Motorola to achieve success in client service.

  - Allied to improving customer service is the need for semiconductor manufacturers to invest in and improve their manufacturing excellence (which has long been regarded as a necessary evil) and which has taken a backseat to new, state-of-the art technology development. Key areas for implementation of improved manufacturing are shipping directly at the end of the manufacturing line to the customer, eliminating paperwork and buffer socks, accepting returns of defective parts without questions asked, and manufacturing to each customer order.

WORKSHOPS

In addition to the main conference proceedings, two workshop sessions were offered, as follows:

- Workshop 1: ASICs--User Barriers to Entry
  - Review of the acceptance of ASICS by the user community
  - Identification of barriers to entry that are slowing or potentially could slow the users' acceptance of ASICs
  - Practical steps to overcome these barriers
- Workshop 2: Applications Markets Focus
  - Western European and North American electronic equipment forecasts and market opportunities
  - Semiconductor consumption by application market
  - Annual procurement survey results

At the end of each workshop, the participating group presented its proposals to the other workshop attendees. The team with the best proposal in each area received an award.

Dataquest is publishing separate newsletters summarizing the results of each workshop.

1987 CONFERENCE

The next Dataquest European Semiconductor Industry Conference is planned for Edinburgh, Scotland, in June 1988. Once again, we expect a large attendance; therefore, we are asking participants to make their reservations early to assure their places at the conference.

Kathleen Killian

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WHERE ARE SEMICONDUCTORS GOING?

Workshop Highlights from Annual European Semiconductor Conference

INTRODUCTION

Dataquest sponsored a workshop at its recent European Semiconductor Conference, held in Madrid, June 3 through 5, that focused on the research and methodology used by our Semiconductor Application Markets service to understand the semiconductor market. This newsletter highlights the workshop presentation and discusses key findings that are a result of our research in North America, as well as our European semiconductor application market research, now based in London.

WHY AN APPLICATION MARKET PERSPECTIVE

A historical look at electronic equipment production and semiconductor consumption shows that the relationship between the two rarely reaches parity. Equipment usually grows between 8 and 14 percent per year, while the semiconductor industry can swing much more dramatically.

At the same time, the industry is edging out of the worst market slump in history and many fundamental changes have evolved. Partnering has become increasingly important, and manufacturers are looking for new applications and market opportunities--particularly those driven by the emphasis on application-specific devices.

Dataquest believes that the industry's emergence from this slump will center on three concepts, all playing equal roles in fostering stable growth:

- Design technology
- Manufacturing technology
- Marketing technology

Design and manufacturing technologies have become givens with today's increasing competition and semiconductor pervasiveness. Both are bottom line keys to survival. An equal emphasis must now be put on the third concept--marketing technology.

To date, marketing technology, or an application market perspective, has been less crucial than the other areas. Traditionally, customers have centered in the data processing and military communities, and being on the leading edge has always spurred the technology push that has driven industry growth.

We also believe that the industry's next market surge will probably occur in the same manner as preceding boom years--with an unforeseen technology that ends up with individual users and takes semiconductor pervasiveness another leap forward to calculators, digital watches, video games, and personal computers. For semiconductor manufacturers, however, this means maintaining a perspective on the customer's customer. Device manufacturers have to help their customers provide solutions, because the ultimate user does not care about the devices. He cares about results: Will the watch keep accurate time? How often will the car need servicing? What will be the vehicle's fuel efficiency? Successful semiconductor manufacturers will keep this type of issue in mind when working in a win-win relationship with their customers.

Dataquest also believes that device manufacturers should cultivate a diversified portfolio of customers across different industries. Stability and growth can often be found in smaller markets and can protect business when a recession environment prevails.

Emphasis too, must lie in understanding why users buy a company's products. Today's industry leaders are insisting on knowing why they won a design-in, what their technology provided, and which problems it solved. They are further examining the market to learn who else might need the solution and how they can enhance their products for this new subset of player.

RESEARCH METHODOLOGY AND RESULTS

Dataquest's semiconductor application market research has three main elements:

- Understanding electronic equipment markets and their specific and aggregate impacts on semiconductor consumption

- Procurement data and semiconductor buying trends

- System semiconductor content analysis on key types of electronic equipment

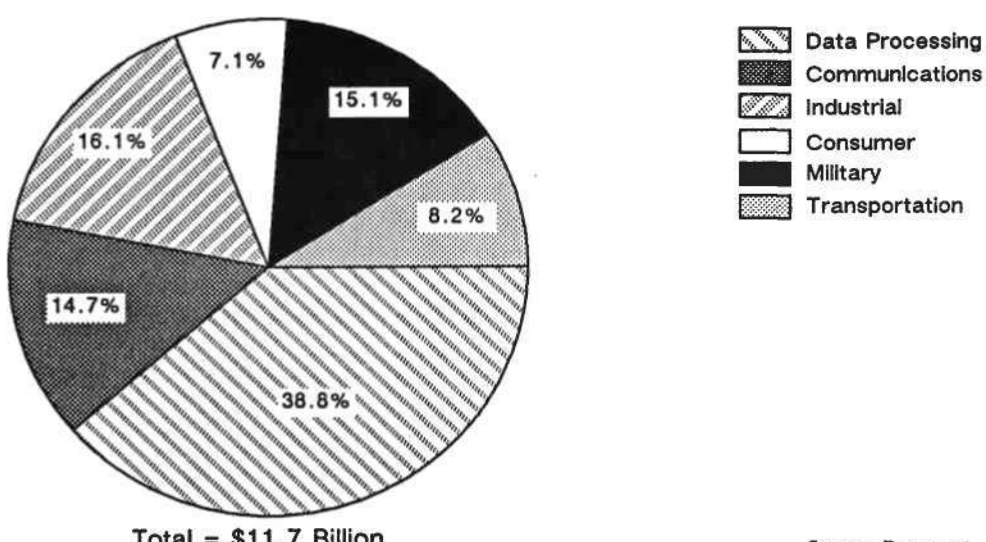
Electronic Equipment Market Trends

At the workshop we discussed the North American electronic equipment market which Dataquest forecasts to grow only 4.8 percent in 1987. Dataquest believes, that for the most part, double-digit growth rates in the electronic equipment market are gone. There are bright spots, however, small markets with high growth rates, that tend to be dwarfed in the larger scheme of things. These markets, although fast-growing, are still small and represent only modest semiconductor markets. They include optical disk drives, workstations, cellular mobile radio equipment, voice messaging, private packet data networks, integrated voice/data workstations, videoteleconferencing, modems, robot systems, and graphics terminals. Combined, we believe these represent a $675.3 million semiconductor market in 1987.

Figure 1 shows Dataquest's estimate of North American semiconductor consumption by application market. The concentration in data processing is indicative of the U.S. market and we do not expect this to change over the next several years, although market opportunities in telecommunications and manufacturing automation continue to emerge. The U.S. market differs from Japan, in that until recently, consumer electronics have dominated Japan's semiconductor consumption. Now in Japan, increasing emphasis is being placed on data processing, industrial, and communications markets. The Rest of World (ROW) region uses most of its components in the consumer segment. As seen in Figure 2, Western Europe is the most evenly spread across the data processing, communications, industrial, and consumer end markets.

Figure 1

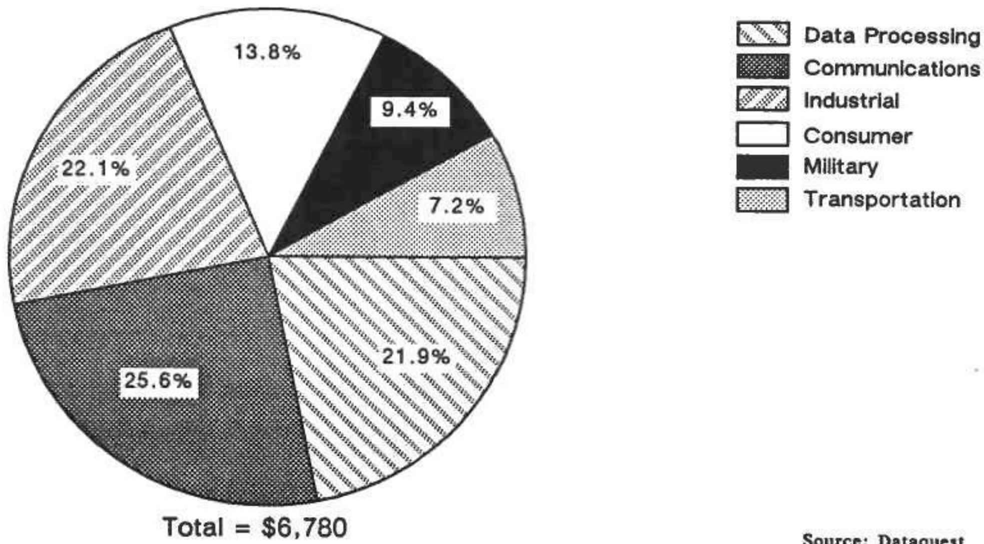
ESTIMATED 1987 NORTH AMERICAN SEMICONDUCTOR CONSUMPTION BY APPLICATION MARKET (Percentage of Total Dollars)



Source: Dataquest July 1987

Figure 2

ESTIMATED 1987 EUROPEAN SEMICONDUCTOR CONSUMPTION BY APPLICATION MARKET (Percentage of Total Dollars)



Source: Dataquest July 1987

Purchasing Survey Results

Recent purchasing surveys, where Dataquest individually interviews major users on an annual and monthly basis, reveal interesting trends. In North America, major users expect 1987 purchases to increase by 13.6 percent. ASIC users rely on internal design teams at the rate of three to one, and 32.0 percent of ASIC nonusers are planning to become users. The nonusers are mainly industrial, data processing, military, and communication equipment manufacturers.

Users expected a continued shift to offshore production. Dataquest believes the trend that impacted 1986 consumption will continue to impact overall 1987 industry growth. Although the market is expected to grow in 1987, we believe that what was once domestic consumption, will now take place in the Far East, namely in Singapore, Taiwan, South Korea, and Hong Kong.

The purchasing research Dataquest has conducted indicates that inventory levels are still a bit excessive, despite popular opinion to the contrary. We believe that target inventory levels will continue to decrease.

We believe the main reason for offshore shifts and reduced target inventory levels is changes in manufacturing and operations that are being implemented by users to remain more competitive. Major issues cited by users, continually involve cost reduction, whose management will impact relationships with suppliers.

European Purchasing Survey Results

A European semiconductor purchasing survey was executed in March and April of this year. This was the first of these periodic surveys to be carried out as part of the European semiconductor application market research. We selected survey participants from the top European electronic companies listed by Electronic Business. Dataquest contacted those people responsible for the purchase of semiconductors; their positions ranged from junior purchasing manager to director of materials.

Overall, Dataquest believes that distribution purchases are increasing in Europe as a percentage of total semiconductor purchases. There are two main reasons behind this. First, the movement from electromechanical industries to electronic systems means that more companies are coming to market with relatively modest requirements for semiconductor purchases; these companies are best served by the distributors. Second, semiconductor vendors are moving to regulate and minimize the sales costs by limiting the number of companies with whom they deal directly. By servicing some of these companies through their franchised distributors, they can increase their overall efficiency.

Survey participants were asked for the regional base of their semiconductor suppliers. We defined the regional base as the semiconductor company's country of origin. About 32.9 percent of purchases were made from European-based semiconductor manufacturers. The United States, Japan, and ROW had approximately 50.0 percent, 14.9 percent, and 2.2 percent, respectively. The survey indicates there are no nationalistic tendencies towards purchasing; suppliers are chosen on their merits for providing price, quality, and delivery.

Users on the whole did not expect to see much of a shift in production to non-European sites. Well over half the participants did not expect to see any movement in their company's production from their present locations. Those companies who did expect to see some movement were the multinational companies with existing offshore locations and with some experience of purchasing and subcontracting assembly offshore. The smaller companies, before moving their production to non-European sites, tend to purchase components offshore and bring them into Europe as an intermediary solution.

We polled participants on the status of their inventories. We asked respondents if their inventories were above, at, or below target levels. Twelve percent responded that inventories were below target, 48 percent at target, and 40 percent above target. We further asked if respondents were satisfied with current inventory levels, and if they expected them to increase, decrease, or stay the same. Here, 16.2 percent expected their inventories to increase, 40.1 percent expected them to decrease, and 43.7 percent expected inventory levels to remain stable. This further supports our belief that on a worldwide basis, contrary to popular belief, inventories are not at an all-time low. The trend that began two years ago to cut back and rationalize inventories from the excessive levels of 1984 is still continuing.

The final question asked was an open-ended one: What are the two major purchasing issues that you are facing? The response was varied, with the top ten most frequently-mentioned issues listed below. Surprisingly, quality was not among the top ten:

- Pricing
- On-time delivery
- ASICs/Semicustom
- Lead times
- Inventory/Just-in-time delivery
- Surface mount
- Currencies
- Political intervention on supply
- Reduce vendor base
- New product introduction

System Analysis--Recent Findings in PCs

The Semiconductor Application Markets service regularly analyzes the content of electronic equipment in order to assess system trends in IC consumption. Recently we analyzed the Compaq 386 and compared it to the popular chip-set approach being taken by several clone manufacturers. We also analyzed IBM's new PS/2, several days after it was announced, and gained insight into IBM's ASIC trends over the last several years in its PC family.

When Compaq entered the market, one of its key goals was to be the first 32-bit PC in the market. To save time, it took a more conservative approach in system design, incorporating over 177 ICs in its newest market entrant. The chip-set approach, most notably taken by Chips & Technologies, reduces chip count significantly, to about 79 ICs. The goal with clone makers, who typically follow the market leader and use PC chip sets, is to be better, faster, smaller, etc. They have different competitive issues at stake. It is interesting to note that of the 79 ICs, eight are application specific. The ASIC functions include:

- Bus control
- Page/interleave control
- Address bus interface

- Data bus interface
- Control signal buffers
- Integrated peripherals controller

As a further example of the integration that has occurred, the integrated peripherals controller includes and replaces components used for:

- DMA control
- Interrupt control
- Timer/counter
- Memory mapping
- Other interface logic

Since IBM's entry into the market, it has gone from zero ASICs in the original IBM PC, to six in the IBM PS/2. In standard logic alone they have gone from 200 ICs in the PC, to 128 in the PC AT, to 82 in their newest model. Overall since 1982, they have reduced total ICs from 250 to 118, and now incorporate all of the ICs on the motherboard, no longer requiring graphics or disk controller boards.

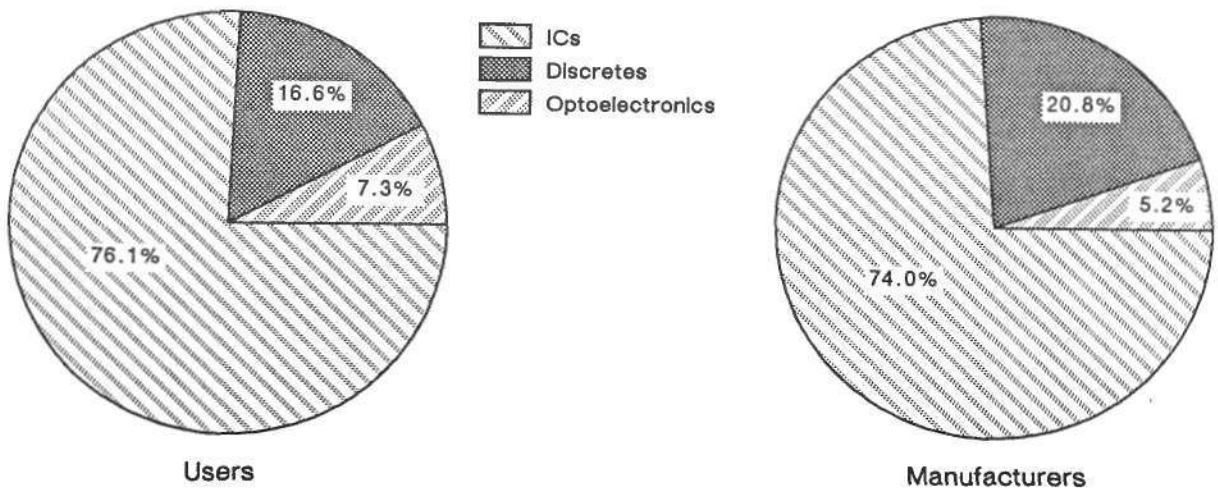
The regional distribution of those polled was 40 percent from Northern Europe, 34 percent from Central Europe, and 26 percent from Southern Europe.

Semiconductor purchases in 1986 for those surveyed were split 76.1 percent for ICs, 16.6 percent for discretes, and 7.3 percent for optoelectronics. The trend clearly indicates a strengthening of purchases of ICs and optoelectronic products. Comparing these results to Dataquest's estimates for European semiconductor consumption (74.0 percent for ICs, 20.8 percent for discrete, and 5.2 percent for optoelectronics), we find that these data from semiconductor manufacturers show a close correlation with the data from the procurement survey participants (see Figure 3).

Users were asked what percentage of their semiconductor purchases were procured through the distribution network; overall this was 37.5 percent. We further categorized the results by company and by end-user segment in order to ascertain the distribution profile by end user. The highest percentage of purchases occurred in the industrial and military segments, with 40.2 percent and 34.6 percent, respectively. The lowest percentage occurred in data processing and transportation, at 6.7 percent and 3.0 percent, respectively. These two segments are both dominated by large OEM manufacturers with close links to the semiconductor vendors.

Figure 3

REPORTED 1986 EUROPEAN SEMICONDUCTOR CONSUMPTION
(Percentage of Total)



Source: Dataquest
July 1987

Dataquest has seen many trends emerge at the center of this perspective. First, we believe that the industry is moving toward a concept of tailored service, which has taken place in many other industries and comes in many forms:

- A close association with smaller businesses
- An emphasis on customer service
- A niche market orientation
- Product differentiation and/or specialization

We also believe that the industry is experiencing a commercial market evolution similar to that of the automotive industry as cited by Alfred P. Sloan, Jr., one of the founders of General Motors. A CLASS ---> MASS ---> MASS-CLASS orientation in the semiconductor industry comprises a move from concentrated efforts in the data processing and military markets through the last 15 or 20 years of the "jelly bean" era, on to what is now appearing as a niche market, ASIC orientation in the pervasive use of devices (see Figure 4).

Figure 4

EVOLUTION OF SEMICONDUCTOR MARKET

Class → Mass → Mass-Class Evolution	
A class market: Expensive cars	Devices for DP and military
A mass market: Basic transportation at low prices	Jelly beans
A mass-class market: Better cars, more diversity	Niche markets, ASICs, ASSPs

Source: Dataquest
July 1987

CONCLUSIONS

Dataquest believes that application market dynamics will continue to shape the industry. Whether it be changes in electronic equipment market growth rates, buying habits, or system design, the overall message to semiconductor manufacturers is to be worldwide suppliers focused on service and user support. We believe that success will be found by the semiconductor manufacturers who help users protect their markets, access technology, and control costs in a win-win environment with their suppliers. This was highlighted in the workshop with roundtable discussions focused on the major concerns now shaping users' business decisions.

Anthea C. Stratigos
Jennifer Berg

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VENTURE CAPITAL IN EUROPE

SUMMARY

Venture capital is a relatively new phenomenon in Europe. The oil shock, the subsequent long recession, and the resulting high unemployment, coupled with the competitive ascendancy of the United States and Japan in new high-technology industries, are causing the West European governments to foster small business enterprises.

During the last three to four years, significant developments in venture capital funding have taken place in Europe. Although not all European countries are at the same level of development, most have active programs currently under way. Dataquest believes that venture capital will be a vital instrument in forthcoming European economic development.

During the last year, Europe has seen a slowdown in venture capital growth. The main reason for this is a general unease about where things will go from here. To this point, Dataquest anticipates that at some point in the future, the industry may undergo a shake-out, with smaller funds absorbed by larger ones.

EUROPE, INC.

Reasons for the creation of a single European common market are several. Perhaps the most important reason is the awareness that the United States and Japan are in the process of overtaking Europe, particularly in high technology. For years, Europe has been the leader in economic and technological development, which makes it even more difficult to adjust to this new situation.

A vital ingredient for a successful Europe is availability of capital. Low-cost industrial capital is vital to international competitiveness. It is here that government policies become so important--to encourage consumer savings that can be channeled to industry, to encourage banks to lend

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industry low-interest capital, and to encourage banks to be closely involved in the management of their prime clients. Governments themselves should keep a tight rein on their financial systems and keep them as internationally competitive as possible.

A desire among Europeans themselves for a single common market in Europe is already half the battle. Isolation and go-it-alone policies have become history. European countries must work together to achieve a single and united Europe if Europe is to remain a considerable power on the world map.

The European Economic Community (EEC) is also working toward this goal by encouraging collaboration in precompetitive research and by adopting Europe-wide technical standards. It believes that a unified European market is crucial to stimulate innovation, entrepreneurial activities, venture capital, and creation of small- and medium-size businesses.

European companies themselves are working more and more closely with one another. In 1983, a 20-strong Round Table of Industrialists was formed to help strengthen and develop Europe's industrial and technological base by creating less fragmented markets. The Round Table has also provided financial backing for Euroventures BV, a trans-European venture capital operation. Euroventures started operating in 1985 and invests through several independently managed satellite funds in European countries.

To encourage cooperation among its member companies and to encourage industrial projects that may otherwise never get started, the Round Table is looking at Euroshare funds (investment trust companies quoted on all European stock markets). These funds would channel private investment into European joint ventures in high-value-added industries such as electronics and telecommunications.

The Round Table's other main proposal is to set up a postgraduate European institute of technology. Such an institution would improve the technical education of the best engineers and help them to consider the best interests of Europe rather than of individual countries. The institution would draw on the resources of European industry, universities, and governments. Research would be applied rather than theoretical and would concentrate on semiconductors and informatics.

The European Commission has encouraged the establishment of the European Venture Capital Association (EVCA) to promote venture capital and ensure a smooth flow of information on developments in the sector. However, venture capitalists in Europe do have some barriers, as evidenced by the fragmented market with differing national regulations, tax climates, and business cultures. The EVCA provides advice to the European Commission on directives intended to harmonize the rules governing venture capital schemes.

SOME CONSTRAINTS

The net of social protection throughout Europe makes it difficult for the European entrepreneur. In addition, a European entrepreneur must face the reality that his home base represents only a small portion of the world market and that this base usually is insufficient to establish a successful long-term existence. The irony is that the sophisticated European market of 300 million people is dissuaded by language, culture, and chauvinism from trading within the European community. Generally, the first line of opportunity considered is that of the United States, not Europe.

Dataquest firmly believes that Europe must break down any outmoded barriers and stimulate cross-boundary financing to create European venture capitalists with European skills in marketing and to establish a European over-the-counter market of sufficient size to match the U.S. market.

AN OPPORTUNITY

Dataquest believes that current technology trends present a vast range of new investment opportunities for venture capitalists in Europe. These opportunities include workstations with shared-access data bases and/or word processing; systems that employ artificial intelligence, including medical diagnostics; software; computer retailing; and communications, including space applications and cellular communications.

There is a concern that too many venture capital funds may have too diffuse a purpose. Dataquest believes that specialization may provide the answer. We further believe that the European venture capitalists should look more to early-stage venture financing called seed capital. As a result of a recent study on ways to revive productive investment, the European Commission is now urging governments within the EEC to overhaul their tax systems to improve incentives and the flow of risk capital. In the United States, research and development partnerships offer attractive tax advantages. This represents an area that could readily be developed in Europe, given the correct fiscal reforms as recommended by the EEC.

A final point of interest is that venture capital is no longer synonymous with high-technology. "Nontech" is the latest buzzword with U.S. venture capitalists and investment bankers. It is estimated that in 1986, 20 percent of the $3 billion of venture capital money raised in the United States went into nontech ventures. These ventures are mainly in speciality retail areas such as shops, food service, and consumer products.

Venture capital in Europe is discussed in more detail in volume II, section 6.3, of the ESIS binders.

Jim Beveridge

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Research Bulletin

ESIS Code: Vol. IV, Newsletters
1987-10

NATIONAL AND LATTICE ANNOUNCE PLD AGREEMENT

In the wake of the merger between Advanced Micro Devices (AMD) and Monolithic Memories Inc. (MMI), the programmable logic device (PLD) market has yet another new force to contend with--an alliance between National Semiconductor and Lattice Semiconductor. As of early this afternoon (May 4), the two companies have announced the signing of a licensing, codevelopment, and manufacturing agreement for high-speed CMOS electrically erasable programmable logic devices, commonly referred to as E^2PLDs.

Under the terms of the agreement, National will have the right to manufacture and market Lattice's family of CMOS E^2PLDs, produced under the trademarked name of GAL (Generic Array Logic). The alliance combines National's substantial CMOS capability with Lattice's innovative field-programmable logic technology. National is also the world's third largest PLD supplier, with 1986 revenue of $33.5 million--approximately 11 percent of the total PLD market.

While the National/Lattice tie-up certainly does not have the same impact on today's PLD market as last week's announced merger between AMD and MMI, the potential of the alliance is clearly aimed at the future of PLDs: CMOS applications. With an estimated CAGR of 48.4 percent between 1987 and 1992, the use of CMOS PLDs is growing inexorably, and may surpass the sales of bipolar PLDs by 1991, as shown in Table 1.

Table 1

PRELIMINARY 1986
WORLDWIDE CONSUMPTION OF PROGRAMMABLE LOGIC DEVICES BY TECHNOLOGY
(Millions of Dollars)

	1985	1986	1987	1988	1989	1990	1991	1992
Total PLD	235.3	308.3	417.0	582.6	764.0	917.8	1,058.6	1,160.8
MOS (CMOS)	10.3	34.3	87.0	187.4	305.8	416.6	538.2	625.5
Bipolar	225.0	274.0	330.0	395.3	458.2	501.2	520.4	535.3

Source: Dataquest
May 1987

The Lattice CMOS GAL devices are pin-for-pin-compatible with MMI's bipolar PAL (programmable array logic) family, which currently accounts for roughly half of the PLD market. This fact caused Lattice some grief when MMI sued the Beaverton, Oregon-based company along with another CMOS PLD supplier, Altera Corp., for infringement of MMI's patents on the PAL architecture. Both suits have since been settled out of court.

Dataquest believes that the market for CMOS PLDs will ultimately surpass the market for bipolar PLDs, as CMOS PLDs combine the inherent power-saving advantages of CMOS with speeds that compete favorably with bipolar. Lattice's niche in the CMOS PLD market is its E^2 technology, which, in addition to the above advantages of CMOS, also allows for greater ease of reprogramming than the more conventional EPROM approach based on ultraviolet-erasable cells. Dataquest also believes that, at just under a $15 million market in 1986, the reprogrammable segment of the PLD business will grow to $300 million by 1992--nearly 26 percent of the total PLD market, of which electrically erasable PLDs will be the technology of choice.

The alliance with National is a further indication of the improving health of Lattice, whose 1986 revenue totaled approximately $10 million. Less than six months ago, Lattice's future seemed very uncertain. With the MMI lawsuit hanging over its head, the company experienced difficulty in securing additional venture capital. Following the resignation of its founder and CEO, Rahul Sud, and its vice president of operations, funding once more materialized. Lattice has not yet appointed a new president.

Dataquest believes that, with the MMI lawsuit out of the way, Lattice will see an operating profit this year. In early March, Lattice signed a second-source agreement with SGS of Italy (who merged last week with Thomson of France), giving the GAL line entry into the European market. In addition to adding National as a second source, Lattice is currently receiving high-quality GAL devices through a foundry agreement with Seiko Epson of Japan.

Neither National Semiconductor nor AMD are strangers to the PLD market. Rather than join forces at this time with a PLD heavyweight, as did AMD in its merger with MMI, National has instead formed a link with a scrappy contender for the fast-growing CMOS segment of the market. In so doing, National gains an innovative E^2 technology. Lest the significance of National's intentions in the ASIC arena be misunderstood, keep in mind that at the Custom Integrated Circuit Conference (CICC) beginning today in Portland, Oregon, National is expected to deliver from five to seven papers--the most from any single company in attendance.

Jim Beveridge
Michael J. Boss
Andrew M. Prophet

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Research *Bulletin*

ESIS Code: Vol. IV, Newsletters
1987-9

AMD AND MMI JOIN FORCES: LOOK OUT, PLD MARKET!

Jerry Sanders, chairman and CEO of Advanced Micro Devices (AMD) and Irwin Federman, president and CEO of Monolithic Memories (MMI), have announced an agreement in principle to merge their two companies. Under the agreement, MMI will convert each of its 21.8 million shares of outstanding common stock into 0.875 shares of AMD common stock. With the final transaction awaiting the approval of the shareholders of each company, as well as regulatory approvals, the merger would allow MMI to operate as a wholly owned subsidiary of AMD.

On the basis of worldwide market share, the merger leaves AMD still in 12th place ranking based on 1986 revenue. AMD's sales for the year were $629 million, whereas MMI's were $210 million. Combined, their $839 million in total semiconductor revenue places them right behind National Semiconductor's 1986 sales of $990 million.

The real story, in terms of market share clout, is the impact of the combined AMD/MMI on the worldwide supply of programmable logic devices (PLDs). The share of market that Fujitsu and Fairchild would have enjoyed in bipolar digital logic pales in comparison with the dominance that AMD and MMI will boast in PLDs. In 1986, MMI's PLD revenue was $140 million, while AMD's was $32 million. Their combined $172 million PLD revenue represents nearly 56 percent of the 1986 worldwide PLD market--which Dataquest believes will expand at a compound annual growth rate (CAGR) of nearly 23 percent between 1987 and 1992.

As a pioneer in bipolar PLD technology, MMI's trademarked PAL family of programmable logic devices has gained the company 51 percent of the worldwide bipolar PLD business. The future, however, belongs to CMOS. With an estimated CAGR of 48.4 percent between 1987 and 1992, the use of CMOS PLDs is growing steadily and will surpass the sales of bipolar PLDs by 1991.

Despite a recent alliance with Seeq Technology of San Jose, California, MMI has been late to establish itself in the CMOS market. MMI's CMOS PLD revenue in 1986 totaled $5 million, 15 percent of that market, giving it the second-place position behind start-up Altera Corp. During 1986, MMI strategically used legal recourse to set up barriers to CMOS PLD start-ups, suing both Lattice Semiconductor and Altera for infringing on its PAL architecture. Both cases have been settled out of court for undisclosed royalties.

Aggressive protection of its patents may help maintain MMI's position as a market share leader in PLDs, but it does nothing to address the fact that innovations in programmable logic are emanating from sources other than MMI, a fact that must greatly concern MMI's management. MMI's brief foray into another avenue of the ASIC business, gate arrays, has proven unproductive. Barely six months after announcing its intention to enter the gate array business, MMI pulled the plug, explaining that "...the potential return does not match the business opportunities that exist in other areas, specifically field-programmable products."

In light of these concerns about MMI's future, the logic of its merger with AMD may at first seem bewildering. Although MMI ran behind the CMOS PLD leader in 1986, AMD wasn't even in the race. Nor does AMD figure in any aspect of the ASIC market except for its bipolar PLD line. With an estimated $100 million in the bank, MMI could surely underwrite its own entry into CMOS. Given its difficulties up to now, however, the merger with AMD is probably the more effective long-term alternative.

To begin with, the merger gives MMI a CMOS capability today. AMD's two wafer fabs in Austin, Texas, have a combined potential for more than 12,000 starts per week in 6-inch CMOS wafers. Fab 15 is capable of operation using 1.7-micron CMOS, whereas Fab 14 can work down to 1.2-micron geometries. MMI can now enter the CMOS PLD arena with substantial manufacturing potential, without draining its corporate war chest through a costly investment in facilities. Also, MMI could conceivably leverage some CMOS process expertise through its equity investments in both Seeq Technology and Cypress Semiconductor.

For AMD, the merger brings into the corporate fold a company whose 1986 revenue grew 22 percent over 1985 (AMD's grew only 2.3 percent), with $100 million cash on hand. In so doing, it places itself in the driver's seat of today's PLD market, with an excellent chance of maintaining a strong position in the CMOS era. There is also some synergy from the viewpoint of AMD's customers. AMD's popular bit-slice microprocessor, the AMD 2900, is frequently used with a sprinkling of MMI PALs surrounding it. The merger further combines AMD's strength in OEM sales with MMI's distribution-oriented sales force. AMD's alliance with Sony for joint development in next-generation IC products also fits well with MMI's strong performance in the Japanese market. MMI has just been granted registration rights for its PAL line by the Japanese patent office.

Quite often in analyzing a merger, there is a temptation to speculate that the weaknesses of one company drove it into the arms of a suitor. As Dataquest has pointed out many times, however, alliances and consolidations are going to be an inescapable part of the changing semiconductor industry landscape. In the AMD/MMI merger, we see two companies whose assessment of the industry environment has led them to the conclusion that they can better guarantee their future success in tandem rather than solo. AMD and MMI are not unique in this point of view--even as Jerry Sanders and Irwin Federman announced the union of their companies, two major European semiconductor manufacturers, SGS of Italy and Thomson of France, were making a similar announcement half a world away.

Jim Beveridge
Michael J. Boss
Andrew M. Prophet

Dataquest
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Research Newsletter

ESIS Code: Vol. IV, Newsletters
1987-8

THOMSON-SGS MERGER

The French Group, Thomson, and the Italian Group, STET, have received approval from their respective governments to go ahead with plans to merge the microchip activities of their subsidaries, Thomson Semiconducteurs and SGS Semiconductors. The merger will involve the creation of a Netherlands-based company, owned 50 percent by Thomson-CSF and 50 percent by STET. Executive Vice-President of Thomson-CSF, Henri Starck, is to be appointed Chairman of the new company, while Pasquale Pistorio, Managing Director of SGS Micro Elettronica, will be Chief Executive Officer. The new company will consolidate activities in Europe, North America, and Asia, serving international markets and generating revenue of more than $800 million.

DATAQUEST ANALYSIS

Thomson achieved worldwide revenue of $436 million in 1986, which put it just ahead of SGS at $370 million. Thomson ranked seventeenth worldwide in 1986, while SGS was twentieth. The Thomson-SGS combination will rank eleventh worldwide and will be Europe's second largest semiconductor concern. An analysis of each company's 1986 sales breakdown by product, end-use segment, and geographic sales territory is detailed in Tables 1, 2, and 3, respectively. The two companies are of similar size and both have embarked on radical, often pragmatic recovery plans since the early 1920s. Their increased focus on global marketing and internationalization, manufacturing efficiency, and customer service has allowed them to significantly outpace the world market growth in recent years despite two significant industry recessions.

Dataquest Incorporated, 1290 Ridder Park Drive, San Jose, CA 95131-2398, (408) 971-9000, Telex 171973

Dataquest believes that this merger is a very positive event for the European semiconductor industry and for each company, both collectively and individually. It will virtually guarantee their place among the world leaders in the 1990s, enabling them to reach their 3 percent worldwide market share goal today, this being considered the critical mass for survival in the global marketplace. It currently places them number 11 worldwide, just behind National Semiconductor and ahead of AMD, with a combined product range that is remarkably complementary. Without doubt, their combined resources mean the emergence of a new powerful force in the world semiconductor market.

Byron Harding
Jim Beveridge

Table 1

ESTIMATED 1986 SALES REVENUE BY PRODUCT
(Percent Based on U.S. Dollars)

Product	SGS	Thomson
MOS	29%	48%
Bipolar	50	20
Discrete	21	32
Total	100%	100%

Source: Dataquest
May 1987

Table 2

ESTIMATED 1986 SALES REVENUE BY END USE SEGMENT
(Percent Based on U.S. Dollars)

Segment	SGS	Thomson
Computer	16%	17%
Consumer (Including Transportation)	41	25
Industrial	26	25
Govt./Military	0	10
Telecommunications	17	23
Total	100%	100%

Source: Dataquest
May 1987

Table 3

ESTIMATED 1986 SALES REVENUE BY GEOGRAPHIC REGION
(Percent Based on U.S. Dollars)

Region	SGS	Thomson
Asia	16%	13%
Europe	65	63
North America	19	24
Total	100%	100%

Source: Dataquest
May 1987

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EUROPEAN MONTHLY REPORT

ESIS Code: Vol. IV, Newsletters

EUROPEAN SEMICONDUCTOR DIVISION

MAY MONTHLY REPORT

STATE OF THE INDUSTRY

Conditions in the industry continue to improve with the March book-to-bill ratio exceeding our earlier prediction of 1.18 to come in at 1.23 (though this is highly likely to be adjusted slightly downwards when the final numbers are assessed). Such a steep jump we feel is abnormal and does not we believe represent reality. A book-to-bill ratio though in the 1.15 to 1.20 region is what we now expect to see and would represent a very positive foundation for the industry recovery.

We have recently completed our analysis of the European semiconductor markets, driven by the European end-equipment analysis, as tracked by the European Semiconductor Applications Markets service (ESAM), and are firmly of the opinion that this recovery is both real and sustainable, barring any major economic or political disasters.

Prices are firming, lead times are stretching and even some allocations are starting to occur. There is also evidence that Japan's OEM's are increasing their orders on U.S. companies, and though our ESAM analysis still shows 1987 to be the third successive year when actual consumption of semiconductor devices will still exceed shipments (net inventory depletion phenomenon), we do expect this trend to be reversed by the end of April 1987 with some slight restocking occurring (just-in-case vs just-in-time) next year.

IN THIS ISSUE

13th Floor, Centre Point, 103 New Oxford Street, London WC1A 1DD ☎ (01) 379-6257 Telex 266195 Fax 01 240-3653
1290 Ridder Park Drive / San Jose, CA 95131 / (408) 971-9000 / Telex 171973

OTHER INDUSTRY COMMENTS

Mergers dominate April's industrial news with three major events announced:

- o Go-ahead for Thomson/SGS merger
- o AMD and MMI to merge
- o National and Lattice pact on PLDs
- o Ericsson wins control of CGCT

Regarding the first item, as featured in last month's "thought for the month", this can only be good news for Europe, and far beyond just the semiconductor industry. I have been commenting for many years that Europe's semiconductor makers have finally 'got religious' and were determined to take their rightful place amongst the World leaders. To date, in terms of size, only Philips had achieved this--now they will be joined by this new company with a combined resource that is awesome. And that in turn will strengthen Europe's OEMs and Europe as a whole.

On the CGCT saga, probably the longest running takeover in electronics history, needless to say the announcement that Ericsson was finally to win the day was received with mixed reactions. Quoted in one report as "an inspired piece of commercial politics", what it does now mean is that an interminable period of uncertainty has now ended and CGCT, under Ericsson management, can now carve out a new role and future. That must be good for everyone concerned.

APRIL INDUSTRY HIGHLIGHTS

Toshiba moves into U.K. telecoms market, announcing its intent to start selling telephone systems for small companies (key systems), and facsimile machines as soon as it gets approval from the British regulatory authorities. This is a technical formality rather than a political decision. Toshiba aims to capture between 5 and 10 percent of the market by 1990. The announcement comes against a background of conflict over Japan's reluctance to liberalize its own telecommunications markets.

Ricoh to produce photocopies in France in Alsace. The move is the latest in a series of decisions by Japanese companies affected by the anti-dumping duties imposed by the EEC. The move follows Ricoh's February announcement that it was planning to triple output at its Telford, U.K. facility from 2,000 to 6,000 copiers per month by the autumn.

Cable and Wireless in £62 million deal to install a submarine optical fibre system in Malaysia. The venture could form part of a fiber optic web linking the key economies in the pacific rim. Under the terms of the memorandum of understanding, a joint venture company is to be formed (49 percent owned by Cable and Wireless and 51 percent by Syarikat Telekom Malaysia, the state-owned telecommunications company), which will be the vehicle for other cable projects originating and terminating in Malaysia.

IBM launches new range of personal computers in a bid to differentiate and distance itself from the clone-makers. Design of the machines, whilst maintaining downwards compatibility with existing software, makes extensive use of proprietary techniques and ASIC circuitry to protect itself from unauthorized copying. The top-of-the-range 32-bit machine will not however be available until the end of 1987 at the earliest.

BT challenged by Mercury and Racal in paging market following their announcement to launch a national radiopaging system by year end. The new network coincides with the rapid expansion in the industry which is growing at around 25 percent per annum.

Cellnet and Vodafone each to invest heavily in their networks, over the next 18 months. Cellnet (jointly owned by BT and Securicor) is committed to spend a further £43 million by August and a further £70 million during 1988 to increase its capacity from 110,000 subscribers by August to 200,000 by Autumn 1988. Vodafone (owned by Racal) plans to spend £30 million by March 1988. Vodafone currently has around 79,000 subscribers and Cellnet 70,000.

Brussels hits at U.S. over unfair trade curbs by opening legal proceedings against two already unfair U.S. trade barriers and is investigating about 30 other Washington imposed import restrictions. The EEC has successfully asked GATT to set up a panel to examine whether new customs fees and taxes on chemical derivatives and petroleum products launched by the U.S. last year conform with GATT rules.

Hong Kong defends "grey market" in ICs insisting that it was up to individual countries to decide whether importing cheap electronic components was detrimental to its local industry. Officials acknowledged that in a free market like Hong Kong, local electronics manufacturers can and do buy 256K DRAMs at less than the $3 per device that the U.S. says is a fair price.

Rhone Poulenc presses for early privatization now that its internal restructuring program is taking effect. With 75 percent of its turnover now outside France and its profits restored, the company is looking for early privatization to achieve the financial and industrial flexibility necessary to compete in the international chemicals industry.

Olivetti reports increased profits for 1986 of L550 billion, up 9 percent on 1985. Olivetti is now the biggest European-owned office automation company. The company also reported a 17 percent increase in turnover to L7,900 billion, stemmed almost exclusively from the recent acquisition of Triumph-Adler, West Germany.

Nixdorf confident as earnings rise by 29 percent to DM222 million. Another double-digit percentage growth rate is also on the cards for 1987. Turnover, up 15 percent on 1985 to DM4.5 billion, is also projected to double within the next four to five years.

Ericsson wins first exchange order in U.S. for a contract from U.S. West, one of the seven regional Bell operating companies, to supply its AXE local exchanges for use in the state of Idaho. The order is believed to be worth in excess of $20 million and is the largest contract

Ericsson has so far won in the United States. The equipment will be used by Mountain Bell, onc of U.S. Bell's three operating companies, to replace approximately 52 older electromechanical exchanges.

GEC to invest $150 million in joint venture with Philips in the field of medical equipment. The cash injection will bring GEC's equity share up to 50 percent thus enabling it to participate equally in the joint ventures management. The combined sales of the new group in 1986 were nearly $2 billion ($1.37 billion Philips, $0.61 billion GEC) making it the largest operation in the medical equipment field.

BOC to build £2.15 million plant in Trail, Canada to supply a 25 year contract to supply tonnage oxygen to Cominco. Cominco has recently built a lead smelting plant in Trail and the new BOC plant will be sited adjacently. The plant has been designed for enhanced Argon recovery and the Argon produced will be sold throughout North America.

Plessey Semiconductors plans 1,000 new jobs following the recent commissioning of its Roborough, U.K. facility. The facility, which so far has cost £33 million, is targeted primarily at the ASIC market. The plan also calls for sales to increase from its present £70 million level to £350 million over the next five years. A further £17 million is targeted to be spent on the Roborough facility over the next two years as well as a further £12 million at its existing Swindon, U.K. facility.

Squeeze in U.K. defence markets starts to bite as four leading OEMs announce redundancy programs. Around 1,825 jobs are scheduled to go over the next few months, blamed on a mixture of slack home and overseas markets, increased competition, and the need for productivity improvements. The companies affected are Thorn EMI, Plessey, Marconi Communications, and Racal.

Mullard to make colour tubes for computer VDU's as part of a £15 million expansion of its Durham, U.K., facility. The project marks a significant diversification for the company, Britain's only remaining supplier of standard colour television tubes. It will also mean that European VDU manufacturers will now have a local source of colour tube supply--at present all European-based manufacturers rely on imported tubes, mainly from Japan.

Philips plans Fl1 billion equity issue via the sale of 20 million common shares registered in the United States and underwritten and distributed Worldwide. It represents about 9 percent of the outstanding share capital and is the largest issue, in terms of money raised by Philips. The proceeds of the issue will be used for investments being made worldwide to compete on a global basis in its core activities of electronic products, components, and telecommunications.

EUROPEAN SEMICONDUCTOR DIVISION ACTIVITY REPORT

Two items dominated April's activity--the upcoming annual conference scheduled to take place in June3-5 at the Palace Hotel, Madrid, and the revision of the European semiconductor market estimates.

An outstanding panel of speakers has been assembled for the conference, this year's theme being "Integrate for the VLSI Era", and fits very timely in the present wave of mergers and consolidations that is currently taking place in the industry.

All of the revised market estimates are now completed including, for the first time, a new analysis--the European Semiconductor Applications Market, this program, under the project management of Jennifer Berg, takes the European electronic equipment production estimates to drive the demand analysis for semiconductor device consumption in Europe, and hence the shipments forecasts, leading or lagging the actual consumption depending on market conditions.

This analysis will be available to existing ESIS subscribers as an add-on module.

THOUGHT FOR THE MONTH

Forget the marketing and technology hype in ASICs--those may sell the concept and get the orders initially but, like an iceberg, this only represents 10 percent of the problem. Rarely discussed, and often poo-poohed by the customer is the critical ingredient and the key to success in ASICs--project management.

This is something that the large OEMs of course are well used to, and is a natural extension of their own project management programs of the end equipment itself, though even here, hyped by promises of "seven-day turnaround" and "full circuit simulation", sloppiness can often creep into the equation.

And for the small to medium size user, often not every disciplined in the rigors of project management, such concepts can often be totally alien, even to the point of distributing a prospective vendor who trys to insist on such disciplines. The motives can even be misconstrued as being the foundation for subsequent litigation should the project not proceed as planned!

To my mind, this is the biggest single factor that will affect the prospective projects success or failure and should never be left to chance, good fortune, or luck. It is also one of the biggest educational problems that the user communicating needs to face, and quickly, if the ASIC dream is not to suddenly turn into a nightmare.

Malcolm Penn

FUTURE EVENTS DIARY

SEMICONDUCTOR CONFERENCES

- APRIL 13-16, Japanese Semiconductor Industry Conference
  Miyako Hotel, Kyoto, Japan
  "VLSI Impact on Future Society"

- APRIL 27-29, European Telecommunications Industry Conference
  Beach Plaza Hotel, Monte Carlo, Monaco
  "New Frontiers for Merging Voice and Data"

- JUNE 3-5, European Semiconductor Industry Conference
  Palace Hotel, Madrid, Spain
  "Integrate for the VLSI Era"

SPECIAL REPORTS

- 1985 News Digest--Available now
- Korean Semiconductor Industry Report--Available now
- IC Update '87--Available now
- GaAs Market Update--Available now
- IC Start ups--Available now
- DSP Market Update--Available second quarter 1987
- Taiwan Semiconductor Industry Report--Available first quarter 1987
- Hong Kong Semiconductor Industry Report--Available first quarter 1987
- China Semiconductor Industry Report--Available first quarter 1987
- 1986 News Digest--Available now

NEWSLETTER SUBSCRIPTIONS

- IC A.S.I.A.
- IC U.S.A (available in English and Japanese)
- European Monthly Report

ON-LINE SERVICES

- Semiconductor Group Database: History, Forecast, Market Share, and Geographical Data
- SIA Database: Bluebook, Flash Report, Forecast
- DQ Monday

For further information on the above items, please call your local DATAQUEST office.

DATAQUEST 6TH ANNUAL EUROPEAN SEMICONDUCTOR INDUSTRY CONFERENCE

June 3-5, 1987, Palace Hotel, Madrid, Spain

conference theme

"INTEGRATE FOR THE VLSI ERA"

speakers will include:

Alex Au - President & CEO
Vitelic Corporation

Andre Borrel - Corp V P
Semiconductor Group
Motorola Incorporated

Tim Curtis - Director European Div.
Unitech Group

Doug Dunn - Managing Director
Plessey Semiconductors Limited

Bernard Hadley - Managing Director
Stack GmbH

Mick Denham - President
Indy Electronics (Scotland) Ltd

Jean-Luc Grand-Clement - Man. Dir.
European Silicon Structures

Miguel de Oyarzabel - Deputy Dir.
Electronics Division
Spanish Ministry of Industry & Energy

Otto Holzinger - Director
Advanced Automotive Engineering
Robert Bosch GmbH

To be announced
Semiconductor Group
NEC Corporation

Robert Sandfort - Vice President
Monsanto Electronic Materials Company

Graham Shenton - Managing Director
IMP Europe Limited

Robert Van Meurs - General Manager
HiFi Compact Disc Group
Philips International BV

Brian Wherrett - Professor
Herriot Watt University, Scotland

Eamon Reay - Materials Manager
Digital Equipment Europe

Topic Highlights

- Europe--Structured for Opportunity and Integration
- European Distribution Channels in the VLSI Era
- Partnering and Alliances--The Ultimate Synergy
- Integrating Manufacturing into the Marketplace
- Application Specific Memories--Tomorrow's Standard
- Quality--The Progress Towards Zero Defects
- Facing the International Challenge

(continued)

Topic Highlights (continued)

- European SC Industry--a suppliers perspective
- VLSI Systems in the automotive environment
- Integrated Optical Electronics
- An Integrated Approach to Siliconization
- Integrated IC Users
- Procurement Strategies for VLSI in the 1990's
- Spain integrating for the VLSI Era
- Integrating Internationally

For further information please contact:

Lyn Cooke
Dataquest UK Ltd
13th Floor
103 New Oxford Street
London WC1A 1DD

Tel: 01-379-6257
Tx: 266195
Fax: 01-240-3653

Early registration is advised as space is limited

Dataquest

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Personal Computer

Personal Computer—Worldwide Shipments and Forecasts

Robotics

Semiconductor*

Semiconductor Application Markets*

Semiconductor Equipment and Materials*

Semiconductor User Information*

Software—Artificial Intelligence

Software—Personal Computer

Software—UNIX

Technical Computer Systems

Technical Computer Systems—Minisupercomputers

Telecommunications

Western European Printer

Executive and Financial Programs

Corporate Alliance Program

Coporate Technology Program

Financial Services Program

Strategic Executive Service

Newsletters

European PC Monitor

First Copy

Home Row

I.C. ASIA

I.C. USA

Focus Reports

The European PC Market 1985-1992

European PC Retail Pricing

PC Distribution in Europe

PC Software Markets in Europe

PC Local Area Networking Markets in Europe

The Education Market for PCs in Europe

Japanese Corporations in the European PC Markets

Home Markets for PCs in Europe

Integrated Office Systems—The Market and Its Requirements

European Market for Text Processing

Korean Semiconductor Industry Analysis

Diskettes—The Market and Its Requirements

Directory Products

I.C. Start-Ups—1987

SpecCheck—Competitive Copier Guide

SpecCheck—Competitive Electronic Typewriter Guide

SpecCheck—Competitive Whiteboard Guide

Who's Who in CAD/CAM 1986

Future Products

- Industry Services
  - Manufacturing Automation
  - Computer Storage—Optical
  - Computer Storage—Subsystems
- Focus Reports
  - Japanese Printer Strategy
  - Japanese Telecommunications Strategy
  - Canon CX Laser—User Survey
  - Digital Signal Processing
  - PC-based Publishing
  - Taiwan Semiconductor Industry Analysis
  - China Semiconductor Industry Analysis
  - PC Distribution Channels
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*On-line delivery option available

For further information about these products, please contact your Dataquest sales representative or the Direct Marketing Group at (408) 971-9661.

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Conference Schedule

1987

Semiconductor Users/Semiconductor Application Markets	February 4-6	Saddlebrook Resort Tampa, Florida
Copying and Duplicating	February 23-25	San Diego Hilton Resort San Diego, California
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Semiconductor	October 19-21	The Pointe Resort Phoenix, Arizona
Office Equipment Dealers	November 5-6	Hyatt Regency Monterey Monterey, California
Military IC	November 12	Hotel Meridien Newport Beach, California
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CAD/CAM Electronic Design Automation	December 10-11	Santa Clara Marriott Santa Clara, California

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1290 Ridder Park Drive
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(408) 971-9000
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Fax: (408) 971-9003

Dataquest International Offices:

Dataquest GmbH
Rosenkavalierplatz 17
D-8000 Munich 81
West Germany
Phone: (089)91 10 64
Telex: 5218070
Fax: (089)91 21 89

Dataquest Japan Limited
Taiyo Ginza Building/2nd Floor
7-14-16 Ginza, Chuo-ku
Tokyo 104 Japan
Phone: (03)546-3191
Telex: J32768
Fax: (03)546-3198

Dataquest UK Limited
13th Floor, Centrepoint
103 New Oxford Street
London WC1A 1DD
England
Phone: (01)379-6257
Telex: 266195
Fax: (01)240-3653

Dataquest SARL
100, avenue Charles de Gaulle
92200 Neuilly-sur-Seine
France
Phone: (01)47.38.13.12
Telex: 611982
Fax: (01)47.38.11.23

Dataquest Taiwan
Rm. 801, 8th Fl., Ever Spring Bldg.
147, Sec. 2, Chien Kuo N. Road
Taipei, Taiwan, R. O. C. 104
P. O. Box 52-25, Tienmou 111
Phone: (02)501-7960/501-5592
Telex: 27459
Fax: (02)505-4265

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Research Newsletter

ESIS Code: Vol. IV, Newsletters
1987-7

256K DRAM PRODUCTION CUTBACKS ACCELERATE 1MB DESIGNS

OVERVIEW

A rush of events in the first quarter appear to be producing a 256K DRAM shortage. Early in the year, the U.S. Department of Commerce accused certain Japanese companies of violating the U.S.-Japanese semiconductor trade arrangement. As a penalty, sanctions will be imposed on a variety of Japanese products, unrelated to semiconductors, such as television sets, laser printers, and disk drives. Prior to the penalties, MITI announced 11 percent cuts in 256K DRAM production in the second quarter of 1987, beyond the estimated 23 percent cut in the first quarter.

As a result, reports of a drying gray market have been coming in. Lead times in the United States have stretched out from ex-stock to 6 to 8 weeks for the more generic, Japanese-made 256K DRAMs. Several new personal computers were announced by IBM, which has reportedly been ordering large volumes of 256K DRAMs for its new PC series. Devices in PLCC packages, or with 100 nanosecond access times or faster, currently have lead times of 12 weeks that are stretching out to 16 weeks.

ESTIMATING THE POTENTIAL DEGREE OF SHORTAGE

Japanese manufacturers accounted for 82 percent of total 256K DRAM factory shipments in 1986. If these manufacturers reduce their production levels to 118 million units in the second quarter, as reported, and keep it flat through the year, their share of worldwide production will be only 56 percent. However, 1987 is projected to be the highest unit demand year for 256K DRAMs, growing to 850 million units, as shown in Figure 1.

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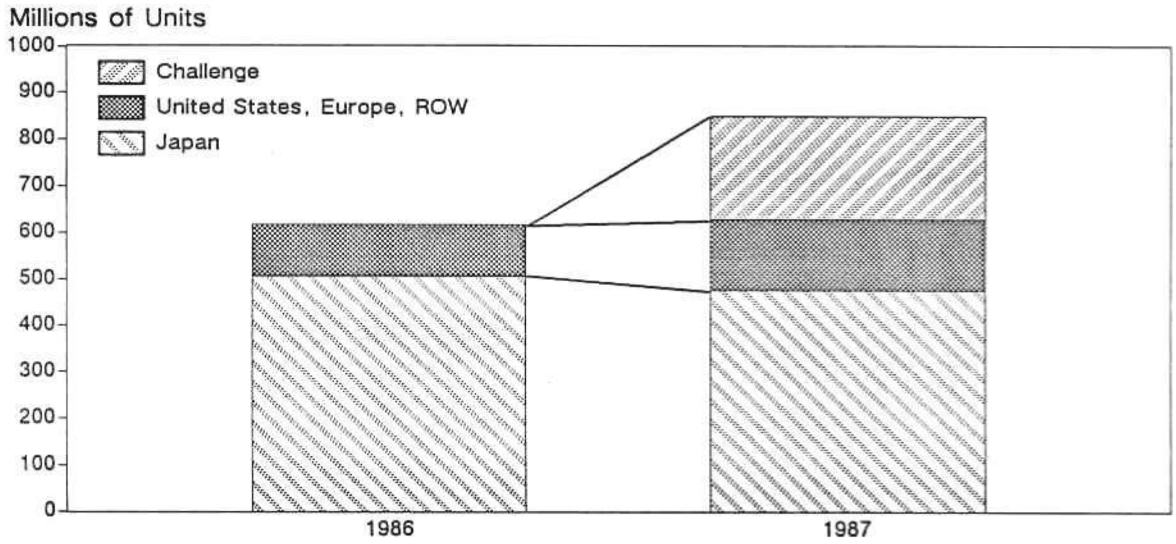
Figure 1

256K DRAM REGIONAL PRODUCTION
JAPAN VERSUS UNITED STATES, EUROPE, ROW



Source: Dataquest
May 1987

It is important to appreciate the magnitude of these production cuts. To meet the remaining 44 percent estimated demand in 1987, the combined production of U.S., Korean, and European firms must more than triple from 1986 rates. From these regions the high-volume producers are Texas Instruments, Samsung, and AT&T. It is not likely that they can produce to these levels by the end of the year. Given the production cutbacks and lack of non-Japanese capacity to fill the void, Dataquest estimates the year's shortage potential to be over 200 million units.

HOW LONG WILL THE SHORTAGE LAST?

Dataquest believes that extended lead times will be a fact of life at least through the third quarter. Bookings tend to grow as lead times increase. We estimate that it will take at least three months for Japanese companies to begin to return to increased production, if at all. The U.S., Korean, and European firms will face the same production lag. However, the high demand for high-speed or surface-mount DRAMs may remain high, keeping lead times of these parts extended through the year.

Another factor increasing the odds of a long-lasting shortage is that Japanese firms, and even some U.S. firms, may not be motivated to increase their production. The 256K DRAM cycle has matured and demand is expected to begin waning in 1988, with the price-per-bit crossover with the 1Mb DRAM estimated to be in the beginning of 1988. Many Japanese as well as U.S. firms may also want to encourage more 1Mb DRAM usage with the shortage and rising prices of 256K DRAMs.

Prices will certainly increase in this scenario. In fact, the high foreign market value prices in the United States will finally be validated, if not liked. The U.S. and Korean firms will likewise increase their prices with the shortage of parts and the lack of gray market competition. Dataquest estimates that average prices in the United States will increase to $2.35 by the middle of the year, from a first quarter average of $2.05. Prices in Europe and Asia are also expected to rise, alleviating the price pressures in those regions.

DATAQUEST ANALYSIS

It is still uncertain if Japanese companies will adhere to MITI's instructions. However, MITI's control of export licenses has been effectively used as a tool to convince them. If the companies comply, then the scenario mentioned above has a high likelihood of occurrence, which is even now obvious to Japanese manufacturers. The market will then accelerate 1Mb design-ins immediately and 1Mb purchases by the end of the year, to gain better availability and cost-effectiveness.

This situation points to the importance of long-term vendor-buyer relationships and of having a balanced supply of components from selected regions of the world. The DRAM buyer market that has been experienced for the last two years may be coming to a close. With supplies for this part tightening, communication lines between buyers and vendors must be finely tuned so that ship schedules do not become affected. The procurement systems set up over the past years will be put to the test for these parts. With supplies of the 1Mb DRAM increasing, the crossover to this part from the 256K DRAM may be accelerated, thus alleviating some of the pressure. It appears that one of the results of the semiconductor agreement is for supplies of parts to be controlled so that "fair prices" can be had by all.

Jim Beveridge
Victor de Dios

Dataquest

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Research Newsletter

ESIS Code: Vol. IV, Newsletters
1987-6

GATE ARRAY SUPPLIERS POSITION FOR FUTURE GROWTH

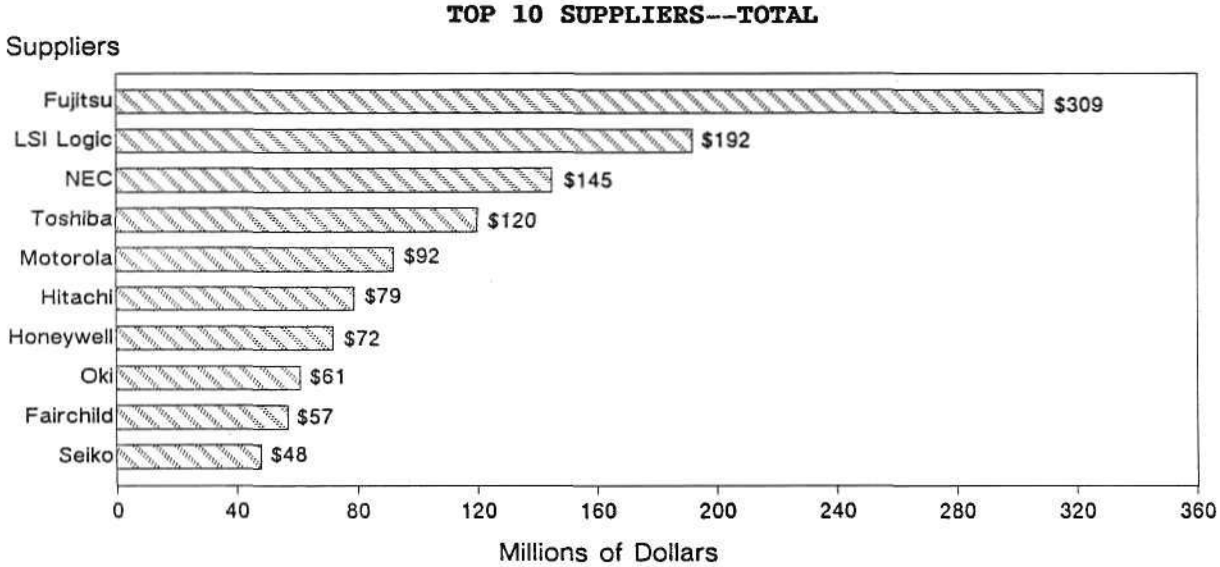
EXECUTIVE SUMMARY

Dataquest has projected the $1.8 billion gate array market of 1986 to exceed $7.8 billion by 1992. Today, there are in excess of 100 merchant gate array suppliers. Fierce competition in the North American market has caused nonrecurring engineering charges (NRE) as well as device pricing to decline to the point where most suppliers sacrifice profits for market share.

Dataquest believes that large, broad-based IC suppliers will dominate the mainstream gate array market and force the small suppliers to be acquired, to move to niche markets, or to move out of the market altogether. Figure 1 shows that three out of the top five 1986 gate array suppliers are large, broad-based Japanese companies. Toshiba had a large number of designs go to production and went from eighth position in 1985 to fourth in 1986.

Figure 1

**ESTIMATED WORLDWIDE GATE ARRAY SHIPMENTS
TOP 10 SUPPLIERS--TOTAL**



Source: Dataquest
May 1987

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During 1986, worldwide MOS gate array consumption increased 49 percent compared to 1985, while bipolar gate array consumption rose 23 percent. North American companies shipped 46 percent of the total worldwide gate arrays while Japanese companies shipped 45 percent. However, Japanese companies had 43 percent of their shipment revenue generated from intracompany sales (sales to internal divisions) while North American companies only had 11 percent intracompany sales. The yen-to-dollar exchange rate also increased the market share of Japanese companies by changing from 238 in 1985 to 167 in 1986. This newsletter will address the following key areas:

- Preliminary 1986 company shipment estimates
- Technology forecast
- Design starts
- Merchant revenue versus intracompany revenue
- NRE and device pricing
- Regional trends

PRELIMINARY 1986 GATE ARRAY RESULTS

Dataquest Definitions

Dataquest defines the commonly used terms as follows:

- Gate arrays--These are digital or linear/digital integrated circuits containing a configuration of uncommitted elements customized by interconnecting one or more routing layers.
- NRE--These are nonrecurring engineering charges or simply the cost of developing the array.
- Intracompany revenue--When an IC manufacturer takes a product line, which was developed and produced for internal consumption, to the merchant market, the revenue associated with this internal consumption is called intracompany revenue; the revenue from sales to outside companies is called merchant revenue.
- Dataquest gate array shipments--The shipment revenue equals the estimated production revenue plus intracompany revenue plus NRE revenue.

Total Gate Arrays

As Figure 1 indicates, Fujitsu is the leader in total gate array revenue. Fujitsu is number two in MOS gate arrays and number one in bipolar arrays as shown in Tables 1 and 2, respectively. However, one must consider that a large portion of Fujitsu's revenue comes from sales to its own divisions. LSI Logic came in number two in total gate arrays with an exclusive MOS product line. NEC remains in third place with a healthy 54 percent increase in 1986 sales over 1985. Toshiba is climbing the top 10 supplier roster at a rapid rate, going from number eight in 1985 to number four in 1986. The next six suppliers are in a close race for market share. The top 10 suppliers in 1986 shared 65 percent of the total available market (TAM). During 1985, the top 10 suppliers shared 61 percent of the TAM. This comparison shows that the top 10 suppliers are gaining market share at the expense of the smaller suppliers.

Table 1

ESTIMATED 1986 WORLDWIDE GATE ARRAY SHIPMENT REVENUE--MOS (Millions of Dollars)

1985 Rank	1986 Rank	Company	1985 Revenue	1986 Revenue
1	1	LSI Logic	$140.0	$192.0
2	2	Fujitsu	101.3	145.0
4	3	Toshiba	45.6	120.0
3	4	NEC	49.0	72.0
7	5	Oki	28.0	49.0
5	6	Sieko	33.8	48.0
6	7	Hitachi	29.1	45.0
8	8	Gould AMI	25.0	27.0
22	9	Honeywell	7.0	27.0
9	10	Hughes	19.2	22.0
Total			$478.0	$747.0

Source: Dataquest
May 1987

Table 2

ESTIMATED 1986 WORLDWIDE GATE ARRAY SHIPMENT REVENUE--BIPOLAR (Millions of Dollars)

1985 Rank	1986 Rank	Company	1985 Revenue	1986 Revenue
1	1	Fujitsu	$120.1	$164.0
2	2	Motorola	68.4	82.6
3	3	NEC	45.0	73.0
5	4	Fairchild	39.8	47.7
4	5	Honeywell	42.0	45.0
6	6	Ferranti Electronics	29.0	38.0
7	7	Hitachi	29.0	34.0
10	8	Siemens	23.4	26.0
8	9	Signetics	28.8	26.0
9	10	Texas Instruments	27.5	24.7
Total			$453.0	$561.0

Source: Dataquest
May 1987

MOS Gate Arrays

As Table 1 indicates, LSI Logic maintained its number one position in MOS gate arrays with a 37 percent growth in 1986 over 1985. However, Toshiba had a large number of designs go to production and it increased sales by an estimated 163 percent. Fujitsu captured many new designs in 1986 and remains in second place. Oki is gaining market share by capturing lower-density designs with high-production volumes. Four of the top 5 MOS suppliers are Japanese companies. The top 10 MOS suppliers accounted for 69 percent of the total 1986 MOS market, compared to 66 percent in 1985.

Bipolar Gate Arrays

The ECL market continues to flourish while the TTL market fades. Mainframe computers are large consumers of ECL arrays. Fujitsu, Motorola, NEC, Fairchild, and Honeywell are the key suppliers to the mainframe manufacturers. These top 5 ECL suppliers shared 74 percent of the $412 million 1986 ECL market. AMCC is also a supplier of ECL arrays and had sales of 24 million dollars mainly in the military and industrial markets.

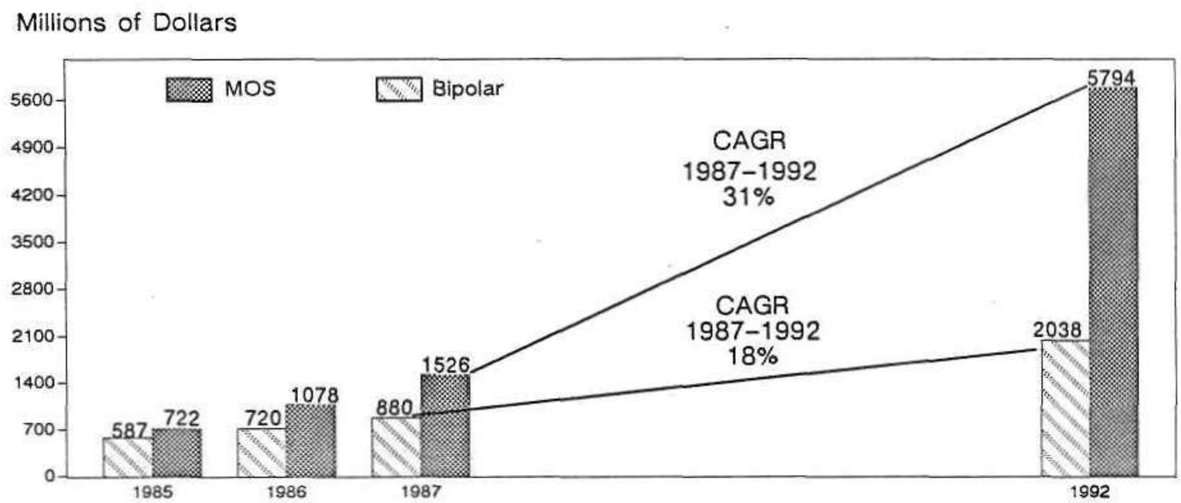
Ferranti Interdesign and Exar dominate the North American linear and mixed linear/digital array markets. It is interesting to note that only 2 of the top 5 bipolar array suppliers shown in Table 2 are Japanese companies. The top 10 bipolar suppliers shared 78 percent of the total 1986 bipolar market, compared to 77 percent in 1985. This is a capital-intensive mature market dominated by large IC suppliers.

GATE ARRAY SUPPLIERS POSITION FOR FUTURE GROWTH

The worldwide gate array market is expected to increase from $1.8 billion in 1986 to $7.8 billion by 1992. Figure 2 illustrates that by 1992 the MOS market will dominate with a $5.8 billion market followed by the $2 billion bipolar market. The compounded annual growth rates from 1987 through 1992 for the MOS and bipolar gate array markets shown in Table 3 are 31 percent and 18 percent, respectively.

Figure 2

ESTIMATED WORLDWIDE GATE ARRAY CONSUMPTION BY TECHNOLOGY



Source: Dataquest
May 1987

Table 3

ESTIMATED WORLDWIDE GATE ARRAY CONSUMPTION
BY TECHNOLOGY
(Millions of Dollars)

	1985	1986	1987	1988	1989	1990	1991	1992
Total	1,308.5	1,797.8	2,406.5	3,163.9	3,773.6	4,851.2	6,175.4	7,832.2
Total MOS	721.6	1,078.0	1,526.4	2,102.0	2,563.9	3,406.3	4,459.0	5,793.9
MOS Digital	704.1	1,057.0	1,500.9	2,071.3	2,527.0	3,360.9	4,402.8	5,723.6
MOS Linear	17.5	21.0	25.4	30.7	36.9	45.4	56.3	70.3
Total Bipolar	586.9	719.8	880.2	1,061.9	1,209.7	1,444.9	1,716.4	2,038.3
Bipolar Digital	516.9	646.8	801.3	977.5	1,120.3	1,351.3	1,618.7	1,937.7
TTL	135.9	154.1	169.5	178.0	176.2	172.7	164.0	150.9
ECL	313.6	412.6	540.5	697.3	836.7	1,071.0	1,349.4	1,686.8
Other	67.4	80.1	91.3	102.3	107.4	107.4	105.2	100.0
Bipolar Linear	70.0	73.0	78.8	84.4	89.4	93.9	97.6	100.6

Note: Columns may not add to totals shown because of rounding.

Source: Dataquest
May 1987

During 1986, the MOS portion of the gate array market increased 49 percent compared to 1985, while the bipolar market experienced a more modest 23 percent growth. Most of the bipolar growth was attributed to ECL arrays with a 32 percent rise in 1986 consumption compared to 1985. Please remember that shipments and consumption include NRE, intracompany, and production. The yen-per-dollar exchange rate applied in 1985 was 238 and 167 in 1986.

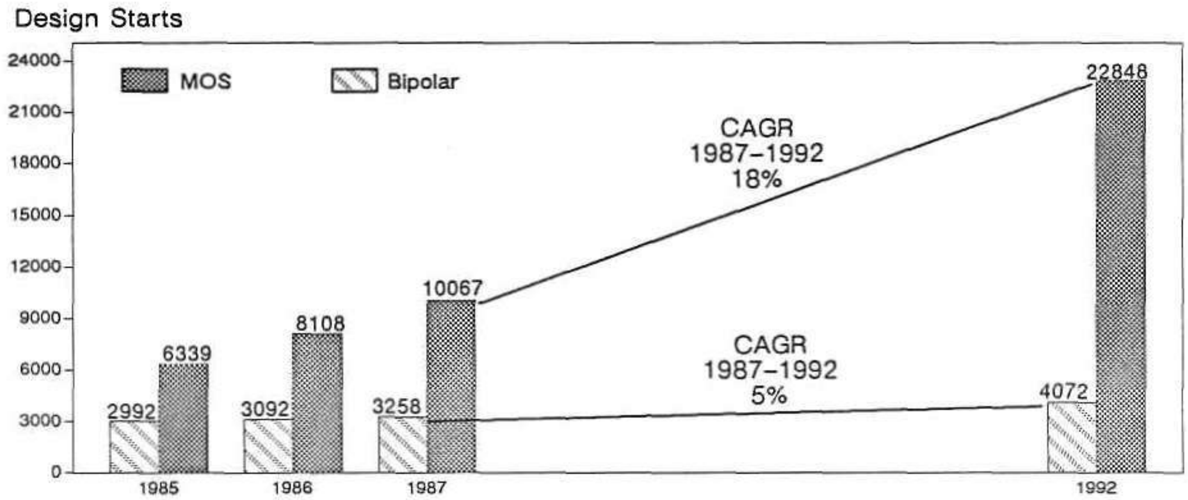
Most gate array suppliers are currently sacrificing today's profits for increased market share. During 1986, device pricing as well as NRE charges decreased in CMOS gate arrays to the point where most suppliers experienced small profits or even losses. Suppliers want to gain as much market share as possible so that they will be able to capitalize on the $7.8 billion market in 1992. NRE charges and device pricing will be addressed later in this newsletter.

DESIGN STARTS DETERMINE FUTURE GROWTH

Design starts are a leading indicator of future gate array revenue. Figure 3 illustrates that there were 11,200 total design starts in 1986 and we expect 26,920 total design starts in 1992. During 1986, MOS gate array design starts grew an estimated 28 percent compared to 1985, while bipolar design starts grew only 3 percent. This low growth rate in bipolar arrays can be attributed to the fact that TTL designs are being phased out while the number of ECL designs are increasing. Dataquest analysis indicates that designs captured in 1986 will take an average of 6 to 12 months to reach the production phase. Thus, a high number of designs in 1986 will result in high production revenue in 1987. However, the percentage of designs that ultimately reach production phase can vary widely. Our analysis indicates that the percentage of designs that go to production for the industry ranges from 30 percent during a depressed semiconductor economy to 70 percent in a thriving semiconductor economy.

Figure 3

ESTIMATED WORLDWIDE GATE ARRAY DESIGN STARTS BY TECHNOLOGY



Source: Dataquest
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Table 4 shows the number of designs captured in 1985 and 1986 by companies from each region. During 1986, North American companies experienced a 22 percent increase in MOS designs and an 11 percent decrease in bipolar designs. Part of the decline in bipolar designs can be attributed to the shift from TTL designs to ECL designs. However, Japanese companies grew 37 percent in MOS designs while increasing 22 percent in bipolar designs, which indicates that Japanese companies will gain market share in both the MOS and bipolar gate array markets during the next two years.

Table 4

ESTIMATED WORLDWIDE GATE ARRAY DESIGN STARTS
BY REGION

	1985	1986
Worldwide Total	9,331	11,200
MOS	6,339	8,108
Bipolar	2,992	3,092
North American Companies	4,924	5,439
MOS	3,184	3,885
Bipolar	1,740	1,554
Japanese Companies	3,297	4,389
MOS	2,429	3,334
Bipolar	868	1,055
Western European Companies	1,041	1,272
MOS	657	789
Bipolar	384	483
ROW	69	100
MOS	69	100
Bipolar	0	0

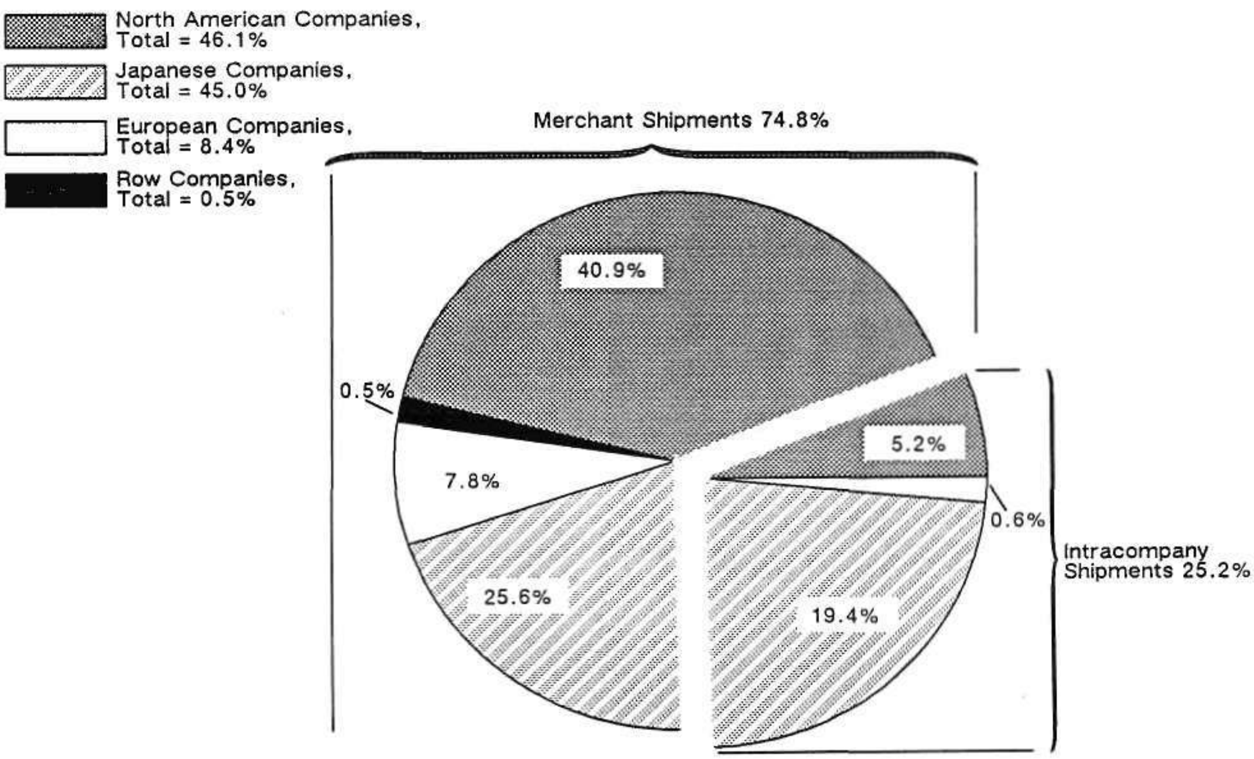
Source: Dataquest
May 1987

MERCHANT REVENUE VERSUS INTRACOMPANY REVENUE

It is important to examine the source of revenue when exploring regional trends. There was 25.2 percent intracompany revenue in the total 1986 worldwide gate array market as shown in Figure 4. Japanese companies had 43 percent of their 1986 worldwide revenue generated from sales to internal divisions compared to only 11 percent for North American companies. During 1986, Japanese companies had 77 percent of the $453 million intracompany market and 35 percent of the $1,345 million merchant market. North American companies had 21 percent of the intra-company market and 55 percent of the merchant market. Intracompany markets are less volatile and less vulnerable to outside competition. However, Figure 4 shows that the combined intra-company and merchant revenue for North American companies and Japanese companies is 46.1 percent and 45 percent, respectively.

Figure 4

ESTIMATED 1986 INTRACOMPANY AND MERCHANT WORLDWIDE SHIPMENTS BY REGION



Source: Dataquest
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MARKET TRENDS

Fierce competition from the more than 100 gate array suppliers produced the following trends:

- Amortized or low NRE pricing
- Declining device pricing
- Increased offshore manufacturing and consumption

NRE Pricing

Suppliers are experimenting with different NRE strategies. Some suppliers try to minimize the up-front NRE charge and amortize the cost of the design over production volume. This can be risky since some designs never go to production. Japanese companies in Japan charge low or zero NRE and require a production order. At the other extreme is the supplier that charges NRE and production cost separately, making each part self-reliant. Between these extremes are various combinations of NRE and production charges that may not represent the true cost of either part. In today's North American market, an increasing number of companies are offering NRE below cost and amortizing the cost of the design over the production volume.

Pricing on NRE for low-density CMOS arrays declined drastically in 1986. During 1985, 1,500-gate CMOS devices had a typical NRE charge of $25,000 to $30,000. In late 1986, these same devices had an average NRE charge of $15,000 to $20,000. This can be attributed to the competitive environment brought about by the 60 to 70 suppliers offering comparable products.

Device Pricing

The price per device is difficult to estimate because prices vary widely due to technology, gate count, and packaging configurations. Thus, a CMOS 2,000-gate device may sell for as low as $3 in high quantities, while an ECL 2,500-gate device may sell for $170. A better way to monitor gate array pricing is on a price-per-gate basis.

The most popular gate arrays (CMOS, 2,000 gates, die only, in quantities of thousands) took a sharp price-per-gate drop from between $0.01 and $0.012 in 1984, to between $0.002 and $0.004 in 1985. During 1986, the price per gate for these same devices fell to between $0.001 and $0.003. Higher gate count CMOS devices took a much smaller drop annually. The price per gate for ECL gate arrays only took an estimated 15 percent drop annually. Price decreases did occur in gate arrays, but not equally across all product lines.

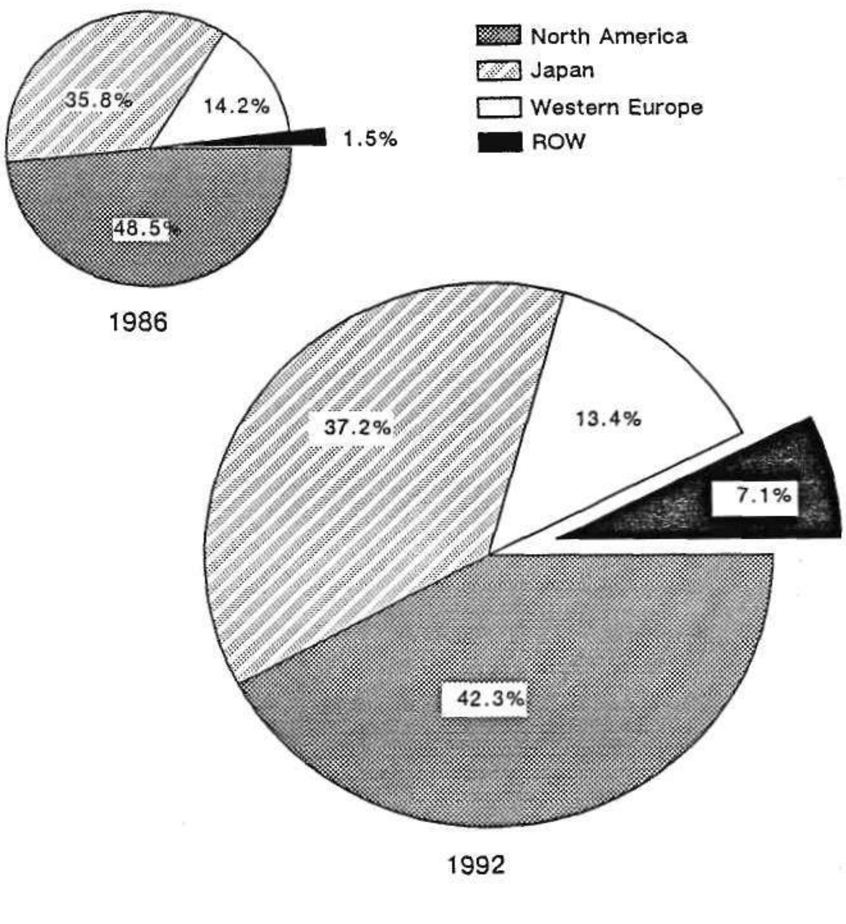
Few suppliers can make a profit with pricing at $0.001 per gate.

Offshore Manufacturing

The escalating value of the yen against other currencies is having a major impact on system manufacturers. This is especially true for those companies that make consumer electronics. In the highly competitive consumer electronics market, building the product at the lowest possible cost can make the difference between success or failure. We see a strong shift of system manufacturing to the Asian Pacific basin. This is true for Japanese system companies as well as North American companies. Dataquest has noted in other publications that there is an increasing demand for all types of semiconductors in Korea, Taiwan, Hong Kong, and Singapore. The Japanese Ministry of Finance reported that in 1986, Japan exported 498 million ICs to the United States while also exporting 444 million units to Korea, 442 million to Taiwan, and 481 million to Hong Kong. The trend in gate arrays is no different. Figure 5 illustrates that Dataquest expects the consumption of gate arrays in Rest of World (ROW) to increase from 1.5 percent in 1986 to 7.1 percent in 1992.

Figure 5

ESTIMATED WORLDWIDE GATE ARRAY CONSUMPTION BY REGION



Source: Dataquest
May 1987

1987 AND BEYOND

The total worldwide gate array market is expected to grow from $1.8 billion in 1986 to $2.4 billion in 1987. We expect a 42 percent increase in 1987 MOS consumption and a 22 percent increase in bipolar consumption. Most of the bipolar growth will be in ECL arrays. We believe that CMOS device pricing will stabilize and not drop below $0.001 per gate. However, low or amortized NRE charges will be common as suppliers battle for design wins.

Suppliers need to position their design wins to capitalize on their strengths while avoiding major competition. We expect Japanese companies in the North American market to continue focusing on capturing lower-density, high-volume CMOS gate array designs as well as high-density ECL designs. North American companies are expected to focus more on capturing high-density CMOS designs and the full range of ECL designs. The gate array market is now dominated by large IC suppliers. The data suggest that Japanese companies will gain market share in both the MOS and bipolar gate array markets over the next two years. We expect 1987 to be the year of truth for the small gate array suppliers. They must decide which path to take: move to a niche market, look to be acquired, or retreat from the market altogether.

Jim Beveridge
Bryan G. Lewis

Dataquest

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Personal Computer—Worldwide Shipments and Forecasts

Robotics

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Semiconductor Equipment and Materials*

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Software—Personal Computer

Software—UNIX

Technical Computer Systems

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Japanese Corporations in the European PC Markets

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European Market for Text Processing

Korean Semiconductor Industry Analysis

Diskettes—The Market and Its Requirements

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  - Japanese Printer Strategy
  - Japanese Telecommunications Strategy
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*On-line delivery option available

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Conference Schedule

1987

Semiconductor Users/Semiconductor Application Markets	February 4-6	Saddlebrook Resort Tampa, Florida
Copying and Duplicating	February 23-25	San Diego Hilton Resort San Diego, California
Imaging Supplies	February 25-26	San Diego Hilton Resort San Diego, California
Electronic Printer	March 23-25	Silverado Country Club Napa, California
Imaging Supplies	March 25-26	Silverado Country Club Napa, California
Computer Storage	April 6-8	Red Lion Inn San Jose, California
Japanese Semiconductor	April 13-14	The Miyako Kyoto, Japan
Color Conference	April 24	Red Lion Inn San Jose, California
European Telecommunications	April 27-29	The Beach Plaza Hotel Monte Carlo, Monaco
CAD/CAM	May 14-15	Hyatt Regency Monterey Monterey, California
Graphics/Display Terminals	May 20-22	San Diego Hilton Resort San Diego, California
European Semiconductor	June 4-5	Palace Hotel Madrid, Spain
European Copying and Duplicating	June 25-26	The Ritz Hotel Lisbon, Portugal
Telecommunications	June 29-July 1	Silverado Country Club Napa, California
Financial Services	August 17-18	Silverado Country Club Napa, California
Western European Printer	September 9-11	Palace Hotel Madrid, Spain
Manufacturing Automation	September 14-15	San Diego Hilton Resort San Diego, California
Business/Office Systems and Software	September 21-22	Westford Regency Hotel Littleton, Massachusetts
Asian Peripherals and Office Equipment	October 5-8	Tokyo American Club Tokyo, Japan
Technical Computers	October 5-7	Hyatt Regency Monterey Monterey, California
Semiconductor	October 19-21	The Pointe Resort Phoenix, Arizona
Office Equipment Dealers	November 5-6	Hyatt Regency Monterey Monterey, California
Military IC	November 12	Hotel Meridien Newport Beach, California
Electronic Publishing	November 16-17	Stouffer Hotel Bedford, Massachusetts
Asian Information Systems	November 30-December 4	Tokyo, Japan
CAD/CAM Electronic Design Automation	December 10-11	Santa Clara Marriott Santa Clara, California

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EUROPEAN MONTHLY REPORT

ESIS Code: Vol. IV, Newsletters

EUROPEAN SEMICONDUCTOR DIVISION

APRIL MONTHLY REPORT

STATE OF THE INDUSTRY

As reported in last month's report, conditions in the industry slowly but surely continue to improve. Bookings continue to show improved strength and the book-to-bill ratio is expected to reach at least 1.18 for March in the United States. The traditional lag has once more reappeared in the European book-to-bill ratio (for the last two years these two curves have been virtually co-incident) with the book-to-bill not expected to reach above unity before June, some six months after the U.S.

It is now believed highly improbably that this current recovery will fizzle out, as in 1986, unless there is a major economic recession in the World electronic industries--an event, though unlikely, is possible should the current bout of protectionism fever get too far out of control.

Moves by MITI to cut back DRAM and EPROM production (32 percent on 256k DRAMs, 21 percent on EPROMs) are already starting to fuel concerns of immediate supply shortages. With user inventories on these parts at ultra-low levels, the great danger is that if Japan does indeed cut back too sharply, the European and U.S. alternative suppliers will be extremely unlikely to be able to absorb the resultant increase in demand--shortages, stretched lead times, and price hikes will undoubtedly result.

Whilst uncertainty still prevails, we do not anticipate any significant changes to our last published forecast (October 1986) when our revised forecasts are released next month, other than that brought about by the continuing weakening of the U.S. dollar and consequent re-evaluation (upwards) in dollar terms the European market estimates.

IN THIS ISSUE

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OTHER INDUSTRY COMMENTS

- U.S. ready to impose tariff sanctions on Japan
- U.S. groups unit on chip threat
- Thatcher warns Japan over C&W telecoms "test case" bid
- Japan's telecom's move prompts trade war curbs
- Japan minister rejects U.S. telecoms request
- Japan threaten's investment cut if EEC widens dumping duties

The above represent just a sample of the headlines that dominated the industrial and political press during March. What started as a "simple" dispute over semiconductor market access has now rapidly escalated to a far more serious level that threatens to rewrite the rule book for International fair trade.

Needless to say, the issues are complex and confusing, with both sides guilty and innocent to a greater or lesser degree depending on the specific issue in question, and providing the rhetoric does not escalate to the point of pushing the World electronics industries into a full scale recession, a more unselfish and harmonious rule book on International trade should begin to germinate. Let us hope so.

MARCH INDUSTRY HIGHLIGHTS

Sony to double output from Welsh colour TV factory at Bridgend with a £30 million investment. The project will make the plant Sony's main television factory in Europe. When the investment is complete by 1990, the factory will have an output of 500,000 colour TV's per annum compared with its 1986 output of 250,000.

American Airlines in $2 billion deal with Airbus and Boeing for 40 aircraft. It is the Airbus group's second big order from the U.S. in the past six months. The deal involves 25 A300-600R aircraft, a modification of the original Airbus wide-bodied aircraft valued at approximately $1.25 billion. American will also order 15 Boeing 767-300ER aircraft valued at approximately $750 million.

Olivetti and Microsoft in optical disk venture to develop, market, and manufacture optical disks in the European market. Also joining the three-way joint venture on an equal sharing basis is Seat. The company, to be called Eikon Corporation, is to be headquartered in Rome and will have an initial capitalization of Lr4.2 billion. This is scheduled to be increased three-fold by year-end. Eikon, which is to become operational in May this year, is Microsoft's first such venture outside the U.S.

Lex, U.K., ahead in profits, despite component losses with pre-tax profits up from £23.6 million to £26.6 million. The automotive sector produced a 23 percent increase in profits at £38.2 million whilst its electronic components group turned in increased losses of £4.5 million. Turnover increased slightly from £1.04 billion to £1.11 billion.

Philips to make digital tape system in Japan via its Marantz subsidiary. It will be able to take advantage of the availability of cheap local components and local know-how. The recorders will be sold in Japan and Europe and may eventually be produced in Europe as well. Marantz is owned 50 percent by Philips and 50 percent by public shareholders through a listing on the Tokyo stock exchange.

BAe wins $260 million order for 13 of its type 146 jet airliner and six twin-engined turbo-propellor light aircraft. The latest orders include ten BAe 146's for Presidential Airways, U.S., two freighter versions of the 146 for the TNT group, and one combined airliner/VIP aircraft for an unnamed African airliner. The new orders for the 146 brings the total of firm orders up to 91 of which 63 have been delivered.

U.K. firm loses $5 billion Taipei mass transit project following mounting political pressure from the U.S. to "buy American". The firm, British Mass Transit Consultants (BMTC), had been working on the project for approximately two years and had expected to continue, at least until the completion of the first phase in 1991. Although it had been told by the Taiwanese authorities that its work was entirely satisfactory, it's contract was abruptly terminated early in March. The Taiwan Government is currently negotiating a new contract with American Transit Consultants of the United States.

Economic growth slackens in West Germany following the announcement of a drop in new domestic business demand in mechanical engineering in January, on top of an already weak export trade. The January order intake was down 14 percent overall, with exports down 17 percent and domestic orders down 10 percent. It is generally believed that the poor export outlook, due to the strength of the Deutschemark against the dollar and other currencies, has caused a number of domestic customers to reduce their investment plans.

Jaguar to spend £50 million with Coman, Italy, the robotics subsidiary of Fiat, for body assembly lines aimed at meeting the car makers needs well into the 1990s. The new lines will be capable of building up to four different models with an annual capacity of 60,000 by mid 1989, readily expandable to 80,000.

Renault withdraws from U.S. car market, signing a preliminary agreement to sell its 46.6 percent controlling stake in AMC to Chrysler in a deal worth up to $550 million. Renault plans to concentrate its recovery efforts on core European car businesses and markets. Renault expects to halve its losses in 1986 to between FFr4 billion to FFr5 billion compared with FFr10.9 billion 1985 and a record FFr12.5 billion in 1984.

France to open 40 percent of its telecommunications monopoly under a plan recently announced by Mr Gerrard Louguet, the French PTT Minister. Legislation on competition in telecommunication services would be drawn up this Spring for ratification by Parliament next Autumn. The total market is currently valued at approximately FFr100 billion. In a parallel move, the French Government is to conduct new tests on the equipment manufactured by the telecommunications groups bidding for control of CGCT before deciding which is to take over France's second largest public switch manufacturing group.

Ericsson wins Bundespost PC order valued at DM70 million. The order for 6,000 personal computers, which will be used in the Bundespost telecommunications offices nationwide, includes both Alfaskop terminals and the up-graded PC-AT compatible WS-286 stand-alone PC. The order was won in the face of stiff competition from 32 manufacturers, including Siemens and Nixdorf. Ericsson recently announced further heavy losses of Skr284 million in its information systems division in 1986 bringing total losses in this sector over the last three years to Skr1.3 billion.

Texas Instruments to shed 320 jobs in U.K. at its Plymouth IC assembly facility. The company had previously announced 200 redundancies at the plant in December last year and this latest decision closes the companies IC manufacturing facility there. The closure will leave approximately 50 staff engaged in computer repair and maintenance. Production previously carried out at Plymouth is to be transferred to the company's plant in Portugal.

Samsung to build £17 million U.K. consumer electronics factory at Billingham, Teeside in spite of fears that the EEC may impose penalty duties on imported components. The plant is slated to produce microwave ovens, video cassette recorders, and colour television sets and could start production in July.

Cellnet U.K. expands radiophone network in £16 million investment program aimed to increase the capacity of its London network and to reduce the risk of congestion. The company is a joint venture between British Telecom and Securicor, the security group. Cellnet's latest investment is in equipment ordered from Motorola, the U.S. electronics group, which is planned to be installed by the end of this year.

Cocom move to reform rules on technology exports aimed towards tightening supervision of sales of goods from non-Cocom members and conforming with the desire of industry in Europe and the U.S. for a less heavy-handled government approach on export controls. Cocom, which began in 1950, tries to prevent military-useful goods and know-how being passed to the Soviet bloc.

Schlumberger ends Fujitsu/Fairchild merger terminating its pact to sell 80 percent of its Fairchild semiconductor operations to Fujitsu. The company blamed the rising political controversy in the United States concerning the venture together with the rapidly increasing trade friction between the U.S. and Japan. No alternate corporate purchaser is thought to be waiting in the wings and the most probable outcome is felt to be a management buy-out.

France plans hypersonic airliner with a target range of 7,500 miles at a speed of Mach 5 (3,800 mph). Aerospatiale, the French state-owned rocket and aircraft company, plans to unveil its outline plans for the project at the Paris airshow in June. The aircraft, which will compete with the U.S. "Orient Express", the British "Hotol", and the West German "Saenger" projects, would weigh approximately 300 tonnes, carry 150 passengers, and fly at an altitude of between 80,000 and 98,000 feet.

Italian Machine tools industry see 17 percent rise in sales in 1986 to Lr2,495 billion, enabling the Italians to maintain their position as the World's fifth biggest producer. Italy's most important export markets were West Germany, the U.S., France, the Soviet Union, China, and the United Kingdom. Altogether exports represented just over 56 percent of the total production.

EEC launches plan to boost exports to Japan covering a wide range of areas including cosmetics and dairy products. Simultaneously, it plans to launch tougher measures to control counterfeiting, a major problem for virtually all the major European names for luxury goods.

Philip's Taiwan VLSI venture opens with plans to produce 10,000 150mm wafers per month by the end of 1987. The new venture, Taiwan Semiconductor Manufacturing Company (TSMC), is 27.5 percent owned by Philips, 48.3 percent by the Taiwan Government, with the remainder held by various private firms including Formosa Plastics, Taiwan's largest conglomerate. James Dykes, former VP and GM of GE's semiconductor division, has been named TSMC's president with Morris Chang, most recently President of GI, chairman. TSMC, which took over the wafer fabrication facilities of the quasi-governmental Electronics Research and Services Organization (ERSO), is expected to sell approximately one third of its wafer output to Philips.

CGE plans record FFr6 billion share offer to coincide with its privatization in May. The total operation will involve about FFr14 billion with around FFr8 billion going to the French Government from the sale of its shares and FFr6 billion to the company from the new share issue. CGE will be the first large state industrial group to be sold by the Government after Saint-Gobain, the pipes and glass company, whose flotation raised approximately FFr8.5 billion last December.

U.S. may retaliate if AT&T loses CGCT bid which is now increasingly seen as a politically strategic issue. The planned decision, which has be postponed several times, is now expected in May. AT&T believed it had won the heavily contested bid last Summer only to be scuppered at the eleventh hour by the intervention of the West German Government on behalf of Siemens.

GTE to sell PBX business to Fujitsu in exchange for a 20 percent interest in a new Fujitsu-GTE Business System Inc. venture due to start April 1st. GTE's flagship Omni line of PBX's is to become the heart of the venture's product line with the GTE 4600 switch targeted to be phased out and replaced early in 1988 by a Fujitsu-designed model. The deal marks the final phase of GTE's program to dismember and divest most of its equipment manufacturing operations.

Dixons U.K. takes over control of Cyclops after closing a take-over bid valued at $384 million. Cyclops 119 store SILO chain gives Dixons a firm beach-head in the United States electrical retailing market. Three Dixon's executives immediately replaced seven resigning Cyclop's directors and the new board immediately approved the sale of Cyclop's Steel and industrial activities to MSL Acquisitions for $110 million.

Italtel renegotiates U.S. switching deal with GTE in the field of public exchanges. The Italian initiative follows last Summer's deal between GTE and Siemens of West Germany under which Siemens is to receive 80 percent of a venture pooling public switching operations in Italy, Belgium, and Taiwan. The re-negotiation, now being discussed with Siemens rather than GTE, is thought likely to lead to the purchase by Siemens of licences for the Linea UT Digital public switching exchange in Italy.

U.K. credit card payment facilities to be linked allowing Barclaycard (Visa) and Access (Mastercharge) cardholders to use the same electronic payment terminals. The move marks a further step towards a U.K. nationwide cashless shopping system. At present, only a few hundred such terminals have been installed in the United Kingdom, though this is expected to increase nearly ten-fold by the end of 1987.

CGE plans £10 million research laboratory in Cambridge, U.K. aimed at having 600 researchers within three years in a building to be constructed on 8 acres of land on the Cambridge Science Park. The research centre would be in addition to the company's two other centres at Wembley, North London, and Great Baddow, near Chelmsford, Essex. Under GEC's plans, the centre would concentrate its work on three main areas of electronics, IC design, artificial intelligence, and solid-state physics.

Linotype, the West German printing technology group, sold to Commerzbank from Allied Signal, U.S., prior to being floated on the West German stock exchange later this year. Linotype is the World's second largest producer of high technology type-setting and associated communications equipment.

VG Instruments, U.K. increases profits 40 percent from £14.3 million to £20.1 million on turnover up 31 percent from £66.1 million to £86.6 million. The news comes despite fears that the restructuring of the Company's American operation would have a temporary adverse effect on orders. The Company's order book is currently strong, especially from Europe and Japan, and a further record year is expected for 1987.

EUROPEAN SEMICONDUCTOR DIVISION ACTIVITY REPORT

Planning for our forthcoming June conference is now completed. The venue is the Palace Hotel, Madrid, Spain on June 3-5.

Our theme this year is "Integrate for the VLSI era", the title being chosen to reflect the structural changes that are taking place within the industry, at company, regional, and device levels. You should now have received the conference brochure together with the list of speakers and the program agenda; should by chance you have not received this, please contact either Lyn Cooke at our London office, 01-379-6257, or if you prefer, your local Dataquest office.

Early registration is recommended as space is limited and we are anticipating a full attendance.

The revision of the European semiconductor market estimates is now in the final stages of completion and is on schedule for publication in April. The task involves the updating of our market estimates by technology, function, and end-use for all regions. This in total comprises 260 pages of information encompassing over 180 tables. Clients who require advance information should use either the on-line facility, the Destiny datadisks, or the inquiry privilege.

THOUGHT FOR THE MONTH

Speculation continued throughout the month of March regarding the prospective SGS-Thomson merger. After initial denials, both companies now publicly admit that "talks are in progress", though details at this stage remain private.

Such an event, however theoretically unlikely, is exactly along the lines that we have been predicting over the last 18 months.

We are undoubtedly living through a period of consolidation in the semiconductor industry, an inevitable part of the industry life cycle. We believe that the industry of the future will comprise of a few, most probably vertically integrated, companies, globally placed supplying the bulk of the World's commodity devices. These companies will be big in size and breadth of products, and will each command a significant World market share. On the other extreme will be many focused companies, so-called niche oriented, that will concentrate their efforts towards speciality, leading edge, or other specialist devices. These companies will be smaller in size and breadth of products, though each will command a strong share in the particular markets they address.

In the middle is a no-man's land, and it is here that most of the industry restructuring will be visible. In other words, the big will get bigger and the small will find a viable niche enabling them to operate very successfully and profitably. A good example of the latter company today is ITT Semiconductors. Headquartered in Germany, ITT has long time pursued a strategy of leadership in consumer electronics VLSI. An early pioneer of TV remote control, their latest technology is typified by their all digital TV IC set, in production since 1983.

What therefore are the merits of such a merger of two of Europe's major semiconductor operations. Each company is of similar size and both, since the early part of the 1980's, has embarked on a radical, often pragmatic, recovery plan, focused on global marketing and internationalization, manufacturing efficiency and customer focus, and have in recent years significantly outpaced the World market growth despite two significant industry recessions. Each has a goal of achieving a 3 percent World market share by the 1990's, or around $1 billion in revenues. Each is about halfway there, with Thomson (1986 Worldwide revenues $436 million) just ahead of SGS (at $370 million).

In short, we believe that such a merger would be an incredibly good event for the European semiconductor industry and for each company, both collectively and individually. It would virtually guarantee them their place amongst the World leaders in the 1990's, enabling them to reach their 3 percent Worldwide and market share goal today, this being considered the critical mass for survival in the global marketplace. It would currently place them number 11 Worldwide, just behind National and ahead of AMD and with a combined product range that is remarkably complementary. Their combined resource would be truly awesome.

We believe the time is right for just these types of consolidation in the industry--those companies that have the ability to realistically reorganize this and have the ability to seek a suitable partnership, alliance, or merger before it is too late will have the strategic advantage.

Whilst in each case there will undoubtedly be seemingly overwhelming parochial, political, and even egotistical issues, we are living in an era where normal rules don't apply anymore--who would have thought even one year ago that a merger of CGE's and ITT's telecommunications business interests would have been possible? Ultimately, Darwin's law of natural selection will apply.

Malcolm Penn

FUTURE EVENTS DIARY

SEMICONDUCTOR CONFERENCES

- APRIL 13-16, Japanese Semiconductor Industry Conference
  Miyako Hotel, Kyoto, Japan
  "VLSI Impact on Future Society"

- APRIL 27-29, European Telecommunications Industry Conference
  Beach Plaza Hotel, Monte Carlo, Monaco
  "New Frontiers for Merging Voice and Data"

- JUNE 3-5, European Semiconductor Industry Conference
  Palace Hotel, Madrid, Spain
  "Integrate for the VLSI Era"

SPECIAL REPORTS

- 1985 News Digest--Available now
- Korean Semiconductor Industry Report--Available now
- IC Update '87--Available now
- GaAs Market Update--Available now
- IC Start ups--Available now
- DSP Market Update--Available second quarter 1987
- Taiwan Semiconductor Industry Report--Available first quarter 1987
- Hong Kong Semiconductor Industry Report--Available first quarter 1987
- China Semiconductor Industry Report--Available first quarter 1987
- 1986 News Digest--Available now

NEWSLETTER SUBSCRIPTIONS

- IC A.S.I.A.
- IC U.S.A (available in English and Japanese)
- European Monthly Report

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- Semiconductor Group Database: History, Forecast, Market Share, and Geographical Data
- SIA Database: Bluebook, Flash Report, Forecast
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For further information on the above items, please call your local DATAQUEST office.

DATAQUEST 6TH ANNUAL EUROPEAN SEMICONDUCTOR INDUSTRY CONFERENCE

June 3-5, 1987, Palace Hotel, Madrid, Spain

conference theme

"INTEGRATE FOR THE VLSI ERA"

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Vitelic Corporation

Andre Borrel - Corp V P
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Tim Curtis - Director European Div.
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Bernard Hadley - Managing Director
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Indy Electronics (Scotland) Ltd

Jean-Luc Grand-Clement - Man. Dir.
European Silicon Structures

Miguel de Oyarzabel - Deputy Dir.
Electronics Division
Spanish Ministry of Industry & Energy

Otto Holzinger - Director
Advanced Automotive Engineering
Robert Bosch GmbH

To be announced
Semiconductor Group
NEC Corporation

Robert Sandfort - Vice President
Monsanto Electronic Materials Company

Graham Shenton - Managing Director
IMP Europe Limited

Robert Van Meurs - General Manager
HiFi Compact Disc Group
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Digital Equipment Europe

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- Europe--Structured for Opportunity and Integration
- European Distribution Channels in the VLSI Era
- Partnering and Alliances--The Ultimate Synergy
- Integrating Manufacturing into the Marketplace
- Application Specific Memories--Tomorrow's Standard
- Quality--The Progress Towards Zero Defects
- Facing the International Challenge

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Topic Highlights (continued)

- European SC Industry--a suppliers perspective
- VLSI Systems in the automotive environment
- Integrated Optical Electronics
- An Integrated Approach to Siliconization
- Integrated IC Users
- Procurement Strategies for VLSI in the 1990's
- Spain integrating for the VLSI Era
- Integrating Internationally

For further information please contact:

Lyn Cooke
Dataquest UK Ltd
13th Floor
103 New Oxford Street
London WC1A 1DD

Tel: 01-379-6257
Tx: 266195
Fax: 01-240-3653

Early registration is advised as space is limited

ABOUT DATAQUEST

Dataquest is the world leader in high-technology market research, offering clients access to a worldwide network of information that provides a critical edge in today's rapidly changing high-technology environments.

Dataquest's research covers an entire generation of high-technology industries, with a primary focus on six broad areas:

- Semiconductors
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- Office equipment
- Industrial automation
- Telecommunications

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*On-line delivery option available

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Dataquest

Conference Schedule

1987

Semiconductor Users/Semiconductor Application Markets	February 4–6	Saddlebrook Resort Tampa, Florida
Copying and Duplicating	February 23–25	San Diego Hilton Resort San Diego, California
Imaging Supplies	February 25–26	San Diego Hilton Resort San Diego, California
Electronic Printer	March 23–25	Silverado Country Club Napa, California
Imaging Supplies	March 25–26	Silverado Country Club Napa, California
Computer Storage	April 6–8	Red Lion Inn San Jose, California
Japanese Semiconductor	April 13–14	The Miyako Kyoto, Japan
Color Conference	April 24	Red Lion Inn San Jose, California
European Telecommunications	April 27–29	The Beach Plaza Hotel Monte Carlo, Monaco
CAD/CAM	May 14–15	Hyatt Regency Monterey Monterey, California
Graphics/Display Terminals	May 20–22	San Diego Hilton Resort San Diego, California
European Semiconductor	June 4–5	Palace Hotel Madrid, Spain
European Copying and Duplicating	June 25–26	The Ritz Hotel Lisbon, Portugal
Telecommunications	June 29–July 1	Silverado Country Club Napa, California
Financial Services	August 17–18	Silverado Country Club Napa, California
Western European Printer	September 9–11	Palace Hotel Madrid, Spain
Manufacturing Automation	September 14–15	San Diego Hilton Resort San Diego, California
Business/Office Systems and Software	September 21–22	Westford Regency Hotel Littleton, Massachusetts
Asian Peripherals and Office Equipment	October 5–8	Tokyo American Club Tokyo, Japan
Technical Computers	October 5–7	Hyatt Regency Monterey Monterey, California
Semiconductor	October 19–21	The Pointe Resort Phoenix, Arizona
Office Equipment Dealers	November 5–6	Hyatt Regency Monterey Monterey, California
Military IC	November 12	Hotel Meridien Newport Beach, California
Electronic Publishing	November 16–17	Stouffer Hotel Bedford, Massachusetts
Asian Information Systems	November 30–December 4	Tokyo, Japan
CAD/CAM Electronic Design Automation	December 10–11	Santa Clara Marriott Santa Clara, California

Dataquest
a company of The Dun & Bradstreet Corporation

1290 Ridder Park Drive
San Jose, California 95131-2398
(408) 971-9000
Telex: 171973
Fax: (408) 971-9003

Dataquest International Offices:

Dataquest GmbH
Rosenkavalierplatz 17
D-8000 Munich 81
West Germany
Phone: (089)91 10 64
Telex: 5218070
Fax: (089)91 21 89

Dataquest Japan Limited
Taiyo Ginza Building/2nd Floor
7-14-16 Ginza, Chuo-ku
Tokyo 104 Japan
Phone: (03)546-3191
Telex: J32768
Fax: (03)546-3198

Dataquest UK Limited
13th Floor, Centrepoint
103 New Oxford Street
London WC1A 1DD
England
Phone: (01)379-6257
Telex: 266195
Fax: (01)240-3653

Dataquest SARL
100, avenue Charles de Gaulle
92200 Neuilly-sur-Seine
France
Phone: (01)47.38.13.12
Telex: 611982
Fax: (01)47.38.11.23

Dataquest Taiwan
Rm. 801, 8th Fl., Ever Spring Bldg.
147, Sec. 2, Chien Kuo N. Road
Taipei, Taiwan, R. O. C. 104
P. O. Box 52-25, Tienmou 111
Phone: (02)501-7960/501-5592
Telex: 27459
Fax: (02)505-4265

Dun & Bradstreet and Dataquest

As a member of the Dun & Bradstreet family of information companies, Dataquest is the world leader in high-technology market research. From semiconductors to systems, Dataquest has been supplying clients with vital information and analyses since 1971.

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Research Newsletter

ESIS Code: Vol. IV, Newsletters
1987-5

A WORLDWIDE IC PACKAGING UPDATE

OVERVIEW

The normal state of affairs in the semiconductor industry is to be in a "state of transition" or to have "reached a milestone." Or, something has occurred that will "revolutionize" the industry. Packaging of semiconductors is no exception.

Significant achievements in VLSI fabrication and design technologies have reached the point where concurrent improvements in die-level interconnection technologies are necessary for continued system performance. Of all the packaging and interconnection technology issues discussed, one issue readily agreed upon is that both users and suppliers of semiconductors are going through a demanding transitional phase of component packaging decisions--decisions that will have to be dealt with in the near future, as the industry approaches submicron geometries.

One very clear trend that we are seeing is that equipment manufacturers are using more and more VLSI devices. There is a sweeping desire to reduce space and cost through more condensed packaging and to automate as much as possible. To accomplish this, packaging technology must approach chip technology.

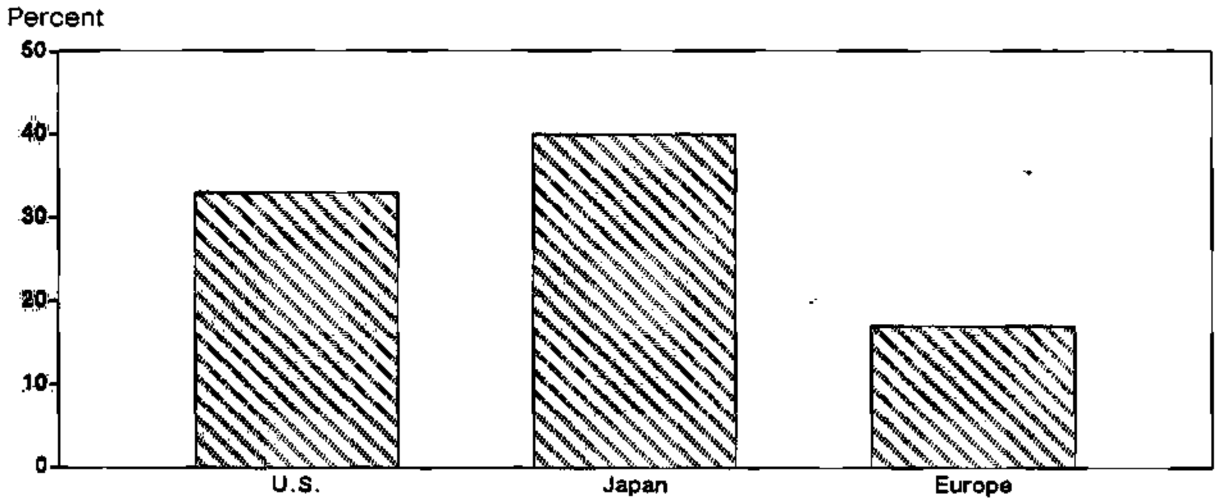
PACKAGE CONSUMPTION

Figure 1 shows the estimated worldwide integrated circuit (IC) package consumption for 1986. The estimates are based on Dataquest's worldwide IC consumption data and therefore show consumption by all packaged ICs. Japan captured 40 percent of packaged ICs in 1986, while U.S. market share dropped to approximately 33 percent and Europe came in at 17 percent. The remaining 10 percent not shown went to ROW.

Dataquest Incorporated, 1290 Ridder Park Drive, San Jose, CA 95131-2398, (408) 971-9000, Telex 171973

Figure 1

ESTIMATED WORLDWIDE IC PACKAGE CONSUMPTION
(1986)



Source: Dataquest
April 1987

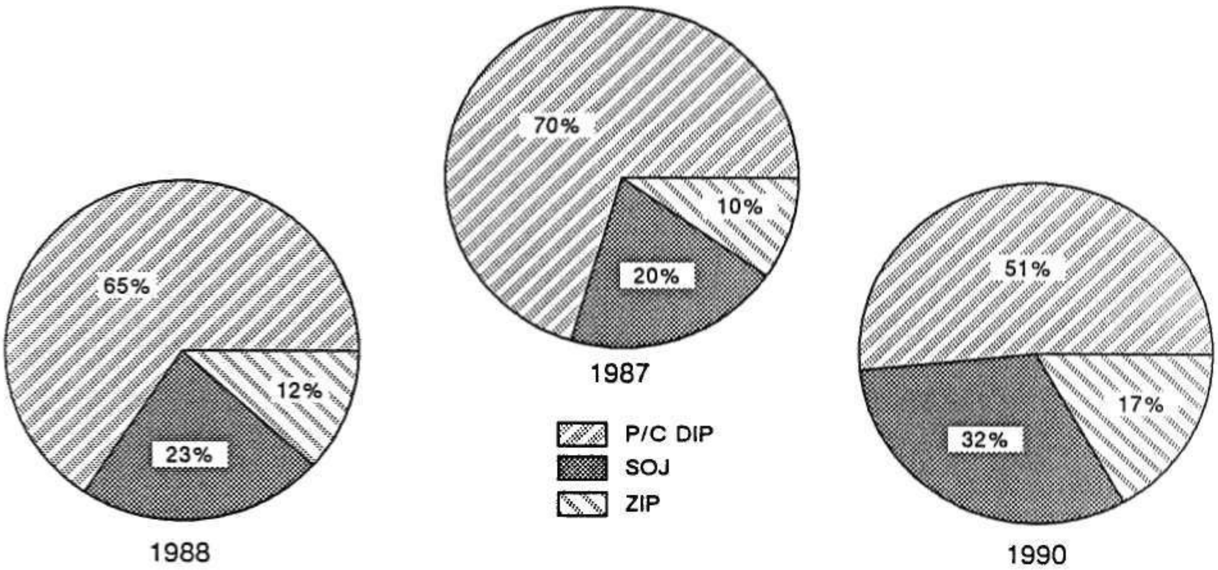
We expect that the Japanese will maintain their lead in the 1988 market using 44 percent of packaged ICs, with the United States holding approximately 38 percent, and Europe with 18 percent. By 1991, we anticipate that Japan will strengthen its lead to 45 percent, by virtue of its majority share of the consumer business, concerted efforts in the industrial sector, and its lead in automated assembly. At this point, U.S. market share will drop to 34 percent, and Europe's share will climb to 21 percent. While Europe is obviously not defeating its American and Asian competitors, we do expect it to modestly regain market share. At this time, we believe that European users are changing to surface-mount technology more readily than the American and Japanese users. Telecommunications and IC smart card applications, focusing on small-outline (SO) and tape-automated bonding (TAB) will provide Europe with the biggest growth opportunities for the next 10 years.

THE MEMORY ROLE

Over the last few years, memory devices have been on the leading edge of packaging technology due to density requirements. We have forecast that approximately 55 million 1 Mbit DRAMs will be shipped worldwide in 1987. As shown in Figure 2, 70 percent of those units will be shipped in either plastic or ceramic dual in-line packages (DIPs). By 1988, DIP package usage for DRAMs will shrink to 65 percent, while zig-zag in-line package (ZIP) and small-outline J-lead (SOJ) usage will grow. As we move into the 1990s, the SOJ package is expected to grow to 32 percent. High-density device architectures, led by smaller geometries and line widths, coupled with the desire to bring down costs while maintaining price competitiveness and building better and faster machines, will require the increased use of surface-mount technology (SMT).

Figure 2

ESTIMATED 1Mb DRAM PACKAGES



Source: Dataquest
April 1987

SMT ISSUES

Despite the many advantages, implementation of surface-mount (SM) packages into systems manufacturing is taking longer than anticipated. Surface-mount technology is still immature and as such the manufacturing infrastructure is not fully developed. Preferring the tested reliability of through-hole (TH) packages, users continue to mix SM/TH designs. Reliability of SM devices has not yet been proven and solder joint inspection is difficult. However, as shown on Table 1, concentrated use of SM devices is occurring in applications where small size and weight are the primary issues. As shown on Table 2, computers were the leading end-use segment for SMDs in the United States, in 1986. While cost reduction was the driving force, reliability continues to play a major role in acceptance of SMT. Europe led the United States in acceptance and usage of SMT in telecom applications; and by virtue of its command over the consumer market, Japan led the market with 10 percent of ICs packaged in SMT. As a comparison, Japan's Printed Circuit Association (JPCA) estimated that SM consumption in Japan reached 13 percent for ICs, and that over the next five years, ICs in SMT will grow to 33.9 percent in Japan.

Table 1

SURFACE-MOUNT TECHNOLOGY

Where?

- Consumer
- Automotive
- Disk storage
- Avionics, missiles, and space
- High-density memories
- Power supplies

Source: Dataquest
April 1987

Table 2

SURFACE-MOUNT TECHNOLOGY
END-USE SEGMENTS
1986

	Japan	Europe	United States
End Use	Consumer	Telecommunications	Computers
Driving Force	Small size	Reliability	Cost reduction/ reliability
Percent of ICs Consumed Worldwide	40%	17.7%	32.8%
Percent of ICs in SMT	10%	8.0%	4.0%
Dominant SMT Approach	TAB/QUAD/SO	SO	SO/CC/TAB

Source: Dataquest
April 1987

SUMMARY

At the present time, we believe that there is no single solution to future VLSI packaging problems. For the 1990s and beyond, we expect that package designs will continue to proliferate. Advanced multichip product designs will incorporate ASICs, use advanced circuit design techniques, and use advanced board assembly methods incorporating TAB and other multichip packages. While plastic packaging has its hermetic limitations, its high-volume, low-cost, high-performance, 40 pin-and-below characteristics will make it the dominant package by 1990.

Automated assembly will change the way that ICs and other components are packaged. TAB or some variation of this method of construction is the most likely packaging style for ICs in the 1990s. Chip-on-board (COB) has also made its way up the automated assembly ladder in consumer applications. From early single-chip digital watch applications, it is now being used in multichip applications such as copiers, facsimile, and IC cards.

REGIONAL ANALYSIS

If we use the premise that memory devices have been on the leading edge of packaging technology due to density requirements, then we can assume that Japan has a two-year lead on the industry and will gain overall leadership in packaging technology before the 1990s. With its vertically integrated structure, Japan can maintain closer technical and strategic cooperation among members of its packaging chain. Their command over the consumer market and surface-mount approach has given them a lead in packaging technology. There are already major efforts among equipment suppliers in Japan to develop automated assembly processes.

Despite major engineering efforts dedicated to designs, substrate and component materials, and assembly equipment, cooperation lags among members of the packaging chain in the United States. At times, cooperation seems better between U.S./Japanese partners than between U.S./U.S. alliances. The strong financial/technical megacorporate links of Japan are nonexistent in the United States. Outside of Texas Instruments and a few systems groups, everyone else has transported assembly offshore. Unlike Europe and Japan, there is very little academic research and cooperation. There is some hope in U.S. research consortiums, but cooperative efforts in packaging are weak. Finally, except for a few systems houses, the fear of capital investments in automated assembly technology has paralyzed many companies into making the decision to automate, a decision that could prevent them from staying on the competitive edge.

Jim Beveridge
Mary A. Olsson

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Research Newsletter

ESIS Code: Vol. IV, Newsletters
1987-4

EXCHANGE RATE QUARTERLY NEWSLETTER

FOURTH QUARTER 1986

Dataquest exchange rate tables involve data from many countries, each of which has different and variable exchange rates against the U.S. dollar. As much as possible, Dataquest estimates are prepared in terms of local currencies before conversion (when necessary) to U.S. dollars. Dataquest uses International Monetary Fund (IMF) average foreign exchange rates for historical data.

All forecasts are prepared assuming no changes in any exchange rate from the last complete historical year--in this case, 1985. During the course of the current year, as local currency exchange rates vary, the appropriate U.S. dollar value changes accordingly. To maintain consistency across all its analyses, Dataquest does not make ongoing adjustments to its forecasts for these currency changes during the current year. As a result of this policy, as the year progresses the forecast numbers could become distorted, in dollars, should the European currencies deviate substantially from the previous year's rates.

Dataquest monitors the exchange rates on a weekly basis using IMF exchange rates, supported by Financial Times exchange rates when IMF data are not yet available. (Financial Times is the accepted U.K. newspaper giving daily updates.) Effective exchange rates for the current year are calculated each month. This information is then used to assess the local currency's impact on U.S. dollar forecasts.

The purpose of this newsletter, which will be updated quarterly, is to record these changes, and thus allow the reader to make any necessary adjustments when interpreting regional data. For each European region, Table 1 gives the local currency per U.S. dollar for 1985, third quarter 1986, and fourth quarter 1986, together with the latest estimate for the whole of 1986. Also shown, for reference purposes, are the same figures for the Japanese yen. As can be seen from this table, the weighted average for all the European currencies for 1986 has increased 20.1 percent with respect to the U.S. dollar, compared with 1985. This represents an increase of 1.5 percent in the exchange rate from third quarter 1986 to fourth quarter 1986. Table 2 shows the 1986 quarterly values for the same regions.

Table 3 illustrates how to interpret the effect of the currency shifts on the Dataquest forecast numbers. For example, the table shows that the constant dollar forecast of $4,418 million for the 1986 total European semiconductor market becomes $5,532 million when adjusted for changes in European currencies.

Table 4 shows the 1986 monthly values of local currency per U.S. dollar for each European region and Japan.

Byron Harding

Table 1

EUROPEAN CURRENCIES--1985 TO 1986
(Local Currency per U.S. Dollar)

Region	1985	Q3 1986	Percent Change Q3-Q4	Q4 1986	Latest Estimate 1986	Percent Change 1985-1986
Austria	20.69	14.67	3.7%	14.13	15.27	26.2%
Belgium	59.41	43.11	3.3%	41.69	44.67	24.8%
Denmark	10.60	7.84	3.3%	7.58	8.09	23.7%
Finland	6.20	4.97	1.2%	4.91	5.07	18.2%
France	8.98	6.78	3.1%	6.57	6.93	22.8%
Ireland	0.94	0.73	0	0.73	0.75	20.2%
Italy	1,909.45	1,435.80	3.2%	1,390.20	1,490.80	21.9%
Luxembourg	59.38	43.11	3.3%	41.69	44.67	24.8%
Netherlands	3.32	2.35	3.4%	2.27	2.45	26.2%
Norway	8.60	7.39	(1.1%)	7.47	7.39	14.1%
Portugal	170.40	147.11	(0.8%)	148.33	149.59	12.2%
Spain	170.05	135.24	0.4%	134.72	140.05	17.6%
Sweden	8.60	6.97	0.7%	6.92	7.12	17.2%
Switzerland	2.46	1.69	1.8%	1.66	1.80	26.8%
United Kingdom	0.77	0.67	(4.5%)	0.70	0.68	11.7%
West Germany	2.94	2.08	3.4%	2.01	2.17	26.2%
Weighted Average (Base 1980 = 100)	182.64	141.44	2.1	139.37	145.86	20.1
Japan	238.54	155.77	(2.9)	160.29	168.52	29.4

Source: IMF
Dataquest
April 1987
Ref. 0387-06

Table 2

EUROPEAN CURRENCIES--1986 BY QUARTER
(Local Currency per U.S. Dollar)

Region	Q1	Q2	Q3	Q4*	Total Year*
Austria	16.49	15.78	14.67	14.13	15.27
Belgium	48.02	45.86	43.11	41.69	44.67
Denmark	8.64	8.31	7.84	7.58	8.09
Finland	5.26	5.14	4.97	4.91	5.07
France	7.21	7.15	6.78	6.57	6.93
Ireland	0.77	0.74	0.73	0.73	0.75
Italy	1,598.27	1,539.03	1,435.80	1,390.20	1,490.80
Luxembourg	48.02	45.86	43.11	41.69	44.67
Netherlands	2.65	2.53	2.35	2.27	2.45
Norway	7.32	7.40	7.39	7.47	7.39
Portugal	152.89	150.03	147.11	148.33	149.59
Spain	147.40	142.83	135.24	134.72	140.05
Sweden	7.41	7.20	6.97	6.92	7.12
Switzerland	1.98	1.87	1.69	1.66	1.80
United Kingdom	0.69	0.66	0.67	0.70	0.68
West Germany	2.35	2.25	2.08	2.01	2.17
Weighted Average (Base 1980 = 100)	154.15	148.48	141.44	139.37	145.86
Japan	187.88	170.13	155.77	160.29	168.52

*Forecast

Source: IMF
Dataquest
April 1987
Ref. 0387-06P

Table 3

EFFECT OF CHANGES IN EUROPEAN CURRENCIES PER U.S. DOLLAR ON DATAQUEST FORECASTS--1985 VERSUS 1986 (Millions of Dollars)

	1985	1986	Percent Change 1985-1986
European Semiconductor Consumption (At constant 1985 exchange rates)	4,720.00	4,418.00	(6.4%)
Weighted European Currency (Assumed) (Base 1980 = 100)	182.64	182.64	N/M
Weighted European Currency (Latest Estimates)	182.64	145.86	20.1%
Effective Consumption (At December YTD exchange rates)	4,720.00	5,532.00	17.2%

N/M = Not Meaningful

Source: IMF
Dataquest
April 1987
Ref. 0387-06P

Table 4

EUROPEAN CURRENCIES--1986 BY MONTH
(Local Currency per U.S. Dollar)

Region	Jan.	Feb.	Mar.	Apr.	May
Austria	17.17	16.41	15.89	15.97	15.66
Belgium	49.95	47.76	46.36	46.28	45.62
Denmark	8.95	8.61	8.35	8.39	8.25
Finland	5.41	5.25	5.12	5.12	5.10
France	7.50	7.16	6.96	7.20	7.11
Ireland	0.80	0.77	0.75	0.75	0.73
Italy	1,664.50	1,588.00	1,542.30	1,556.90	1,528.70
Luxembourg	49.95	47.76	46.36	46.28	45.62
Netherlands	2.75	2.64	2.56	2.56	2.51
Norway	7.55	7.29	7.12	7.15	7.44
Portugal	157.57	152.28	148.81	149.99	148.93
Spain	152.85	146.97	142.37	143.73	141.85
Sweden	7.59	7.40	7.23	7.24	7.15
Switzerland	2.07	1.96	1.91	1.91	1.85
United Kingdom	0.70	0.70	0.68	0.67	0.66
West Germany	2.44	2.33	2.26	2.27	2.23
Weighted Average (Base 1980 = 1980)	-	-	-	-	-
Japan	200.07	184.64	178.93	175.62	166.83

*Forecast

(Continued)

Table 4 (Continued)

EUROPEAN CURRENCIES--1986 BY MONTH
(Local Currency per U.S. Dollar)

Region	June	July	Aug.	Sept.	Oct.
Austria	15.71	15.14	14.52	14.35	14.10
Belgium	45.69	44.34	42.73	42.26	41.61
Denmark	8.28	8.05	7.76	7.72	7.56
Finland	5.19	5.07	4.93	4.91	4.89
France	7.13	6.93	6.73	6.68	6.55
Ireland	0.73	0.72	0.74	0.74	0.73
Italy	1,531.50	1,478.40	1,420.80	1,408.20	1,386.60
Luxembourg	45.69	44.34	42.72	42.26	41.60
Netherlands	2.52	2.43	2.33	2.30	2.26
Norway	7.61	7.47	7.35	7.34	7.35
Portugal	151.17	148.43	146.23	146.67	146.89
Spain	142.92	137.57	134.21	133.95	133.29
Sweden	7.21	7.06	6.93	6.91	6.88
Switzerland	1.84	1.75	1.66	1.65	1.64
United Kingdom	0.66	0.66	0.67	0.68	0.70
West Germany	2.24	2.15	2.06	2.04	2.00
Weighted Average (Base 1980 = 1980)	-	-	-	-	-
Japan	167.95	158.60	154.00	154.72	155.95

*Forecast

(Continued)

Table 4 (Continued)

EUROPEAN CURRENCIES--1986 BY MONTH
(Local Currency per U.S. Dollar)

Region	Nov.	Dec.*	1986*	1985	Percent Change 1985-1986
Austria	14.26	14.03	15.27	20.69	26.2%
Belgium	42.04	41.42	44.67	59.41	24.8%
Denmark	7.64	7.53	8.09	10.60	23.7%
Finland	4.95	4.90	5.07	6.20	18.2%
France	6.62	6.54	6.93	8.98	22.8%
Ireland	0.74	0.73	0.75	0.94	20.2%
Italy	1,402.10	1,381.80	1,490.80	1,909.45	21.9%
Luxembourg	42.04	41.42	44.67	59.38	24.8%
Netherlands	2.29	2.25	2.45	3.32	26.2%
Norway	7.53	7.53	7.39	8.60	14.1%
Portugal	149.40	148.69	149.59	170.40	12.2%
Spain	136.13	134.74	140.05	170.05	17.6%
Sweden	6.96	6.91	7.12	8.60	17.2%
Switzerland	1.69	1.66	1.80	2.46	26.8%
United Kingdom	0.70	0.69	0.68	0.77	11.7%
West Germany	2.03	1.99	2.17	2.94	26.2%
Weighted Average (Base 1980 = 1980)	-	-	145.86	182.64	20.1%
Japan	162.64	162.29	168.52	238.54	29.4%

*Forecast

Source: IMF
Dataquest
April 1987
Ref. 0387-06P

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Research Newsletter

ESIS Code: Vol. IV, Newsletters
1987-3

As you may have noticed, Dataquest has adopted a new banner for research newsletters and research bulletins. We hope you are pleased with the results. Please continue to file newsletters and bulletins in the appropriate binder.

SEMICON EUROPA, ZURICH, SWITZERLAND

On March 11, Malcolm Penn, Dataquest Vice President and Director of European Operations, presented a status of the industry report at the Semicon Europa opening press conference. For the benefit of all of Dataquest's European Semiconductor Industry Service clients, a copy of the speech is attached.

Dataquest, Incorporated, 1290 Ridder Park Drive, San Jose, CA 95131-2398, (408) 971-9000, Telex 171973

Status of the Industry--Is There Life after Recession?
Semicon Europa, 10 March 1987, Zurich, Switzerland

by

Malcolm G. Penn, Vice President, Director of European Operations
Dataquest Europe

SECOND HALF 1986 OVERVIEW

In the first half of the year, the semiconductor industry grew faster than expected; however, in the second half, growth was slower because of a combination of factors. Key factors affecting semiconductor industry growth and resulting prices included: continued reduced demand in the computer industry, low growth in the telecommunications industry, and rigorous inventory reduction programs. Dataquest's revised estimate for 1986 is for negative 6.8 percent local currency growth in Europe, which is down from our earlier negative 2 percent forecast. Consumption growth in 1987 is expected to be a tempered plus 10 percent in local currency as inventory reduction programs are stabilized and production requirements become met by increased shipments of smaller quantities.

The events of the second half of 1986 reflected a combination of market and government reactions to a subdued recovery in which survival pricing lingered longer than anticipated. Users and distributors have instituted ongoing inventory reductions and made the "ship-to-stock, just-in-time" philosophy an actuality. Semiconductor manufacturers have responded to demands of shorter lead times and reliable ship dates as buyers share scheduled component requirements with their vendors.

OUTLOOK FOR 1987

The forces that impacted 1986 are expected to linger into 1987. Low inventory levels require a reliable vendor base. The long-term user-vendor working relationships that exist now will be tested in 1987 as demand is expected to increase gradually, putting strain on tuned supply lines.

The increase of end-use demand that was expected to come by the end of 1986 did occur in the first half of the year but put in only a lackluster performance in the remainder of 1986. The first half of 1987 will continue the static growth pattern set in late 1986 as capacity continues to adjust to a different market environment. Relatively gradual growth is forecast to occur by mid-1987 as production rates more closely match consumption.

Capacity utilization rates are expected to rise to 67 percent in 1987 from a 56 percent rate in 1986. This 12 percent increase reflects the cautiousness of semiconductor manufacturers as they squeeze increases in productivity out of existing equipment while facing a gradual growth sales year. While facing a relative gradual growth year, many manufacturers are retiring aged plants and investing in yield-enhancing equipment for their newer fab lines.

The extended recovery into 1987 will tie in with major new product announcements and new capital required for the growth forecast in 1988.

In the most part, we have reached a situation where inventory use rates and semiconductor purchases are in balance. Production quantities are now being supported by purchases instead of inventories.

CURRENT STATUS--FIRST QUARTER 1987

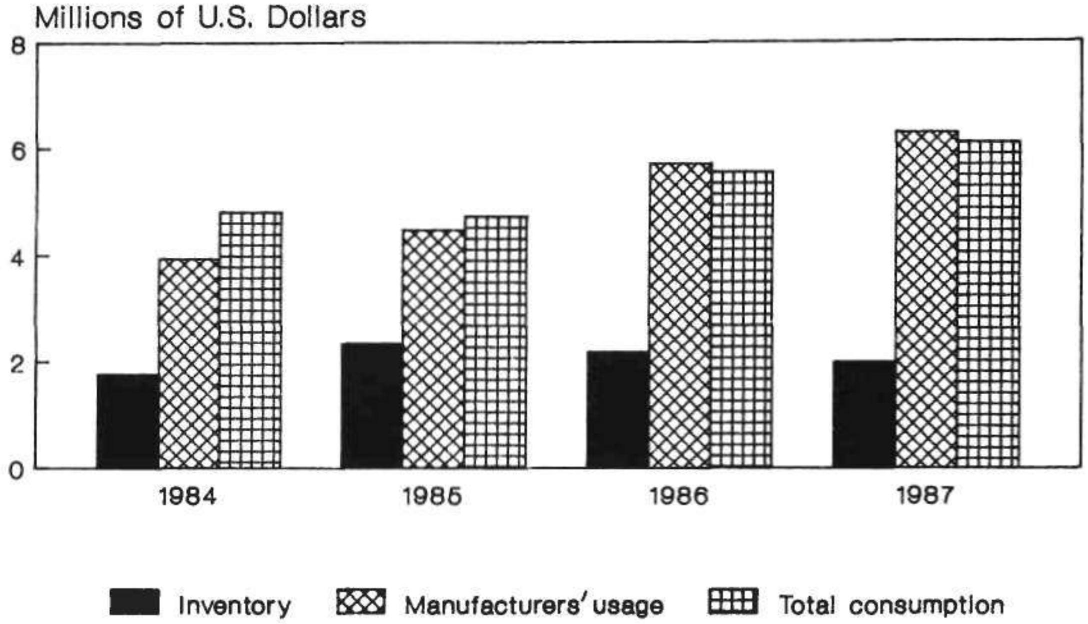
At the Semiconductor Manufacturers

The first quarter of 1987 is getting off to a robust start, more so than most industry participants had forecasted. We recently polled several major players who reported February bookings up 15 to 20 percent versus January, with particular strength in the U.S. markets. OEM demand was strong with users buying for production and inventory. IBM in particular was reported as buying for inventory.

Looking at the product areas, microprocessor demand is strong (automotive and computer) and memory and glue logic both reported as very strong. There is also the beginning of OEM longer-term commitments--their business is up and they are in turn translating that demand increasingly into component commitments.

Demand for leading-edge products, for example, the 80286, is very strong and lead times are starting to stretch out. Whilst there is enough capacity in place at the moment, some constraints are likely to surface in the second half-year. Figure 1 shows the reduction in inventory, from its peak in 1985 of 25 weeks down to a projected all-time low of 16 weeks average for 1987, together with the manufacturers' actual usage and semiconductor TAM buildup. Our current forecasts project a 10 percent local currency growth rate for Europe, or around 23 percent in U.S. dollars based on current exchange rates.

European Semiconductor Consumption Profile
(Millions of U.S. Dollars)



Source: Dataquest
March 1987

At the Equipment Manufacturers

Most of the companies we polled are reporting a very high level of sales activity in the U.S.--lots of running ground by the salesmen, but very little in the way of new sales. Whilst the tire kickers are out there with a vengeance, most new sales that do materialize are for small quantities of equipment for minor capacity upgrades. However, if the semiconductor vendor's demand continues to increase as it currently is, it would not be unreasonable to expect the start of some big orders in the May/June time frame. Overall, though, in the United States, 1987 demand for equipment is not going to be that strong.

In Japan, the situation is much, much worse. They have not even reached the tire-kicking stage, and an upturn here is likely to be one to two quarters after that in the United States.

Korea, however, remains very active.

If we turn now to Europe, demand has in general held up reasonably well, at least in comparison with the United States and Japan, especially from such companies as Philips, Siemens, and Thomson. However, even here, equipment purchases still remain at a lower level.

At the Materials Suppliers

This is the one area where we have seen an upturn in demand. Silicon consumption was up in 1986 and will be up again in 1987, especially now that semiconductor unit production is starting to increase. Silicon ASPs, however, remain depressed, reflecting the still overcapacity in the industry.

The depreciation of the U.S. dollar versus the yen is critically hurting the Japanese vendors' sales, especially in the United States, and to a lesser extent, that same exchange rate phenomenon is causing similar problems for the European manufacturers.

LONG-TERM OUTLOOK

By the end of 1988 we expect the familiar demand pull upon production to begin, creating overcapacity and, in turn, leading to reduced demand and falling prices. The peak and trough of this 1988-through-1989 cycle should not be as pronounced as the 1984-through-1985 roller coaster ride because of the aforementioned strategic partnerships that are now being made. Another moderating influence on the next semiconductor cycle is the increase of multinational corporations operating within their regional end-markets' boundaries.

CONCLUSION

Dataquest forecasts a moderately strong 1987 worldwide growth rate for the semiconductor industry, with sales increasing 17.7 percent in dollars at current exchange rates. This increase over the 1986 growth of 14 percent in local currencies illustrates the underlying demand for electronics as the industry climbs out from the bottom of the last cycle in 1985. Continued overall inventory reduction is forcing many to rethink what normal inventory turns and resulting unit levels should be. Manufacturers are heeding the demands of users and are providing improved shipment schedules that are being met and overall better pricing in return for accurate rolling forecasts that do not abruptly change.

The current overall soft semiconductor pricing reflects a buyers' market that is expected to continue through the first half of 1987. The world is trying to digest the technology now available while the next generation of components is waiting in the wings for volume shipment. Designs of systems using 32-bit MPUs and 1Mb-and-above DRAMs will begin to come onto the market beginning in early 1987 and will gradually increase in production volume. The relatively limited capacity for this new technology will shore up prices overall, but mature products will continue to experience stiff price competition.

Malcolm Penn

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EUROPEAN RESEARCH NEWSLETTER

ESIS Code: Vol.IV, Newsletters
1987-02

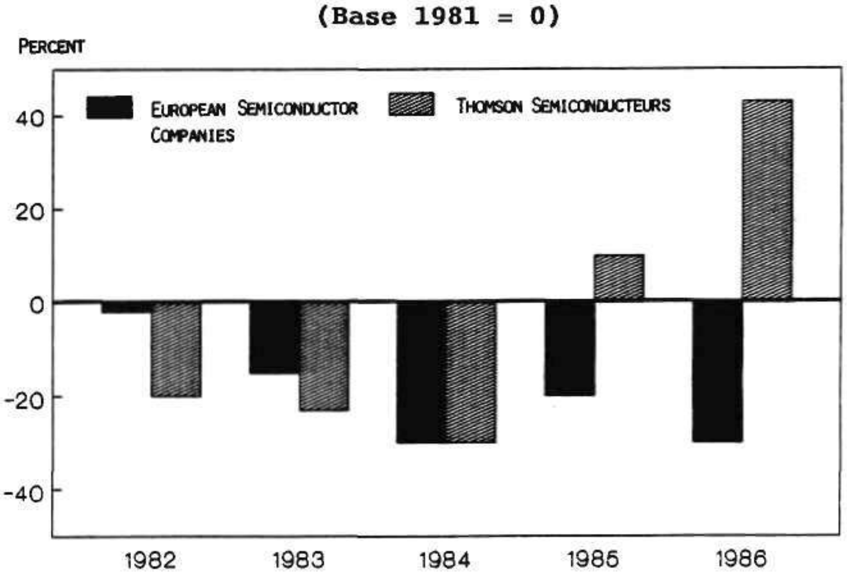
THOMSON SEMICONDUCTEURS: HALF WAY TO THE OBJECTIVE

INTRODUCTION

In 1982 Thomson Semiconducteurs embarked on an ambitious plan to become a major force in the worldwide semiconductor market. At that time it set itself the objective of 3 percent worldwide market share by 1990. In 1985 Thomson turned the tide and outpaced worldwide and European market growth (see Figure 1 below), and subsequently made considerable progress toward its goal. In 1986, Thomson achieved worldwide revenue of $436 million, ranking seventeenth overall and overtaking Siemens to become the second largest European semiconductor manufacturer after Philips-Signetics. This newsletter provides an update on Thomson's current position, plans, and future outlook.

Figure 1

THOMSON SEMICONDUCTEURS VS. TOTAL EUROPEAN SEMICONDUCTOR COMPANIES WORLDWIDE MARKET SHARE PERCENT GROWTH 1981-1986 (Base 1981 = 0)



Source: Dataquest
February 1987

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1290 Ridder Park Drive / San Jose, CA 95131-2398 / (408) 971-9000 / Telex 171973

BACKGROUND

Thomson Semiconducteurs has become the dynamic company it is today because of sweeping management changes instituted by the parent company, Thomson S.A., in the early 1980s. Alain Gomez became chairman of Thomson S.A. in February 1982. The Harvard Business School Graduate instituted and enforced rigorous financial controls and tightened the responsiveness of the management structure by slashing headquarters staff by two-thirds. He reorganized the company into five key areas: consumer products, engineering and industrial products, detection equipment and electronic systems, medical equipment, and electronic components. At the same time, he disposed of irrelevant or unprofitable groups.

In September 1982, Mr. Gomez persuaded Jacques Noels to leave his post as president of Texas Instruments, France, to join Thomson as corporate planning vice president. In April 1983, Mr. Noels took charge of Thomson Semiconducteurs and implemented organizational and management changes that allowed the company to take advantage of worldwide opportunities in the expanding semiconductor market of 1983-1984.

During the period from 1982 to 1985, Thomson Semiconducteurs consolidated its various disparate semiconductor facilities and activities into a homogenous entity. The semiconductor facilities and activities of Thomson CSF, Thomson-EFCIS, CIT-Alcatel, Eurotechnique, and Mostek Corporation (purchased in November 1985) have been merged and restructured in accordance with the demands of the market. Productivity has increased, cycle times have been reduced, and substantial investments have been made on R&D, plant, and machinery. Managers from IBM, ITT, Motorola, and Texas Instruments have been recruited and are putting their many years of industry experience to work within the revitalized company so that it can now effectively respond to market opportunities in a timely manner.

THE COMPANY TODAY

Thomson Composants (which comprises the semiconductors, hybrid and passive components division), has reached approximately FFr 5.7 billion turnover in 1986, and employs 15,000 people worldwide. Since 1982, the company has invested 44 percent of its annual revenue in R&D and capital in the semiconductor area. In 1986 alone this figure stands at an estimated 49 percent, despite the period of 1985 and 1986 being one of the worst industry recessions in semiconductor history. Of the estimated FFr 5.7 billion in revenue in 1986, approximately two-thirds of this was in semiconductors. The semiconductor group is organized into five separate divisions: MOS, Bipolar, Specific Silicon Services, Discrete, and Military & Space. The MOS Division concentrates its activities on five basic semiconductor product areas:

- Programmable memories
- Chip carrying cards

- Microprocessors
- Telecommunications devices
- Random access memories

A division was created in March 1986 for application-specific integrated circuits (ASICs), and board level and development systems.

The November 1985 acquisition of the facilities and assets of the Mostek Corporation has now been fully absorbed into the semiconductor activity. Thomson's worldwide semiconductor products and production have been rationalized into the following market-driven centers of excellence:

Europe	United States	Both
• Consumer	• Computer	• ASIC
• Bipolar	• RAM	• Microprocessor
• Programmable memory	• RF power	• Industrial
• Discrete		• Military
• Board level and development systems (VME bus)		• Telecom - USA, LANs - Europe, switching

Where common responsibilities exist in both the United States and Europe, the programs are coordinated so that there is no duplication of effort.

Thomson Composants Mostek Corporation (TCMC) is now thought to be operating at break-even. This strategic acquisition secured a major marketing and fabrication presence for Thomson in the United States, plus a world-class mask making and diffusion facility. The deal brought increased product offerings, additional technology, and additional sales coverage. The France/United States interaction is akin to a strategic partnership. Dataquest views the combined strength of Thomson and TCMC as a true positive with absolute synergy in processing and marketing.

James Fiebiger (ex TI/Motorola), who came to Mostek two months before it was purchased by Thomson, continues as head of TCMC. Thomson Semiconducteurs European MOS Integrated Circuits Division is headed by Marc Lassus (ex Motorola/Matra-Harris). Another key player is Philippe Geyres (ex IBM), who then was manager of the Bipolar IC Division (he recently became worldwide strategic marketing and program manager). Together they instituted major changes at the facilities in Grenoble, Saint-Egreve, Rousset, and Nancy in France. For example, the new assembly and test facility near Nancy opened officially in April 1986.

It is one of the most advanced sites in the world and is fully "robotized" for automatic die-attach, wire bond, molding, QA sampling, and laser marking for batch ID. The assembly expertise at the facility comes via a technology exchange agreement with Oki Semiconductor of Japan.

Thomson has wafer fabrication processing technology worldwide of 1.2-micron (HCMOS) gate dimensions in production, and 0.5 micron in R&D. The company expects to be in production with a 0.8-micron process in the 1987/1988 time frame that is being developed jointly by Thomson in Grenoble, Leti, Association MOS, and Mostek. Thomson is using ASICs and EPROMs together with advanced world class CAD capability, rather than DRAMs, as technology drivers to push forward its state-of-the-art product technology. Recently Thomson and SGS announced a joint venture to develop a 4-Mbit EPROM by 1990. A 1-Mbit device has already been developed by Thomson in Grenoble, and will be ready for production sampling during 1987. Thomson has already demonstrated a world class capability in EPROM and smart card technology.

Thomson believes that its design centers and CAD will enhance component performance and impact vertical integration across the company, as well as push process achievement and variety. Existing design centers are located as follows:

- Grenoble--Microprocessor/telecommunications/ASIC/Bipolar/ Military
- Rousset--Non-volatile memory/Smart Card/Microcalculator
- Vilingen--Dedicated consumer products
- Japan--ASIC
- United States--RAM/microprocessor/telecommunications/ASIC/military
- Aix-en-Provence--Protection devices/smart power
- Tours--Energy Conversion

In addition to the extension of its existing design resource in Grenoble, new design centers have been implemented in Grenoble and Velizy, France; Munich, Germany; Basingstoke, United Kingdom; Milan, Italy; Phoenix and Dallas, the United States; and Singapore. A silicon compilation joint venture between Thomson, Bull, and French Universities, called Sycomore, will be operational soon. A second joint venture between Bull, ICL, Siemens, Thomson, and various universities, called AIDA (silicon compilation plus artificial intelligence) is anticipated to come to fruition in three to four years time. This investment in CAD is seen as a strategic move to ensure future strength in design and technology innovation whereby it is expected that CAD, not the basic technology itself, will surface to be the biggest (long-term) differentiating factor.

DATAQUEST ANALYSIS

Dataquest believes that the Thomson plan is undoubtedly ambitious, especially considering the increasing competitiveness of the industry, but nonetheless on target per the original 1982/1983 blueprint, and with substantial progress already achieved. We believe that the Mostek asset acquisition will prove to be a major benefit, not a liability, in the achievement of this plan.

Thomson management ranks with the world leaders; they are determined, energetic, and full of entrepreneurial spirit, and, most significantly, they have a sense of true cause. The product range of Thomson spans the majority of end-user needs except for commodity DRAM and standard logic devices, and the company's technologies, both in process and CAD, are among the world leaders.

When Thomson embarked on the plan, the peers of the industry did not really believe that the company would get even this far. Even though the road ahead is tough, Thomson continues to move forward. Execution remains the key factor to future success, but so far Thomson has demonstrated that this is not a problem.

Malcolm Penn
Kathleen Killian

Dataquest

Product Offerings

Industry Services

Business Computer Systems
CAD/CAM
Computer Storage—Rigid Disks
Computer Storage—Flexible Disks
Computer Storage—Tape Drives
Copying and Duplicating
Display Terminal
Electronic Printer
Electronic Publishing
Electronic Typewriter
Electronic Whiteboard
European Semiconductor*
European Telecommunications
Gallium Arsenide
Graphics
Imaging Supplies
Japanese Semiconductor*
Office Systems
Personal Computer
Personal Computer—Worldwide Shipments and Forecasts
Robotics
Semiconductor*
Semiconductor Application Markets*
Semiconductor Equipment and Materials*
Semiconductor User Information*
Software—Artificial Intelligence
Software—Personal Computer
Software—UNIX
Technical Computer Systems
Technical Computer Systems—Minisupercomputers
Telecommunications
Western European Printer

Executive and Financial Programs

Corporate Alliance Program
Coporate Technology Program
Financial Services Program
Strategic Executive Service

Newsletters

European PC Monitor
First Copy
Home Row
I.C. ASIA
I.C. USA

Focus Reports

The European PC Market 1985-1992
European PC Retail Pricing
PC Distribution in Europe
PC Software Markets in Europe
PC Local Area Networking Markets in Europe
The Education Market for PCs in Europe
Japanese Corporations in the European PC Markets
Home Markets for PCs in Europe
Integrated Office Systems—The Market and Its Requirements
European Market for Text Processing
Korean Semiconductor Industry Analysis
Diskettes—The Market and Its Requirements

Directory Products

I.C. Start-Ups—1987
SpecCheck—Competitive Copier Guide
SpecCheck—Competitive Electronic Typewriter Guide
SpecCheck—Competitive Whiteboard Guide
Who's Who in CAD/CAM 1986

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- Industry Services
  Manufacturing Automation
  Computer Storage—Optical
  Computer Storage—Subsystems
- Focus Reports
  Japanese Printer Strategy
  Japanese Telecommunications Strategy
  Canon CX Laser—User Survey
  Digital Signal Processing
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Conference Schedule

1987

Semiconductor Users/Semiconductor Application Markets	February 4-6	Saddlebrook Resort Tampa, Florida
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Western European Printer	September 9-11	Palace Hotel Madrid, Spain
Manufacturing Automation	September 14-15	San Diego Hilton Resort San Diego, California
Business/Office Systems and Software	September 21-22	Westford Regency Hotel Littleton, Massachusetts
Asian Peripherals and Office Equipment	October 5-8	Tokyo American Club Tokyo, Japan
Technical Computers	October 5-7	Hyatt Regency Monterey Monterey, California
Semiconductor	October 19-21	The Pointe Resort Phoenix, Arizona
Office Equipment Dealers	November 5-6	Hyatt Regency Monterey Monterey, California
Military IC	November 12	Hotel Meridien Newport Beach, California
Electronic Publishing	November 16-17	Stouffer Hotel Bedford, Massachusetts
Asian Information Systems	November 30-December 4	Tokyo, Japan
CAD/CAM Electronic Design Automation	December 10-11	Santa Clara Marriott Santa Clara, California

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EUROPEAN RESEARCH NEWSLETTER

ESIS Code: Vol.IV, Newsletters
1987-01

EEC FUNDING--WILL IT BE FEAST OR FAMINE?

The EEC's Council of Ministers recently approved a draft 1987 budget of ECU 37 billion. (The ECU, the European Currency Unit, is a weighted average of European currencies.) The proportion of this being allocated to R&D programs such as Esprit was discussed at a meeting of EEC research ministers in Brussels in December 1986. This newsletter summarizes the events to date and analyzes the probable effects on European industry.

BACKGROUND

Over the last five or six years, there has been a qualitative change in the nature of subsidies offered by governments--away from revitalizing declining sectors, such as steel and shipyards, and toward increasing support across a broad range of high-technology industries.

The first phase of transEuropean projects (e.g., Esprit and RACE) has now been completed; the idea of European cooperation has been instilled and partially accepted; and now governments have to decide what to do next. Resources are limited; research projects are numerous; nationalistic ambitions are high and have to be weighted against the idea of a united Europe. This will not be an easy task.

WHAT WAS PROPOSED

In October, there was a meeting of EEC research ministers in Luxembourg to decide on proposals for the next phase of transEuropean research. This resulted in outline proposals to spend ECU 7.7 billion on R&D support in the next five years. (For comparison purposes, the EEC spent ECU 3.7 billion in the last four years.) Although the proposed amount is a mere 5 percent of the total EEC budget, there has been dissent on this issue among the 12 member countries. The United Kingdom,

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France, and West Germany insist that projects should genuinely break new ground. The three countries also want to see the budget pruned to ECU 3.5 billion to ECU 4 billion because of fears about the EEC's budget crisis, (i.e., can the EEC meet long-term budget commitments while it is under the current financial strain). There has been continuous haggling over this budget, which has already been cut to its present ECU 7.7 billion, from ECU 10.35 billion.

It is said that to date, Esprit-sponsored projects have not yielded any dramatic breakthroughs. This adds ammunition to the three countries' argument. However, it must also be said that Esprit has succeeded in other ways. It has encouraged transnational cooperation, companies have come out of isolation, and thus the hitherto strong national barriers are being broken down. As Jaques Stern, Chairman of Bull, said recently, "Collaboration has produced quite a remarkable change. Instead of thinking only in national terms, we now realize there is a European dimension to our problems."

Considering further ramifications of Esprit--because of the above change in corporate thinking, a number of companies have entered into bilateral agreements. For example, Bull, ICL, and Siemens set up a joint center to research advanced computer software; Siemens and Philips joined forces in the Semiconductor Megaproject; and Bull and Olivetti agreed to manufacture banking terminals.

In addition, there are now plans to institute common standards across regional boundaries in the communications networks.

WHAT WAS THE RESULT?

On December 8, 1986, the European Parliament gave formal support for the ECU 7.7 billion research budget for the period 1987-1991. It will also urge the EEC to withdraw the budget proposals completely if member states cannot agree on them in full. Officially, the budget proposals must be agreed upon by the end of the year.

On December 9, 1986, the EEC research ministers' meeting took place. As expected, it was a stormy meeting, which continued throughout the night. The ministers failed to agree on proposals for the research budget.

However, a compromise was put forward by Karl-Heinz Narjes, the Commissioner responsible for an interim ECU 3.7 billion plan to last three years. Member states decided to meet on December 22 for a final attempt to agree.

On December 19, the ministers canceled the December 22 meeting, because they said agreement on increased funding was considered remote. The European Commission, angered by the cancellation, withdrew Mr. Narjes' compromise proposal. To date the situation remains unresolved.

HOW WILL THIS AFFECT THE INDUSTRY?

There are two schools of thought on this matter.

The first says that if the research budget is rejected, the EEC's chances of closing the technology gap with the United States and Japan will be reduced. In addition, existing research programs could only keep running until spring 1987. One of the first casualties would be RACE, a major EEC program on telecommunications. It would only have funding until the end of this month.

The second school of thought states that EEC research, administered by EEC officials in Brussels, is hindering Europe's progress, and that the administration is too readily accepting the status quo without even trying to encourage healthy change. The task facing Europe is to now move beyond joint research, into development of marketable products for a worldwide market. No company can meet the massive investments required alone. The companies themselves will need to devise new forms of cooperation and integration of resources. This can best be done through direct negotiations, following the business interests of companies involved--an example is SGS and Thomson, which are discussing the possible merger of their semiconductor businesses.

Although the road is not easy, transnational megers must take place if companies are to truly become of worldwide caliber. The EEC should realize that existing research programs, centrally administered, have been a catalyst. It is now time to go further--to decentralize operations and give support to companies so that they can form a genuine common market.

Iza Hallberg

Dataquest

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Computer Storage—Rigid Disks

Computer Storage—Flexible Disks

Computer Storage—Tape Drives

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Japanese Semiconductor*

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Personal Computer—Worldwide Shipments and Forecasts

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Semiconductor User Information*

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CAD/CAM Electronic Design Automation	December 10-11	Santa Clara Marriott Santa Clara, California

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EUROPEAN MONTHLY REPORT

ESIS Code: Vol. IV, Newsletters

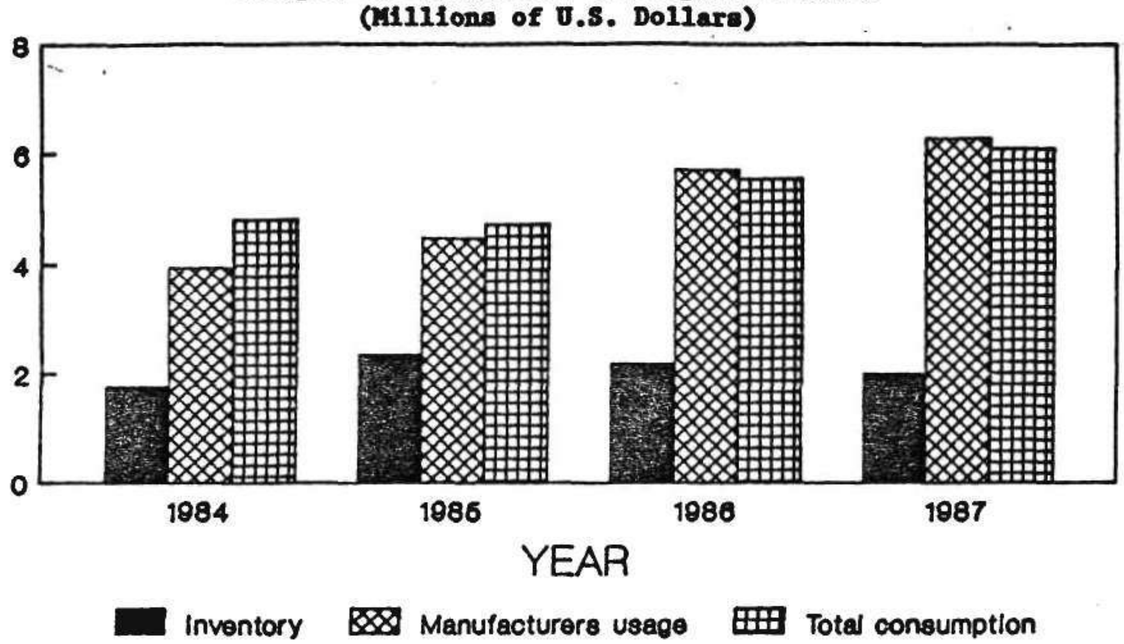
EUROPEAN SEMICONDUCTOR DIVISION

MARCH MONTHLY REPORT

STATE OF THE INDUSTRY

Figure 1

European Semiconductor Consumption Profile
(Millions of U.S. Dollars)



Source: Dataquest
March 1987

IN THIS ISSUE

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The first quarter of 1987 is getting off to a robust start, more so than most industry participants had forecasted. We recently polled several major players who reported February bookings up 15 to 20 percent vs. January with particular strength in the U.S. markets. OEM demand was strong with users buying for production and inventory. IBM in particular was reported as buying for inventory.

Looking at the product areas, microprocessor demand is strong (automotive and computer) and memory and glue logic both reported as "very strong". There is also the beginning of OEM longer term commitments--their business is up and they are in turn translating that demand increasingly into component commitments.

Demand for leading edge products, for example the 80286, is very strong and lead times are starting to stretch out. Whilst there is enough capacity in place at the moment, some constraints are likely to surface in the second half-year.

Figure 1 shows the reduction in inventory, from its peak in 1985 of 25 weeks down to a projected all time low of 16 week average for 1987, together with the manufacturer's actual usage and semiconductor TAM build up. Our current forecasts project a 10 percent local currency growth rate for Europe, or around 23 percent in U.S. dollars based on current exchange rates.

OTHER INDUSTRY COMMENTS

Action against Japan's IC thrust accelerates--February saw a heightened pace in both the EEC anti-dumping action against Japan and in the disagreements on the U.S./Japan IC pact. In the former, EEC officials now seem set to open an anti-dumping investigation into imports of Japanese memory ICs into Europe, initially on EPROMs. A separate complaint on DRAMs is expected to follow shortly. Principal beneficiaries will be Philips, Siemens, and SGS as well as Inmos and Matra Harris. Japan however dominates these markets in Europe with around 80 percent and 90 percent market shares respectively.

In a parallel move, there is a growing prospective trade row brewing on the EEC's initiative to clamp down on the Japanese "screwdriver" operations in Europe and the proposal to extend anti-dumping duties to a wide range of products made in Europe by Japanese companies but with a high proportion of cheap imported components.

The now infamous U.S./Japan trade accord is increasingly sailing into heavy waters and, not surprisingly, as predicted in our original analysis, is not achieving what it set out to do. Japan has conceded that there are flaws to the pact and that it is not working, and in a dramatic attempt to address the growing "grey" market, has mandated a 20 percent cut in production over the coming weeks in an almost desperate bid to raise prices, especially in Japan and other non-U.S. markets. This plan, however, is restricted to 256K DRAMs at a time when many Japanese companies are of their own volition busily ramping down production here to emphasise production of the next generation 1Mbit DRAM.

At the same time, whilst the U.S. is attempting to shore up the pact with Japan, it is having to defend its actions against a formal complaint to GATT by the EEC that the pact is illegal.

Customer commitment fuels Norsk Data's success--In January, Norsk Data announced preliminary 1986 figures showing turnover up 37 percent to Nkr2.58 billion, and pre-tax profits up 29 percent at Nkr468 million. Of this, approximately 40 percent of its sales are from exports. Mr. Rolf Skar, President, and Chief Executive, puts this success story down to three strategies:

- build and design state-of-the-art products that are at least cost effective as its competitors;

- Successfully convert from a computer manufacturer to an end-user focussed organization;

- Integration of its equipment into its customer's businesses to provide them with systems tailored for their uniques applications.

Around 75 percent of the company's R&D resources are directed towards software and software development.

Norsk Data makes mini-computers, the most powerful of which is the recently announced ND-5000 series super mini-computer which makes extensive use of CMOS gate array technology. This enabled the company to double the machine performance from its predecessor whilst at the same time cutting the component count in half, a critical factor in reducing the cost of the system. Computing power that needed 21 boards in the preceding family of machines was reduced to three with performance increase to over 50 MIPs.

FEBRUARY INDUSTRY HIGHLIGHTS

Inmos wins $21 million IBM order, to supply an electronic palette IC known as a 'colour look-up table'. The chip makes it possible to paint any point on a computer screen in any of 296 shades and is a variation of Inmos transputer integrated circuit. It is believed that the ICs would be used in IBM's new personal computers which it intends to announce later this year. In addition, IBM is also believed to have placed an order worth up to $1.5 million through its Federal Systems Division for Inmos's SRAMs. These ICs are believed to be for use in a project connected with the U.S. space shuttle.

Olivetti and EDS in joint-venture, to enter the rapidly growing market for computer integrated systems for manufacturing companies. The venture presents an important move for Olivetti, traditionally weak in software, and for EDS, a General Motor subsidiary, which is keen to build up its presence outside the U.S. The new company will be called Integrated Systems Management and will be based in Milan, Italy. It will offer tailor made mainframe and mini-computer systems with compatible telecommunications links, primarily to manufacturing companies.

Philips and Sony consider mini compact disc project aimed at the traditional single record market. Worldwide sales of singles have been declining as music buyers have switched to tapes and LPs, though the singles market remains important as it it used to promote artists and LPs. The talks held recently between Philips and Sony center on technology standards as well as marketing aspects. Philips has proposed a three and half inch mini disc, which would play about twenty minutes of music, while Sony is believed to want a smaller size.

USM floatation for LSI Logics European subsidiary on the U.K. unlisted securities market. A provisional target for May has been set, subject to stock exchange clearance. The company plans to sell about 10 percent of the equity in the European operations, all in new shares. The floatation is partly to raise capital to help fund its expansion in Europe and also to help build up a separate identity in the European market.

CAP U.K. and Plessey form joint-venture in data communications aimed at exploiting the fast expanding World market for data communications networks. The two company's will each have a 50 percent share in the new venture which is targeting for business primarily in the U.K. and rest of Europe. The data communications systems industry has developed to help companies which need to transmit large amounts of information between offices in different locations, or between computerised workstations within a single building.

Amstrad lifts half-year profits by 159 percent to £71.3 million. Amstrads low-cost personal computer, launched in September, accounted for much of the 112% increase in sales which rose to a value of £273 million in the half-year. Amstrad is planning to launch different versions of its personal computer and word processors this year, as well as other audio and video products.

Tornado Aircraft Group seek Tokyo link covering an agreement with Japan for the exchange of military technology. Panavia aircraft, the three nation military aircraft consortium, sees such an agreement as essential if its attempts to sell its Tornado fighter bomber to Japan are to succeed. Only the U.S. has an agreement with Japan at the moment which places the U.S. in an extremely favourable position for the sale of military hardware to Japan.

Siemens wins U.S. telecommunications order for a large public telephone exchange from one of the seven regional telephone operating companies. The deal, with Ameritech of Chicago, is believed to be worth about $12 million. The contract provides Siemens with a strong lead in the struggle by foreign competitors to win part of the $4 billion a year American switching market. Siemens won the Ameritech contract in the face of threats by the U.S. government to prevent the company selling to the regional groups and follows a long campaign to become a supplier of telephone exchanges to the U.S.

Europe-wide scheme for managed data networks is being considered in all the main European countries. The plan would be to collaborate in providing international managed data networks for large companies. Managed data networks, which is the convergence between telecommunications and computing, are private lines used by large companies for data traffic. Whilst at the moment these are mainly used in-house, increasingly there is a trend for these to be utilised by companies to communicate with their customers and suppliers.

Zanussi back in profit following its takeover by Electrolux after five years of losses. The results in 1986 showed a net profit of more than Lira30 billion, compared with Lira32.4 billion loss in 1985, and Lira130 billion in 1984. Under the management of Mr. Rossignolo, the Zanussi chairman installed by Electrolux in 1984, the company has undergone a significant industrial and financial restructuring, including a reduction in workforce from 19,000 employees to 15,400 at present and a Lira340 billion capital investment in factory automation.

Japan ready to sell digital audio tape systems with Matsushita, Sony, and Aiwa set to launch machines early in March. Matsushita is the World's largest consumer electronics company operating under the National, Panasonic, and Technics brand names. In a parallel announcement, Matsushita also announced it would manufacture audio hi-fi tuners and video tape recorders in France. VTR production will start at Longway, Lorraine, in August. Production of hi-fi tuners has already started and will reach 54,000 units a year.

Sinclair returns to PC market following the launch of a low-cost portable machine aimed at business people and professionals. The Z88 computer weighs under two pounds and was designed by Cambridge Computers, a company established last year by Sir Clive Sinclair to develop personal computer ideas. The machines will be manufactured by Thorn EMI with production targetted at 10,000 units a month from April. Target price will be £200 and will be distributed initially by mail order. The machine features an 80 column by 8 line liquid crystal display, and a gate array VLSI circuit manufactured by NEC of Japan. The machine is not directly compatible with the IBM PC however.

Lucas in £52 million takeover bid for Western Gear, the aerospace subsidiary of Becor Western, a Wisconsin based engineering company. The acquisition is seen as part of Lucas' strategy of building up its aerospace and industrial divisions. Western Gear made pre-tax profits of $8 million on sales of $115 million in the nine months to the end of September 1986. Its products include actuation systems, auxilliary gearboxes, and helicopter transmissions. The acquisition, which is uncontested, is expected to be completed during April.

Dixons makes $384 million bid for Cyclops Corporation, Pittsburg, the U.S. home entertainment and appliance company. If the bid succeeds, Cyclops' steel making and other industrial interests will be sold to MSL Acquisition, an affiliate of Alleghany Corporation. The bid will leave Dixons with 19 large retail stores trading as Silo and 11 Busy Beaver do-it-yourself outlets for an estimated net cost of $311 million. Dixons presently controls around 20 percent of the U.K. electrical goods market and the acquisition would provide it with a significant share of the $40 billion a year U.S. market.

Ricoh to triple U.K. copier output at its Telford, Shropshire plant. The move is the latest in a series of decisions by Japanese companies affected by anti-dumping duties imposed by the EEC on exports from Japan into Europe. U.K. production is intended to be increased from 2,000 units a month to 6,000 units a month by Autumn, making the Telford plant Ricoh's largest outside Japan. Ricoh, which claims about 15 percent of the U.K. copier market, began making copiers at Telford in April last year. Recently the EEC announced that it was expecting to increase anti-dumping duties on Japanese copiers from 15.8 percent to 20 percent before the end of February.

Settlement for Texas Instruments has been reached in out-of-court agreements by three more Japanese IC manufacturers, Oki, Mitsubishi, and Matsushita, following similar settlements with Toshiba, Sharp, and Fujitsu. As a result of the settlements, the Japanese companies will make royalty payments to Texas Instruments over the next five years. As a result of the agreement, TI has now asked the ITC to withdraw the trade complaints against the six Japanese companies. The complaints against Hitachi and NEC of Japan and Samsung, Korea however remains intact.

Thomson to manufacture Whitechapel workstations in France in a bid to help Whitechapel achieve 5 percent of the French market. Thomson will be making Whitechapel's machines at Laval, North West France and is expected to make about £2.5 million worth of its products in the first year. Whitechapel and PCS Cadmus, a West German company, are the only European companies with a significant share of the European market, each holding about 2 percent. The market is mostly dominated by U.S. companies.

Philips expands Scottish plant in anticipation of the launch of its large digital PABX exchange in the U.K. market. The exchange, the Sopho-S2500, has just been approved by Oftel, the regulatory agency for the U.K. telecommunications industry. Philips has already substantial orders for the 2500 model and is targeting 20 percent of the U.K. market by 1989.

Fiat and Stet in alliance talks with U.K. for a link-up of their telecommunications activities. The Italians are anxious to achieve an alliance with Plessey and GEC to act as a market response to both last year's French acquisition of ITT's international operations, and to the international venture between Siemens, West Germany and GTE, France. The move is seen as a further consolidation of the fragmented European telecommunications industry.

British Aerospace set to receive £500 million government support towards its participation in the development of the new generation of airbus civil airliners, the A330 and A340. The package, to be spread over six years will be offered on condition that it is used only for this development program and will be repaid according to strict guidelines. The announcement follows the successful first flight of the Airbus A320 which has now achieved orders of more than 400 aircraft.

West German GDP forecast to fall in first quarter of 1986 by approximately 1 percent according to one of Germany's leading economic institutes. This will be the first fall since 1983. The institute reported industrial orders were lower and warned that more export hardship is on the horizon because of the continuing strength of the Deutschmark.

U.K. AWACs deal resists U.S. trade law and sets a precedent for future U.K.'s success in resisting attempts by the U.S. to apply its trade laws abroad. The agreement, signed late in February for the purchase of six AWACs from Boeing, is quoted to be free from any acceptance by the U.K. government that trade laws can be applied to encroach on U.K. sovereignty. In a separate agreement, Boeing has undertaken to the U.K. government to provide British industry with offset work equivalent to the value of 130 percent of the value of the AWAC's purchase order over the next eight years.

AT&T links with SAT, (Society Anonyme de Telecommunications), a French manufacturer of telecommunications transmission equipment, as a way to increase its chances of gaining control of CGCT, the state public telephone equipment manufacturer due to be privatised shortly. AT&T and its European telecommunications partner Philips, have been trying for the past eighteen months to gain control of CGCT which would give the AT&T/Philips joint-venture a 16 percent share of the French public switch market. The French government has set a price of FFr500 billion for the sale of CGCT as part of its privatisation programme. In addition to AT&T/Philips, Siemens, West Germany and Ericsson, Sweden are both intensely interested in forming an alliance with CGCT.

Brother plans Japanese microwave oven plant at Wrexham, North Wales, to produce 200,000 microwave ovens annually starting at the end of 1987. The company joins a growing band of Japanese companies establishing local manufacturing bases to compete in the rapidly expanding U.K. and European markets for microwave ovens. Brother began manufacturing electronic typewriters at the plant two years ago. Three other Japanese electronics groups with manufacturing operations in Wales, Sharp, Matsushita, and Hitachi have already announced plans for diversifying into microwave ovens.

Matsushita reports first decline in 11 years with consolidated net profits down by 34 percent to Y164 billion on a turnover of Y4,575 billion, down 9.5 percent on the previous year. The company result was severely effected by the rise in the Yen value against the dollar and slow economic growth in Japan. Video cassette recorders, the company's main product line, increased in sales volume but generated lower revenue because of a shift in mix towards lower priced models and the fall in export earnings.

Toshiba seeks bigger European market share following the recent announcement of increasing production of 1 megabit DRAM ICs at its Braunschweig, near Hannover, plant. Toshiba's market ranking in Europe is only 15th compared with its worldwide market rank of third place behind NEC and Hitachi. Toshiba's target is to move into the top five companies in Europe within the next five years. In parallel with its DRAM thrust, Toshiba is also pushing hard at the ASIC market. It has already three design offices located in Dusseldorf, Germany, Stockholm, Sweden, and in the U.K., with a fourth being added at Braunschweig shortly.

Paribas makes successful debut on the French stock exchange with shares trading at a premium of 18.5 percent on the offer price of FFr405. Demand for Paribas shares is expected to remain strong since French institutions were almost totally excluded from the 38 times over-subscribed share offering. In the wake of the successful privatisation of Paribas, France is now planning to accelerate the sale of state-owned companies. Already earmarked for sale are the television station group TF1, the electrical group CGE, the Harvas advertising agency, the bank CCF, and some smaller groups. The French privatisation programme began at the end of 1986 with the successful floatation of St Gobain, the glass and packaging group.

EUROPEAN SEMICONDUCTOR DIVISION ACTIVITY REPORT

Planning for our June conference is now nearing completion. The venue is in the Palace Hotel, Madrid, Spain, on June 3-5. Our theme this year is "Integrate for the VLSI Era", the title being chosen to reflect the structural changes taking place within the industry at company, regional, and device levels. The list of speakers confirmed and an outline of the topics to be discussed is detailed in the Datagram which we have included with this mailing. On the conference front, Dataquest staff were active during the last month delivering keynote addresses at Semicon Europa, Zurich and the Scottish Development Agencies ASIC Seminar in Glasgow.

Our revision of the European semiconductor market estimates is underway. The task involves the updating of our market estimates by technology, function, and end-use for all regions. This in total comprises 260 pages of information encompassing over 180 tables. Publication is scheduled for April.

Planned for March publication are updates of Proposed Plant Investments, (Volume II Section 6.1.1). A complete revision of the section on the European Economy featuring information on Government initiatives, RACE, ESPRIT, (Volume II, Section 1.4); R&D Investment tabling the estimated worldwide semiconductor related RT&D expenditures of European companies, (Volume II, Section 6.2) and a complete Economic Overview of West Germany, (Volume I, Section 6.1).

THOUGHT FOR THE MONTH

In 1986, semiconductor consumption in the rest of world region grew a staggering 52 percent--whilst the other regional markets either barely grew or even contracted. In 1987, we project a further year of well above average growth, whilst the other regions look set to turn in only a modest upswing. Why is this so?

To understand this, one has to look at the underlying trend in electronics production in the Far East, and nowhere is this more pronounced than in Singapore. Statistics recently released by the Singapore Department of Statistics show Singapore's Electronics Production index is up 55 percent on 1983, the majority of which was achieved in 1986. Production, which rose substantially in 1984, plunged back to near 1983 levels in 1985 primarily as a result of a sharp rise in local labour costs earlier in the 1980s.

Now electronics is leading the economy out of a deep recession that still plagues many other sectors. Singapore's electronics industry is dominated by foreign companies producing for export. Virtually all the major companies have factories there, including Matsushita, Hitachi, Siemens, SGS, Philips, Nixdorf, AT&T and General Electric. Unlike other countries in the Far East region, Singapore does not have rules that limit foreign equity ownership or mandate technology transfer. In addition, capital can be quickly moved both in and out. Since Singapore is a tiny country, multinational companies are not viewed as a threat to its national development. In essence, Singapore has accepted that no domestic company could ever become large enough to compete seriously against such industrial and technological giants. As such, there is no government or company led pressure to errect barriers to limit such operations.

In this regard, Singapore is something of a haven for Japan's (increasingly) hard pressed electronics giants, all of whom are under extreme pressure to move manufacturing offshore in an effort to cut costs and increase profits.

For example, Aiwa, in an effort to escape the effects of the Yen's appreciation, is closing down its main Japanese factory, shutting down production lines one at a time, dismantling them, and re-assembling them in Singapore just six weeks later.

Singapore also has become the World's largest manufacturer of disk drives with Seagate Technology having three factories there that employ about 6,000 workers and produce 11,000 disk drives a day.

This trend, which has already impacted Europe's manufacturing industry since the 1970's, has increasingly been affecting the U.S. manufacturing base since the early 1980's, and is now impacting Japan. The reality is that this manufacturing capacity is unlikely ever to return back to the home base and the impact on the semiconductor regional TAM will be both profound and far reaching. Semiconductor companies that fail to take advantage of this TAM explosion in the Far East will confine themselves to the slower growing ranks emphasising yet again the importance of being international.

Malcolm Penn

DATAQUEST 6TH ANNUAL EUROPEAN SEMICONDUCTOR INDUSTRY CONFERENCE

June 3-5, 1987, Palace Hotel, Madrid, Spain

conference theme

"INTEGRATE FOR THE VLSI ERA"

speakers will include:

Alex Au - President & CEO
Vitelic Corporation

Andre Borrel- Corp V P
Semiconductor Group
Motorola Incorporated

Ulrich Byszio - Managing Director
Enatecknik GmbH

Doug Dunn - Managing Director
Plessey Semiconductors Limited

Bernard Hadley - Managing Director
Stack GmbH

Otto Holzinger - Director
Advanced Automotive Engineering
Robert Bosch GmbH

Kenzo Nakamura - Snr Executive V P
Semiconductor Group
NEC Corporation

Robert Sandfort - Vice President
Monsanto Electronic Materials Company

Graham Shenton - Managing Director
IMP Europe Limited

Robert Van Meurs - General Manager
Hi fi Compact Disc Group
Philips International BV

Topic Highlights

- Europe--Structured for Opportunity and Integration
- European Distribution Channels in the VLSI Era
- Partnering and Alliances--The Ultimate Synergy
- Integrating Manufacturing into the Marketplace
- VLSI Applications in the Automotive Environment
- Application Specific Memories--Tomorrow's Standard
- Structuring Silicon for the VLSI Era
- VLSI Inventory Management in the 1990's
- Quality--The Progress Towards Zero Defects

For further information please contact:

Lyn Cooke
Dataquest UK Ltd
13th Floor
103 New Oxford Street
London WC1A 1DD

Tel: 01-379-6257
Tx: 266195
Fax: 01-240-3653

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EUROPEAN SEMICONDUCTOR DIVISION

FEBRUARY MONTHLY REPORT

STATE OF THE INDUSTRY

In the past two months some signs of marginal improvement in terms of unit volumes booked have emerged. Vendors report increased distribution activity as inventories begin to move. Pricing remains flat and stable although some product families e.g. memories are being affected by external issues sucn as the U.S./Japan trade agreement. This modest improve in the business climate is being experienced across all sectors of the industry except personal computers. Pricing however continues to come under intense pressure pushing down the value of the units shipped.

In the drive for cost savings, reductions in inventories in both OEM's and distribution continues to be the major area of focus. Traditionally inventory reduction had been confined to the domain of component stocks, but during the past two years manufacturers have turned their attention to each of the individual stages of production in their efforts to reduce costs still further.

DATAQUEST is currently in the process of a cross-industry validation of the respective market segments in order to produce an industry update newsletter in the coming month.

One area of concern is the continued appreciation of European currencies against the U.S. dollar. The Deutchmark in particular has moved from DM2.44 per annum a year ago to 1.86, a change of 23.8 percent. The nett effect is that exports from West Germany have become increasingly uncompetitive which is now beginning to impact the growth of the industrial base in West Germany. Similarly the same situation is occurring in the major exporting countries across the whole of Europe. All this throws a cloud of uncertainty over the outlook for the second half of 1987.

IN THIS ISSUE

144/146 New Bond Street / London W1Y 9FD England / (01) 409-1427 / Telex 266195

1290 Ridder Park Drive / San Jose, CA 95131 / (408) 971-9000 / Telex 171973

OTHER INDUSTRY COMMENTS

More disputes looming on trade--with Japan, EEC and the United States all increasing the tempo of the present disputes as well as threatening further retaliatory actions.

The U.S./Japan trade accord again bore the brunt of the criticism, accusation, and counter accusation with continued evidence presented by the United States citing Japanese "violations" of the IC pact. In addition the United States Defence Department took its own initiative calling for a "defence semiconductor initiative" aimed at re-establishing the United States World leadership in semiconductor manufacturing technology and ensuring the supply of advanced semiconductor ICs for the United States military contractors.

In a parallel dispute, the EEC is threatening to apply anti-dumping rules to the so-called Japanese "screwdriver" assembly operations in Europe which rely heavily on cheap imported components, especially from Japan. This proposal is already causing Japanese exporters much concern. If implemented, it would force an increase in the local content of products manufactured in Europe by Japanese companies.

The threat provoked an unprecedented move by Japan's powerful Keidenren, the confederation of business organizations, to send a formal letter of protest to the heads of state and top officials of all EEC countries warning that such a move would give rise to "serious concern" over the future of the industrial co-operation between Japan and the member states.

In addition, the EEC is considering launching an anti-dumping investigation against imported Japanese electronic printers. This move follows the recent two month extension of provisional anti-dumping duties on imported Japanese photocopiers for four months last August.

JCB, U.K., Computer Integrated Manufacturing (CIM) program--yields substantial dividends at JCB Transmissions which now claims to be operating successfully the largest CIM system of its type in Europe. The system, which cost £3.5 million to install, has allowed JCB to increase output by the equivalent of 50 percent and significantly reduce manufacturing costs.

The plant produces axles for all types of JCB backhoe loaders, wheeled loaders, and crawler excavators together with gearboxes for some backhoes and telescopic handlers. The medium size plant employs around 190 staff, produced 20,000 finished components in 1986 for a turnover of £22 million and a 26 percent return on capital. Key to the CIM strategy was the decision to use the smallest possible number of suppliers. Schermann, West Germany, supplied 10 machining centres, each with an automatic 80-tool magazine; BT Rolatruc, Sweden, provided 12 automatic guided vehicles, and the mainframe and other computers on the system were supplied by DEC.

The distributed computer system is linked to a central computer that supervises the flexible manufacturing system which is run on a week-to-week program fed in by the factory's materials manager.

JANUARY INDUSTRY HIGHLIGHTS

AT&T and Philips win US$200 million phone order in Indonesia, one of the World's largest telecommunications markets. The award is viewed as a blow to Alcatel, the European industry's new flagship company launched early this year following the merger of CGE of France and ITT of the United States. The U.S.-Dutch joint venture, ATP, will supply 100,000 digital lines in Jakarta, the capital, and Surabay, Indonesia's second city and main industrial centre.

Database will aid European access to U.S. innovations and help U.S. entrepreneurs gain access to the European market. The new venture, Techstart International, is to comprise of a list of hundreds of innovative U.S. companies published and distributed free of charge on a quarterly basis. Techstart plans to charge each company a fee, most probably $250 per product listed, to be included in the database.

Strong Yen hits Japan's electronics industry providing one of the bleakest outlooks in more than a decade. For the first time in recent history, Japan's output shrank in 1986 to Y17,896 billion, nearly all of the ground being lost in consumer products, down 8.7 percent, mainly due to weaker exports. At the same time, there is an increasing trend in the industry to move to offshore production sites where labour costs are lower.

Matsushita plans joint venture in West Germany with Quick-Rotan, a sewing machine motor manufacturing in Darmstadt. The new company, based in Rotenburg, Hessen, will make motors for Matsushita's office equipment plants in the United Kingdom and West Germany, both of which are due to start production in 1987.

Ericsson wins $84 million Thai order for the expansion of its existing telephone network. Ericsson has already supplied its AXE exchanges for the Thai network, and though this current order covers the design and construction of local networks in north-east Thailand and Bangkok and consists mostly of laying cables, it is expected to yield further hardware orders for its AXE exchanges in the near future.

Ericsson and Siemens plan mobile phone link-up to co-operate in the research and development of a new mobile telephone system. The companies hope to introduce the new "D-Net" system in Northern Europe by the 1990/1991 timeframe.

High-technology controls have corroded U.S. links with allies according to the draft of a report issued by the National Academy of Science during January. The report claims that U.S. policy is now "over-correcting" previous weak controls and recommends that instead of unilateral U.S. controls, the Co-ordinating Committee on Multilateral Export Controls (Cocom) finds a common approach to the re-export of items originating in Cocom nations.

ICL and Geisco plan joint venture in the fast growing market for the electronic interchange of business information. The new company, to be called International Network Services (INS) will be 60 percent owned by ICL and 40 percent by Geisco and will benefit from more than 450 existing customers of ICL and Geisco.

Plessey wins DHSS digital telephone order to set up one of the United Kingdom's largest digital telephone networks. The £3 million order entails the supply of 57 exchanges of between 40 and 400 lines throughout the U.K.

U.K. wins Nato satellite order worth £90 million to build two advanced military communications satellites. The order, placed with Marconi and British Aerospace, was won in the face of the stiff competition from General Electric of the United States.

Toshiba to build 1 Mbit DRAMs in West Germany, as part of its pre-emptive drive into Europe with its one megabit product line. Its decision follows a move by NEC, the World's largest semiconductor producer, to expand its assembly operation in Scotland into a full-scale fabrication unit. Production is due to start this month and output is expected to reach 100,000 ICs per month when fully on stream.

Unisys picks Livingston, Scotland, for European repair centre as part of its reorganization following the merger of Sperry-Univac and Burroughs. Sperry had an existing repair and refurbishment plant at Livingston and activity there is expected to double following this move.

Olivetti in copier link with Canon to form a joint venture near Turin to make copiers, laser printers, facsimile transmitters, and other office equipment. This is Canon's first joint manufacturing venture in Europe and the first Japanese joint venture in Italy in electronics. It will be equally owned by Olivetti and Canon and will operate out of Olivetti's Aglie reprographics factory. Olivetti is transferring its copier research and production into the venture and Canon will invest about L10 billion over the next three years as well as transferring its laser printing and other electronic publishing systems technology.

Siemens in $165 million U.S. deal to take full control of the main operations of Telecom Plus International, a Florida communications group. Siemens has agreed to lift to 100 percent its present 35 percent stake in Tel Plus Communications, the main operating subsidiary of the Boca Raton-based Telecom Plus company. Siemens is also taking over three smaller subsidiaries of Telecom Plus.

Airbus expects initial order for A-340 from Lufthansa for 15 aircraft and an option to take a further 15 of the four-engine airliner. Air France is expected to follow with an order for seven aircraft over the next decade. The prospective order follows the $2 billion deal for 50 A-320 aircraft with Guiness Peat Aviation (GPA), the Shannon-based aircraft financing organization. This brings the total orders and options for the yet to fly A-320 to 437.

Europe's brown and white goods companies plan intelligent home under a new joint development agreement recently announced. If successful, a householder would be able to control and monitor kitchen appliances, burglar alarms, central heating, and lighting in any part of the home from an armchair in front of the television set. Thorn EMI, GEC, and Mullard, U.K.; Philips, Netherlands; Electrolux, Sweden; Siemens, West Germany, and Thomson, France are to spend £12 million to make appropriate communications systems fully compatible. The project is expected to take about two years with early systems on the market six months later.

Kohl coalition retains power in Bonn but with a reduced majority. As such, West Germany is set for four more years of centre right coalition government lead by Mr Kohl's Christian Democratic Union (CDU).

Japanese benefit most as car sales in Western Europe rise 9 percent with Japan's share increasing 19 percent to 1.36 billion cars, an 11.7 percent market share. Volkswagen of West Germany, with its subsidiaries Audi and Seat, retained the leadership position with 14.7 percent market share.

British Telecom's (BT) monopoly on installation approval to be suspended with full anticipation that the suspension be made permanent before too long. At present, private contractors can install equipment on business premises but BT has to inspect the equipment to certify it has been correctly linked to its network.

South Korea to liberalize imports and cut tariffs in an effort to reduce its trade surplus expected to reach $10 billion in 1987, partly because of South Korea's currency advantage over Japan's appreciating Yen. Much of the revised policies are aimed at reducing its $7 billion trade deficit with the U.S. and in an effort to head off protectionist sentiment, South Korea plans to liberalize import rules for personal computers and large passenger cars in the second half of 1987 as well as a series of other immediate measures designed to help the situation.

NEC raises Scottish output for Europe aimed at the fast growing market for telecommunications ICs, especially for such products including sophisticated telephone sets, private branch exchanges, mobile telephones, and devices for recording and storing messages.

Matra set for stake in GCA, the troubled U.S. manufacturer of semiconductor production equipment. GCA is currently engaged in a $54 million restructuring program which will bring in Sumitomo of Japan. GCA already has a joint venture with Matra in France, Matra-GCA, and as part of the restructuring of the group, Matra is expected to trade its 50 percent stake in the joint venture for a direct holding in GCA.

Siemens's earnings dip to DM1.47 billion for the year ending September 1986, down from DM1.53 billion the previous year. At the same time, Siemens also announced it was buying the outstanding 25 percent of the loss-making Transformatoren Union (TU) from AEG, now part of Daimler-Benz, to give it full ownership of the electrical components company.

Quality still sells as West German exports suffer currency setback following the relentless strength of the D-Mark. After impressive growth rates in recent years, leading export industries are now experiencing stagnation or steep declines in export markets. Quality, however, still sells and has provided a cushion from the worst effects of the currency especially in cars, but even so, earnings are bound to suffer from the bleaker export outlook.

Digital tape (DAT) close to launch in spite of objections from the international music industry. The system allows high quality copying from compact discs. Aiwa is planning to launch its DAT machines in Japan by March, in time for the traditional spring consumer spree with Toshiba expected to follow shortly thereafter in May. Other companies are expected to announce their plans over the next few weeks.

Philips starts Japanese joint venture to promote interactive CD (CD-I) together with Toppan Printing Company, Japan's biggest printing firm. The new joint venture will be called Denshi Media Services Co., a Tokyo-based company that will help Far Eastern companies develop products for use with CD-I players. Denshi will aid publishers, software firms, and others to design, program, and pre master programs for the 650-Mbyte discs.

EUROPEAN SEMICONDUCTOR DIVISION ACTIVITY REPORT

In the month of January the following documents were published or entered the publication cycle:-

Newsletters:

- Preliminary European Market Share Estimates
- European Communications Equipment--Semiconductor Market Analysis
- December News Digest
- January News Digest

Company Profiles:

- General Instrument
- Inmos
- Motorola
- Rifa

Service Sections:

- Introduction to Service--Volumes I, II and III
- Revised Table of Contents

A fifth binder was added dedicated for the News Digest both to facilitate filing of the digest and make room in Volume IV for the growing number of newsletters being published. Included with this new binder were new covers and spines for the existing binders giving them a new more aesthetic look.

Planned for publication in February:-

Newsletters:

- European Distribution Trends--'86/'87
- EEC Funding--Will it be Feast or Famine
- Thomson Semiconducteurs "Halfway to the Objective"

Company Profiles:

- ASEA
- Eurosil
- Ferranti
- Harris
- Hewlett Packard
- Matra-Harris
- Telefunken

During the month an ASIC questionnaire was submitted to all major players in Europe to expand still further our growing database in this area. The results will be published in a forthcoming service section and newsletter.

Our Quarterly Industry Forecast was re-addressed and validated and is the subject of a newsletter currently in preparation. The end user markets continued to receive our focus to eventually provide a further dimension to our market analysis.

Our annual conference planning is now well underway with the final touches being put to the program--you can expect to hear full details in next month's Monthly Report.

THOUGHT FOR THE MONTH

As we enter 1987, prospects in the semiconductor industry have never looked bleaker. In the short term, the deep recession that started in the fall of 1984 is only slowly emerging into a modest growth phase, and in the longer term, the substantial restructuring currently underway of the industry Worldwide will cause tremendous repercussions for the World players over the next decade or so.

The U.S. has had to face up to the humiliating fact that it is no longer the centre of the technological leadership in all areas of either semiconductor production or even production equipment manufacturing. And in addition, the loss of some of its key end equipment manufacturing industries to offshore locations (at best) or foreign competitors (at worst) is having a devastating effect not only on the U.S. balance of payments, its employment and GDP, but also on the ability of those industries to provide the necessary market pull to nourish the semiconductor industry.

Ironically, this same scenario is almost an exact re-run of what happened in Europe in the 1970's, and as Europe's end equipment and component companies are presently discovering, the reversal of this trend is a slow and painful process.

And Japan, the present winner today, has its troubles too, primarily as a result of its very success, especially in the form of a high yen value, increased protectionism from the U.S. and Europe, and increased competition from the so-called "five tigers". Already, to cut costs and help maintain battered profit margins, Japanese manufacturers are moving offshore, with the consequent negative effect this is already starting to have on Japan's GDP, employment, and balance of payments. A familiar story?

There are many industrial parallels to look back to in an attempt to predict the likely outcome, though I'm not sure how valid some of these parallels will be in today's environment of increased international trade and technological advancement.

Perhaps of biggest concern though is the increasing intervention of governments in the arena, (a) because it dramatically illustrates the level of seriousness of the problems and (b) because their very involvement is more likely to drive the industries into global recession through excessive legislation and/or the cumbersome nature of the legislative and fiscal procedures. As a very small but vivid example, the present U.S./Japan memory trade agreement, with its built in quarterly price reviews, is doing little to encourage a return to stability of procurement in the purchasing environment, in fact the opposite is more true. Buyers, aware of price reductions around the corner, are merely placing short term orders to meet immediate needs.

It is increasingly clear that we are currently embroiled in World war E, E for economy. At the moment, thankfully, the actions are limited to a few skirmishes on specific issues and a lot of sabre rattling. The thought of this escalating to an all-out confrontation is frightening and would result in consequences at least as devastating as the previous World wars, probably more so as there would doubtless not be a winner at all. Only once this fact is fully appreciated can real progress be made for economic harmony and free trade, for the benefit of all and not to the detriment of another.

Malcolm Penn

FUTURE EVENTS DIARY

SEMICONDUCTOR CONFERENCES

o APRIL 13-16, Japanese Semiconductor Industry Conference
Miyako Hotel, Kyoto, Japan
"VLSI Impact on Future Society"

o MAY 6-8, European Telecommunications Industry Conference
Beach Plaza Hotel, Monte Carlo, Monaco
"New Frontiers for Merging Voice and Data"

o JUNE 3-5, European Semiconductor Industry Conference
Palace Hotel, Madrid, Spain
"Integrate for the VLSI Era"

SPECIAL REPORTS

o 1985 News Digest--available now
o Korean Semiconductor Industry Report--available now
o IC Update '87--available now
o GaAs Market Update--available now
o IC Start ups--available now
o DSP Market Update--second quarter 1987
o Taiwan Semiconductor Industry Report--available first quarter 1987
o Hong Kong Semicounductor Industry Report--available first quarter 1987
o China Semiconductor Industry Report--available first quarter 1987
o 1986 News Digest--available first quarter 1987

NEWSLETTER SUBSCRIPTIONS

o IC ASIA
o IC U.S.A (available in English and Japanese)
o European Monthly Report

ON-LINE SERVICES

o Semiconductor Group Database: History, Forecast, Market Share and Geograhic Data
o SIA Database: Bluebook, Flash Report, Forecast
o DQ Monday: available first quarter 1987

For further information on the above items, please call your local DATAQUEST office.

Dataquest

a company of The Dun & Bradstreet Corporation

1290 Ridder Park Drive
San Jose, California 95131-2398
(408) 971-9000
Telex: 171973
Fax: (408) 971-9003

Dataquest International Offices:

Dataquest GmbH
Rosenkavalierplatz 17
D-8000 Munich 81
West Germany
Phone: (089)91 10 64
Telex: 5218070
Fax: (089)91 21 89

Dataquest Japan Limited
Taiyo Ginza Building/2nd Floor
7-14-16 Ginza, Chuo-ku
Tokyo 104 Japan
Phone: (03)546-3191
Telex: J32768
Fax: (03)546-3198

Dataquest UK Limited
13th Floor, Centrepoint
103 New Oxford Street
London WC1A 1DD
England
Phone: (01)379-6257
Telex: 266195
Fax: (01)240-3653

Dataquest SARL
100, avenue Charles de Gaulle
92200 Neuilly-sur-Seine
France
Phone: (01)47.38.13.12
Telex: 611982
Fax: (01)47.38.11.23

Dataquest Taiwan
Rm. 801, 8th Fl., Ever Spring Bldg.
147, Sec. 2, Chien Kuo N. Road
Taipei, Taiwan, R. O. C. 104
P. O. Box 52-25, Tienmou 111
Phone: (02)501-7960/501-5592
Telex: 27459
Fax: (02)505-4265

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EUROPEAN MONTHLY REPORT

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EUROPEAN SEMICONDUCTOR DIVISION

JANUARY MONTHLY REPORT

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DATAQUEST UK LIMITED HAS MOVED OFFICES

OUR NEW ADDRESS IS:

13TH FLOOR, CENTREPOINT,
103 NEW OXFORD STREET, LONDON WC1A 1DD
TELEPHONE: (01)-379-6257 FAX: (01) 240-3653 TELEX: 266195

STATE OF THE INDUSTRY

Preliminary estimates of the World semiconductor market indicate a 26 percent increase in revenue when measured in U.S. dollars. By this measure, Japanese producers fared well achieving a 43 percent growth in worldwide shipments with European producers achieving the next best growth at 16 percent. United States manufacturers fared worst of all achieving only a 10 percent growth.

In total semiconductor revenues, NEC maintained its first place ranking with Hitachi and Toshiba in second and third place respectively, pushing Motorola and Texas Instruments into fourth and fifth place. Toshiba showed an above average growth even when currency effects are taken into account and by year end, on a month by month basis, may have overtaken Hitachi in second position. Much of this growth can be attributed to their success of the 1MBit DRAM.

IN THIS ISSUE

Of the European manufacturers, Philip-Signetics recorded a 27 percent revenue growth maintaining its sixth place world ranking, with Thomson (growth rate 35 percent) and SGS (growth rate 23 percent) at 17th and 21st rank respectively. Noteworthingly, in 1986 Thomson overtook Siemens to become Europe's second largest Worldwide semiconductor manufacturer. Table 1 shows the preliminary 1986 world semiconductor marketshare rankings.

Table 1

PRELIMINARY 1986 WORLD SEMICONDUCTOR MARKET SHARE RANKING
(Millions of Dollars)

1986 Rank	1985 Rank	Company	1985	1986	Percent Change
1	1	NEC	1,984	2,638	33.0%
2	4	Hitachi	1,671	2,305	37.9%
3	5	Toshiba	1,468	2,261	54.0%
4	2	Motorola	1,830	2,025	10.7%
5	3	Texas Instruments	1,742	1,820	4.5%
6	6	Philips-Signetics	1,068	1,356	27.0%
7	7	Fujitsu	1,020	1,310	28.4%
8	10	Matsushita	906	1,233	36.1%
9	11	Mitsubishi	642	1,177	83.3%
10	8	Intel	1,020	991	(2.8%)
11	9	National Semiconductor	925	990	7.0%
12	12	Advanced Micro Devices	615	629	2.3%
13	14	Sanyo	457	585	28.0%
14	13	Fairchild	492	510	3.7%
15	22	Sony	252	475	88.5%
16	16	Sharp	329	456	38.6%
17	17	Thomson	324	436	34.6%
18	15	Siemens	420	429	2.1%
19	19	Oki	307	427	39.1%
20	23	Rohm	249	379	52.2%
21	20	SGS Semiconductors	300	370	23.3%
22	18	RCA	310	370	19.4%
23	21	ITT	270	312	15.6%
24	24	Harris	247	264	6.9%
25	25	Analog Devices	226	232	2.7%

Source: Dataquest
January 1987

A number of smaller companies showed growth rates above the industry average, including Eurosil, LSI Logic, Semikron, Telefunken Electronic, and VLSI Technology. DATAQUEST believes these firms have successfully exploited market niches in this difficult year.

Looking now to the European semiconductor market shares, Philips-Signetics dramatically maintained its number one position increasing its lead over Texas Instruments by $186 million. The top five rankings for 1986 remain unchanged from 1985 with SGS Semiconductors moving up two positions to sixth place and ITT up one place to ninth rank. Toshiba recorded a record breaking growth of 53 percent increasing its European rank from 16th place to 14th.

Table 2 shows the preliminary European semiconductor marketshare rankings.

Table 2

ESTIMATED 1986 VERSUS 1985 EUROPEAN SEMICONDUCTOR REVENUES OF 25 LEADING SUPPLIERS
(Millions of U.S. Dollars)

1986 Rank	1985 Rank	Company	1985	1986	Annual Growth
1	1	Philips-Signetics	$596	$802	34.6%
2	2	Texas Instruments	$468	$488	4.3%
3	3	Motorola	$389	$425	9.30%
4	4	Siemens	$270	$357	32.2%
5	5	Thomson	$240	$302	25.8%
6	8	SGS Semiconductors	$201	$244	21.4%
7	8	National Semiconductor	$218	$236	8.3%
8	9	ITT	$185	$215	16.2%
9	7	Intel	$212	$214	1.0%
10	10	NEC	$174	$198	13.8%
11	10	Advanced Micro Devices	$174	$172	(1.2%)
12	13	Telefunken Electronic	$133	$164	23.3%
13	12	Hitachi	$169	$160	(5.3%)
14	16	Toshiba	$ 72	$110	52.8%
15	14	Fairchild	$105	$102	(2.9%
16	15	RCA	$ 80	$ 85	6.3%
17	17	Plessey	$ 66	$ 78	18.2%
18	19	Fujitsu	$ 64	$ 70	9.4%
19	18	Ferranti	$ 65	$ 66	1.5%
20	20	Analog Devices	$ 51	$ 65	27.5%
21	21	Monolithic Memories	$ 42	$ 48	14.3%
22	22	Hewlett-Packard	$ 39	$ 46	18.0%
23	25	Semikron	$ 30	$ 43	43.3%
24	23	Matra-Harris	$ 36	$ 40	11.1%
25	24	Harris	$ 31	$ 38	22.6%

Source: Dataquest
January 1987

DATAQUEST's preliminary Market Share Service Section is currently being completed and will be available to all client binder holders shortly.

OTHER INDUSTRY COMMENTS

Thomson to join SGS in FFrl.5 billion IC project--in a bid to develop a new generation 4Mbit EPROM. The proposed Thomson-SGS venture highlights Europe's efforts to establish an improved position in the world semiconductor market dominated by U.S. and Japanese companies. The four year project is one of eight European high technology projects under the French inspired Eureka program for European high technology.

This program complements the existing collaboration between Philips and Siemens in the development and production of megabit DRAMs and SRAMs. By collaborating on such a venture, DATAQUEST believes the two compannies will be able to leverage their research and development resources very effectively to their mutual benefit.

Reports in the press also indicate the possibility of further technological co-operation and even a merger of their semiconductor businesses with the view to creating an alliance to enable the companies to compete more effectively in the World semiconductor market. Collectively Thomson (number 17 worldwide) and SGS (number 21 worldwide) would rank number 11 worldwide just behind National Semiconductor and ahead of AMD, and with a product range that is remarkably complementary.

Given the fact that both companies are state-owned, such an outcome could be difficult to achieve. However, given the increasingly competitive nature of the semiconductor industry and the parallel trend for a shake-out amongst the manufacturers worldwide, DATAQUEST believes such a possibility to be an extremely appealing option. Individually, each company faces a tough challenge ahead--collectively their combined strength would be awesome.

U.S. may fund plans to boost IC manufacturers--following a task force recommendation to set up a $1.6 billion fund to combat the growing U.S. military dependence on foreign semiconductor supplies. The purpose of the fund would be to restore the international competitiveness of the U.S. semiconductor industry over five years. As such, the struggle between the U.S. and Japan for leadership of the World semiconductor market is quickly moving beyond a trade dispute into a national economic and defence issue.

Two issues are elevating the debate over the future of the U.S. IC industry to a higher level. Firstly, semiconductors are the basic building blocks for all electronic goods--without a semiconductor industry to provide a base for all U.S. high technology endeavours, downstream effects will be pervasive and the future economic strength threatened.

And secondly, advanced semiconductors are essential to the technological superiority that is central to U.S. defence policy. Apart from the concern of increasing dependance of U.S. military contractors on foreign IC supplies, without a strong and competitive commercial semiconductor industry, you will not have the military supply capability needed.

Japan pledges $9 billion aid scheme--to help direct some of its vast current account surpluses towards the economies of developing countries. In addition, an approximate $1.8 billion low interest loan fund will be set up over three years at the World Bank. The idea here is to enable the bank to increase its lending to the potentially strong developing countries in the hope of stimulating their economies.

Japan has been under increasing pressure from the developing countries to use its surpluses to help their economies and whilst the moves were welcomed, they did not manage to silence critics. Foreign governments are particularly irritated by the large proportion of Japanese aid spending which is tied with the recipient obliged to use it to buy only Japanese goods and services.

DECEMBER INDUSTRY HIGHLIGHTS

A.P., U.K., unveils plan for electronic braking system with the production start in January of an electronic anti-skid braking system costing under £150 initially, falling to £80 at maximum volumes. The system has been secretly in development over the past three years and is set for an initial production rate of 600 units per day at the Company's Leamington Spa factory. The system, called AP Lockhead Antilok, uses wheel-rotation sensors and electronic control of sensors to adjust braking pressure and prevent skidding under emergency braking. It appears set to rival both the low cost hydraulic and mechanical system launched earlier in 1986 by Lucas Girling, U.K., and Ford as well as electronic systems produced by West German companies Robert Bosch and Alfred Teves.

U.K. Satellite TV franchise goes to Granada consortium, British Satellite Broadcasting (BSB), comprising Granada, Virgin, Pearson (owner of the Financial Times), Anglia Television, and Amstrad Consumer Electronics. So far £80 million has already been committed to the project and a further £120 million underwritten by the founding shareholders. BSB is looking for other potential investors to fund the balance of the project and hopes to launch its service in 1990 under a 15-year franchise. Government subsidised French and West German DBS satellites are already built and are waiting for flights of the European space rocket Ariane to resume. Both are expected to be launched during 1987.

Unisys to shut down Cumbernauld, U.K., plant following the merger and consolidation of Burrough's and Sperry's computer businesses. Since the shutdown at the former Burroughs plant last February, only an engineering and distribution function has remained. The closure will leave Unisys with one large production facility in Scotland in the nearby town of Livingston making document processing equipment for financial institutions. The Cumbernault plant used to make small minicomputers.

Volkswagen looks for maintained profits in 1986 compared with 1985 despite a 13 percent fall in the third quarter results. Profits in the fourth quarter rebounded to first half-year levels with some subsidiaries turning in higher profits than in preceeding months. Increasing unit sales and resulting high capacity utilization enabled the group to limit the effects of the adverse factors which had depressed third quarter earnings. Total Worldwide sales, excluding Seat, will be 2.5 million units compared with 2.4 million in 1985.

Volvo to dominate track venture with GM with an initial 76 percent stake in the U.S. heavy truck venture. The agreement, concluded in mid-December, effectively marks the withdrawal of General Motors from direct involvement in the heavy truck sector. It will also boost Volvo's position which is already third behind Daimler-Benz and Renault-Mack.

Schlumberger in $1.7 billion write-off attributed to its oilfield services division and provision against potential interest to be paid to the U.S. tax authorities in a long-standing dispute over Schlumberger's tax liability for earnings from operations on the outer-continental shelf of the U.S. The company has been badly hit by the collapse of its main market for oil drilling and measuring equipment. Last year Schlumberger wrote off more than the entire purchase price by Fujitsu for its Fairchild Semiconductor subsidiary with a $485 million charge.

British Telecom fights plan for easier entry to telecom market pending forthcoming proposals which are expected to suggest sweeping away many of the mandatory tests on new telecommunications equipment. British and foreign manufacturers trying to sell new equipment such as private exchanges and telephones have complained about the time and cost involved in getting their equipment approved for U.K. use.

Tokyo may thwart Cable & Wireless' (C&W), U.K., entry to the Japanese international telephone market, the most closed market in the World. Inevitably, its ambitions are meeting some vigorous in-fighting within the Japanese establishment. Under the C&W plan, the U.K. company would take a 20 percent stake in IDC, a new consortium set up to run an alternative international telephone service to and from Japan.

Japan vows to insist on higher IC prices and to force its semiconductor manufacturers to raise prices in Europe and Asia. The promise came after the U.S. Trade administration threatened for the first time to terminate the U.S./Japan semiconductor trade treaty unless

Japanese dumping of DRAMs and EPROMs in third countries stopped immediately. In a parallel action, European semiconductor manufacturers lodged an anti-dumping complaint against their Japanese competitors alleging that they were selling EPROM ICs in the EEC at below cost. The complaint was filed by the European Electronic Component Manufacturers Association. A second complaint covering DRAMs is expected to be filed shortly.

EEC gives legal safeguard to IC designers against unauthorized copying of IC chip designs. The measures will also safeguard EEC IC exports to the U.S. The decision comes in direct response to the U.S. threat to withhold copyright protection for imported ICs unless its own IC producers were offered anti-copying safeguards in foreign markets. The EEC will now require the 12 states to fall in line with the U.S. microchip design protection practice that was embodied in the recent U.S. semiconductor Chip Protection Act.

West Germany head's export league, this year as the World's biggest exporter of goods when measured in U.S. dollars. The U.S. has previously held this position for more than 60 years when it took over the lead from Britain in 1921. The U.S. export growth remains sluggish and over the past two years has only partially recouped the sharp decline experienced in the early 1980's.

West Germany and Hungary in VCR joint venture, the first East/West European joint venture, to produce colour TV sets and video cassette recorders. The agreement is between Standard Elektrik Lorenz (SEL) of West Germany and Skala-Coop, Hungary's most innovative retailer. It calls for an eventual annual production of 100,000 units, three quarters of which will be colour TVs. Most of the units are targeted for internal consumption though some exports to other Eastern European countries is hoped for.

Toshiba's net profits plunge 65 percent to Y12 billion in the first half year to September on sales down 10 percent to Y1,561 billion. The poor performance was blamed on the strong yen, the consequent setback in exports, particularly consumer goods, and a drop in deliveries for nuclear power plants.

Blow to U.S. bid for CGCT following objections by the Government's legal advisors to the sale of more than 20 percent of the company abroad. This deals a blow to the efforts by AT&T which has been seeking jointly to acquire a 60 percent controlling interest in CGCT with Philips.

Electronic shopping pilot scheme to go ahead in U.K. following the British clearing banks plan to introduce within two years the first stage of a national electronic shopping system. The announcement follows several years of planning during which the banks were unable to agree to a common approach. Electronic shopping, or electronic funds transfer at the point of sale (EFTPOS), involves the use of credit or debit cards in place of cash or cheques. Under the scheme, 2,000 counter-top terminals will be installed by the end of 1988 in three major U.K. cities.

All Nippon Airways (ANA) to buy 10 Airbus A-320s with options on 10 more in a deal which could eventually be worth Y160 billion. ANA, Japan's biggest internal airline, is currently expanding its international routes and this is the first Airbus purchase it has made. The A-320 was chosen over the Boeing 737-400 and McDonnell Douglas MD-88 because of its superior maintenance and reliable construction. ANA has not yet decided on financing or on an engine choice.

ITT seeks to streamline Spanish operation and is understood to be looking for a public sector takeover of Marconi Espanola, ITT's Spanish electronics subsidiary. The proposals also include the offer of a Pta12.7 billion capital injection for the main ITT subsidiary, Standard Electrica and initiatives for job creation in exchange for government aid to cover about 5,800 redundancies at Standard Electrica over the next five years.

British Telecom launches lasercard file system enabling up to 800 pages of text and photographs to be contained on a single card. The tamper-proof cards have been developed by Drexler Technology of California which holds the patents. BT Business Services aims to sell the idea to a range of customers particularly in the health and security industries.

Malaysian cars to be sold in the U.S. by Proton, the Malaysian state-owned car group which started production only one year ago. The importer is Bricklin Industries, a privately owned company, which aims to sell between 80,000 to 100,000 cars a year in the U.S. The cars to be exported are based on the front-wheel drive Mitsubishi Lancer and restyled by International Automotive Design of the United Kingdom. Proton is 70 percent owned by the Government-owned Heavy Industries Corporation of Malaysia and 30 percent by Mitsubishi of Japan.

McDonnell-Douglas wins Mitsui order for 5 MD-11s following a deal the previous week with British Caledonian for 9 of the aircraft. Mitsui is a big Japanese industrial conglomerate moving increasingly into the aircraft leasing business. The formal launch of the MD-11 program has been underwritten.

Japan's World trade surplus fell to $7.4 billion in November, 6 percent lower than in October, as the volume of exports dropped by 7.8 percent. Its trade surplus with the EEC however continued to widen with exports up 22.6 percent to $2.24 billion.

Bull to lead computer venture with a 65.1 percent stake in the proposed new venture that links it with NEC of Japan and Honeywell of the United States. The venture's name has yet to be announced. At first Bull will acquire a 42.5 percent stake for $130 million with NEC acquiring a 15 percent for approximately $50 million and Honeywell the remaining 42.5 percent. However, Honeywell will cede 22.6 percent of its shareholding to Bull for about $65 million during the next two years.

Japan digital tape talks end in failure as Japan resists pleas from the West to fit a digital tape spoiler. Such a device would make the tape system incapable of recording from digital compact disks. Japan argued that whilst it was opposed to commercial piracy and would co-operate to help stamp it out, home taping was quite different and should be distinguished from piracy. DAT machines are expected to be launched in Japan in the next few months.

Amstrad to launch IBM PC clone in the United States following the signing of Video, a Dallas-based company with a national distribution network. Video resigned its contract with Commodore to take on the Amstrad franchise. Amstrad expects to launch its PC in the United States during January with initial shipments to be made starting in February.

ES2 links with TI in ASIC design pact aimed at giving it a much broader client base. The agreement will ensure that ES2 and TI adopt a common approach in their design methodology for ASICs, one of the fastest growing segments of the semiconductor market. TI in turn has a similar understanding with Philips, the largest semiconductor manufacturer in Western Europe. By using common standards, the three companies will be able to offer customers a wide range of choice with ES2 concentrating on very low volumes and Philips and TI able to produce the ICs in the bigger volumes.

Thomson CSF plans to raise FFr4 billion, FFr2 billion immediately with a further FFr2 billion during the next three years. Thomson also confirmed that in 1986 Thomson SA, the main group holding company, had received FFr680 million in capital grants from its state shareholder as well as FFr80 million of grants deferred from their 1985 allocation.

Saint-Gobain issue 14 times oversubscribed as buyers swamp the French bourse to purchase stock in France's first privatization of a national company. The investors sought a total of around 275 million shares with only 19.6 million planned for issue. The French government had originally planned to offer 20 percent of the shares abroad but cut this back to 18 percent to meet domestic demand.

Japan's car exports to EEC plunged in November as self-imposed restraints finally began to bite. The decline is the first since last Autumn. Toyota, the leading producer, said its exports to the EEC in December were down 32.9 percent on November with Nissan and Mazda down 63.9 and 61.9 percent respectively. Japan's car exports had been rising sharply during 1986 as the Japanese producers shifted their sales efforts from the United States to Europe.

Washington curbs machine tool imports with unilateral limits imposed on exports from Switzerland and West Germany. Japan and Taiwan have already agreed to voluntary export restraint for five years starting January 1987. Seven other countries, including the United Kingdom and South Korea, have been warned not to take advantage of the limits to gain marketshare.

Toshiba-led group to build TV component plants in China estimated to be worth between $200 million and $300 million. The order, the largest manufacturing deal with a Japanese group to date, provides fresh evidence that China is starting to step up the pace of foreign plant purchases. These had fallen off markedly in 1986 because of the rapid decline in China's foreign reserves.

U.S. moves towards a ban on Europe's phone-makers by initiating action to bar the sales in the United States of telephone equipment from countries that discriminate against U.S. products. The FFC's action, initially aimed at Siemens of West Germany, is widely seen as further evidence of growing friction over the international telephone equipment market.

South Koreans to open a video tape factory in Ireland, the biggest South Korean investment so far in Europe. Saehan Media, one of the World's largest videotape manufacturers, is to open an I£60 million factory in the West of Ireland and will employ approximately 800 people within two years.

Taiwan to redress trade surplus, faced with growing American protectionism, by lowering import tariffs and buying more U.S. goods. The plans call for $2 billion to be trimmed of its $13 billion 1986 U.S. trade imbalance in 1987.

Swiss telecommunications companies plan merger with Autophon and Hesler, Switzerland's two biggest telecommunications companies, planning to merge from next June. The new enterprise will have annual sales of around SFr2 billion, employ 13,000 people, and account for nearly two thirds of the Swiss telecommunications industry's output.

Magneti Marelli raises L321 billion by means of the issue of equity and bonds on the Milan bourse. The company, which in 1986 is expected to achieve sales of around L700 billion, plans to use the proceeds to acquire control of a 65 percent stake in Fiat-Matra.

AT&T makes $3.2 billion write-off, probably the largest ever in corporate history, against its 1986 earnings. The charge is related to planned restructuring operations across its range of activities in line with its strategy of refocusing on its core business of long-distance telecommunications. It also plans to reduce its workforce by a further 27,400 on top of the large cuts already announced in the past two years.

Michelin to supply radial tyres to the United States Air Force for the F-15E fighter aircraft. The deal is regarded as a breakthrough for the French tyre maker which has eight plants in the United States and Canada. Michelin has supplied about 10,000 of its Air X radial tyres to the United States aerospace industry, however the F-15E order is the first in which a U.S. fighter aircraft is originally equipped with radial tyres.

Britain chooses AWACS, rejects Nimrod, with plans to purchase six aircraft with an option to buy two more at a cost of $860 million. The decision ended the ill-starred 9-year Nimrod program development by GEC which has already cost $960 million at current prices. A further $660 million would have been needed to complete the program with no guarantee it would meet the U.K.'s Royal Air Force requirements.

Rover signs new Honda deal covering the next joint venture car to be produced by Austin Rover, part of the state-owned Rover Group. When the new model appears, probably in 1989, it will replace the Austin Maestro, the Rover 200 series, and possibly the Honda Accord.

STC excluded from European telephone group following the merger of the telephone interests of ITT and CGE. The new group will now account for about 43 percent of the European public telephone exchange market. The deal, which was signed at the closing stages of December, also excludes Telefonica, Spain's semi-state-owned telephone monopoly.

Racal in Vodafone buy-out in a cash and share deal worth in total $161 million aimed at giving it greater flexibility in overseas markets. The agreement with Millicom of the United States and the Hambros banking group will allow Racal to consolidate the company's position in one of the fastest growing areas of electronics.

Aeritalia to build 12.7 percent of MD-11 airframe, more than double the Italian company's participation in the DC-10 manufacturing program. The deal is projected to be worth around $4 million in revenue for each MD-11 delivered. Aeritalia's developing experience in applying carbon fibre technologies to aircraft fuselage panels was the reason for the collaboration. It is part of a longstanding collaboration that dates from the mid-1960s and has involved supplying components for DC-8, DC-9, and MD-80 series of aircraft.

N.V. Philips dissolves U.S. Philips Trust, a 47-year old holding structure for its U.S. assets, and has disclosed plans to integrate management from the Netherlands parent company into its U.S. companies. The trust was established prior to the Nazi invasion of the Netherlands as a means of protecting its U.S. holdings.

NEC increases 256K DRAM output at its Singapore facility to a rate of one million units per month to meet increased demand for U.S. office automation equipment manufacturers assembling systems and sub-systems in South East Asia. 40 percent of NEC's semiconductor supplies to South East Asia are not shipped to the office automation market, up from zero in 1981. Output at the U.S. Roseville facility is also being increased from two million units per month to three million units per month. Free from FMV floor price restrictions, the price of U.S. produced DRAMs is lower than that of Japanese made devices giving NEC a competitive edge over other Japanese suppliers.

EUROPEAN SEMICONDUCTOR DIVISION ACTIVITY REPORT

The main focus of December's activity centered on the 1986 provisional marketshare estimates, see State of the Industry in this issue. The formal update to the Destiny database tables is now being completed and will be available to all client binderholders, both in disk and printed versions, shortly.

December also saw the move from our 6-year old location in New Bond Street to Centrepoint approximately one kilometer away. We apologize for any disruption to our business activities during this time period, though hopefully this should not prove too serious.

Since DATAQUEST first opened its U.K. office doors in 1980 with a staff of two, at December 31st 1986 it had grown in size to 31 staff with research programs covering five different technology areas--semiconductors, telecommunications, printers, and more recently industrial automation, and computers. During the first quarter of 1987 the office equipment and financial services research programs will be launched. The move to new premises was necessary as part of this expansion program.

A formal open house has been scheduled for Thursday 5th February; should anyone wish to visit us on that occasion please do so, we would be more than pleased to welcome you and show you our facilities. We would however appreciate your calling Lyn Cooke in advance on 01-379-6257 to let us know your intentions so we can plan to accommodate you accordingly.

Two other items worthy of special mention are the forthcoming joint semiconductor user (SUIS) and applications (SAM) services conference scheduled for February 4-6 at Tampa, Florida, a copy of the announcement is attached with this newsletter. For further information please contact your local DATAQUEST office.

Also included with this newsletter is your opportunity to receive a complimentary copy of our IC Asia and IC USA newsletters. IC USA is available both in English and Kanji (please specify). The above are bi-monthly newsletters on the Asian and U.S. marketplace respectively. This offer is open until February 28th so I recommend your early response on the form provided.

THOUGHT FOR THE MONTH

For January's thought for the month, I would like to reminisce on the items reviewed here over the past 12 months.

January: looked at the 1985 preliminary market share analysis, the changing semiconductor industry structure, the success of Japan's longterm strategy, the improved international position of Europe's semiconductor companies, and the restructuring and repositioning of the U.S. companies.

February: commented on the rebirth of the circuit designer, though this time now designing in silicon with the advent of ASIC, silicon compilation, and fifth-generation software.

March: reviewed the mass market for ASICs and questioned whether the market was truly ready yet. The dilemma remains that so far only the large and/or relatively sophisticated user has been addressed with the vast majority of small to medium size companies still left untapped, and no clear role yet established for distribution.

April: looked at the preliminary ruling by the U.S. Department of Commerce on MOS memory dumping on the United States and its broader implications on World trade.

May: turned the attention to just-in-time and the changes this concept was having on the structure of the semiconductor and electronics industries.

June: reviewed the European distribution long term trends and issues, in particular the pressure on pre-tax margins, changing market positions of the United States, European, and Japanese suppliers, the growth in ASIC, the growth in user base, and the impact of ship-to-stock, just-in-time, and increased competition.

July: spotlighted Canon's manufacturing experience in Europe and especially their difficulty in obtaining quality parts from local European manufacturers.

August: focused entirely on the extremely sensitive issue of the then announced U.S.-Japan trade accord; its objectives, its potential pitfalls, the issues, and the concerns.

September looked at the building of Japan's information society--a joint effort between government, local authorities, and private companies.

October: looked back at the present metamorphosis that is currently being undertaken in the semiconductor industry and the new realities that have permanently changed the semiconductor industry.

November: Commented on the Fujitsu acquisition of Fairchild, the joint Fujitsu/Hitachi 32-bit microprocessor joint venture, and the TRON project.

December: closed the year with the spotlight turned to ASIC quality and reliability issues--the new ASIC battleground for the 1980s.

I would also at this stage like to step back and pause to remind readers of the very positive benefits that the semiconductor industry has provided for society--something often overlooked especially at this time when the industry is struggling for survival. Were it not for the intrepid breed of new industry entrepreneurs that have worked and managed their businesses at phenomenal growth rates, both positive and negative, since the 1960s, our society now would be in a very different World from the reality of today.

Malcolm Penn

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FUTURE EVENTS DIARY

SEMICONDUCTOR CONFERENCES

- FEB 4-6, Semiconductor User and Applications Conference
  Saddlebrook Resort, Tampa, Florida
  "Partnering in a Global Economy"

- APRIL 13-16, Japanese Semiconductor Industry Conference
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SPECIAL REPORTS

- 1985 News Digest--available now
- Korean Semiconductor Industry Report--available now
- IC Update '87--available now
- GaAs Market Update--available now
- IC Start ups--available now
- DSP Market Update--second quarter 1987
- Taiwan Semiconductor Industry Report--available first quarter 1987
- Hong Kong Semicounductor Industry Report--available first quarter 1987
- China Semiconductor Industry Report--available first quarter 1987
- 1986 News Digest--available first quarter 1987

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- IC ASIA
- IC U.S.A (available in English and Japanese)
- European Monthly Report

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- Semiconductor Group Database: History, Forecast, Market Share and Geograhic Data
- SIA Database: Bluebook, Flash Report, Forecast
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1987

A Dataquest Conference for Electronics Industry Decision Makers

February 4–6
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Partnering in a Global Economy

The health of the electronics equipment industry continues to impact the demand for semiconductors. At this conference, industry experts will discuss the semiconductor user's perspective on issues affecting operations, manufacturing, and procurement, as well as other dynamics impacting business relationships between semiconductor makers and buyers.

Key speakers will include:
- Ken Stork, Corporate Director of Materials and Purchasing, Motorola, Inc.
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- Clark Preston, Manager of Manufacturing, Technical Services, IBM Corp.
- John Durkin, Manager of Procurement, Unisys
- Doug Newman, Vice President, Marketing, National Semiconductor Corp.

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- A look at linking users and suppliers: the distributor's new role
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This annual conference is jointly sponsored by Dataquest's Semiconductor User Information Service and Semiconductor Application Markets (SUIS and SAM).

A conference brochure with more details will be forthcoming.

SAM 86-3
November 1986

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EUROPEAN MONTHLY REPORT

ESIS Code: Vol. IV, Newsletters

EUROPEAN SEMICONDUCTOR DIVISION

DECEMBER MONTHLY REPORT

STATE OF THE INDUSTRY

Though there are no signs that conditions in the industry are deteriorating, the opposite is also true. Overall there is no significant change to report since last month's report. As such, we are still staying with our latest (October) forecast for European growth, but re-emphasise that this must be considered as best case; our worst case scenario for 1987 local European currency growth yields only 7.3 percent over 1986.

Several areas give cause for hope, and some for concern. Firstly, we are now convinced that, barring unforseen disasters, the worst of this recession is behind us. However, do not confuse recession with the parallel industry resructuring that is simultaneously taking place; for some companies, the worst is far from over--some will probably never recover their former glory.

Secondly, the World economic data is still providing mixed signals; currently end-markets are very quiet, but again, this must be analysed regionally. Consumption in non-U.S. markets is much stronger than in the United States, particularly in the Far East; and that trend is here to stay for at least the next decade.

And thirdly, business is slowly getting better, albeit at a painfully slow pace, with moderately low inventories at OEMs, and the economies merely muddling along. If any of these change for the better, there is a real opportunity that we could be faced with a classic industry upturn which, if controlled, is just what the industry needs. Our concern however is, has the industry slimmed down to the point whereby such an upturn cannot be controlled? That is just what the industry does not need.

IN THIS ISSUE

144/146 New Bond Street / London W1Y 9FD England / (01) 409-1427 / Telex 266195

1290 Ridder Park Drive / San Jose, CA 95131 / (408) 971-9000 / Telex 171973

OTHER INDUSTRY COMMENTS

Fiat wins battle for control of Alfa Romeo--the illustrious but struggling Italian Motor Company, as predicted in last month's European monthly report. Early in November, after a detailed analysis of rival bids from Ford and Fiat, IRI-Finmeccanica, the State group which controls Alfa, confirmed that a Fiat proposal was thought more economically advantageous. As such, Fiat will now acquire 100 percent control of Alfa. The expanded Fiat group will become a close rival to Volkswagen-Seat for the top position in the European car market, with a share of around 14 percent. Its turnover will be over Lr31,000 billion and it could be producing around 1.5 million cars by 1990.

The Fiat bid was superior to Fords in three important respects. Firstly Fiat was bidding for the entire Alfa group, whereas Ford only wanted the Alfa car company. Secondly, Fiat was ready to take full control and to fund all of Alfa's operating losses, whereby Ford would have taken only 19.5 percent for three years before moving up to 51 percent. And thirdly, Fiat gave more concrete assurances about jobs.

The purchase price of Lr1,050 billion is to be paid in instalments between 1991 and 1995.

Toshiba and Motorola in joint venture deal--in yet a further example of the maturing and consolidation that is taking place in the worldwide semiconductor industry. The agreement covers a joint manufacturing venture in Japan and a wide ranging exchange of products and technologies. As part of the agreement between the two companies Toshiba will actively support Motorola's access to the Japanese semiconductor market. The agreement will also help Motorola re-enter the world market for dynamic random access memories.

The new agreement will license Motorola to manufacture memory ICs designed by Toshiba including both DRAM and SRAM devices. In return, Motorola will sell to Toshiba its 8-bit and 16-bit microprocessor devices and eventually, as Motorola's access to the Japanese market improves, allow Toshiba to gain access to the basic technology.

The two companies also plan to build a joint venture factory at Izumi city, 350km north of Tokyo. Previously Motorola had planned to build its own plant on the site. The factory is expected to begin production in the first quarter of 1988, and will initially produce Toshiba designed memory ICs including the 1Mbit and 4Mbit designs, as well as microprocessors designed by Motorola.

No agreement has been reached on the 32-bit microprocessor as yet.

U.S./Japan trade accord again dominates news--with increasing concern by the U.S. government and calls for sanctions against Japan by the U.S. chip makers. The United States is concerned to halt the many alleged violations of the agreement by Japanese IC makers that they are continuing to dump memory ICs in third country markets and in Japan at below cost prices. Japan's Ministry of Trade and Industry (MITI) confirmed that prices of Japanese semiconductors were lower in third country markets, though it did not necessarily agree that the agreement was being broken.

One of the options available is that the U.S. Government could reinstate two major anti-dumping suits against Japanese memory IC manufacturers. These suits were suspended as part of the trade agreement. Paradoxically, if such an action were taken, the result would be still higher U.S. prices for Japanese made memory chips and an exacerberation of the price differential between the United States and other countries.

This would not be welcomed by the U.S. computer and electronic equipment manufacturers who buy Japanese ICs in the United States and who have already complained that the trade agreement has increased U.S. chip prices placing them at disadvantage to foreign competitors.

The U.S. Government is now placed in the difficult position of trying to reconcile the conflicting demands of the U.S. IC manufacturers with those of U.S. IC purchasers.

NOVEMBER INDUSTRY HIGHLIGHTS

Hoechst bids for top chemical spot following a $2.85 billion bid for Celanese of the United States. If successful, the bid would make it the largest chemical company in the world. The offer is the largest ever made by a German company and one of the biggest by any European concern in the United States It is also the latest instance of a German concern using the strength of the DM against a much weakened dollar to strengthen its interests in the United States

CGE and ITT expand plan for joint venture to include their respective cable and optical fibre assets. The venture would create the world's second largest telecommunications concern after AT&T of the United States. The addition of the cable and optical fibre operations would increase the assets of the activities grouped in the joint venture from $4.3 billion to $4.6 billion. It would also lead to the reduction of ITT's original stake in the joint venture from 37 percent to 35 percent.

Hitachi and Fiatallis in joint venture talks thought likely to center upon the production in Turin, Italy of a line of hydraulic excavators based upon a pooling of the two company's technologies. Fiatallis, the Fiat group construction machinery subsidiary, holds about 50 percent of its domestic market though its product line is now beginning to age. In contrast, Hitachi's range is modern and well designed. Komatsu, the main Japanese producer of hydraulic excavation equipment, is due to start manufacturing in the United Kingdom next year. Japanese interest in moving into local manufacturing has been spurred by anti-dumping duties imposed on their excavators by the EEC in 1984.

Fiat to import Brazilian cars, a saloon version of the UNO small hatchback, from Fiat Automoveis, its Brazilian subsidiary, starting next year. Annual shipments are expected to be between 60,000 and 80,000 units. The model is to be called the Duna and will be sold mainly in Italy. Fiat is currently using 140,000 Brazilian built diesel engines a year in its European models, and is also importing around 75,000 147 models from Brazil.

Rhone-Poulenc may buy Union Carbide Agrochemical Operations in a deal which is expected to be worth between $500 million and $600 million. Although at least three other international chemical companies are believed to have put in bids for Union Carbide's insecticide and other agrochemical operations, the French group is now seen as the leading contender. If successful, the group will acquire six plants in the United States, three in Brazil, one in France, and another in Canada.

Philips reports third quarter profits decline down 27 percent at FL127 million and further warned that full year earnings were also likely to show a decline. Sales fell 12 percent to FL12.7 billion in the third quarter reflecting not only currency translation losses, but also slower than expected sales of TVs and VCRs, plus stiffer competition in the United States.

French defence spending to rise by an average of 6 percent a year in real terms under a new 5 year defence budget approved by the French cabinet early in November. By the end of the period, defence spending will absorb close to 4 percent of GNP against a low in recent years of 3.8 percent in 1986. The plan provides for FFr47.4 billion to be spent on equipment purchases by the armed forces from 1987 to 1991.

South Korea to compete in European PC market following the decision by Hyundai, the industrial and electronics conglomerate, to launch its personal computer in Europe. The machine due to go on sale early next year will compete with low cost personal computers such as the PC 1512 model recently launched by Amstrad.

Xerox to open research unit at Cambridge, its first European research centre. Research will focus on the interaction between humans and computers, including artificial intelligence. The centre will be coordinated by Xerox's U.S. Research Unit at Palo Alto.

Amstrad updates personal computers and is to increase hard disk computer production. Around 35 percent of the initial orders for the machines have been for hard disk versions. In parallel, Amstrad is believed to be working on a re-design of the models aimed at making it even more cost effective by taking charge of the design of some of the key components. In particular the hard disk is thought to be under scrutiny. Key to Amstrad strategy in low cost manufacturing is to reduce duplication of components to an absolute minimum.

Electrolux to buy U.S. garden products division of Emerson Electric of the United States. The acquisition, the second important takeover made by Electrolux in the United States this year, follows its $745 million takeover at the end of March of White Consolidated Industries, the third largest U.S. white goods manufacturer. The Beaird-Poulan/Weed Eater operation has annual sales of $190 million, employs about 1,000 people, and has plants in Arkansas, Louisiana, and Toronto. The takeover will increase Electrolux's sales in forestry and garden products by around 50 percent. The acquisition from Emerson will further expand its range with several portable powered garden tools such as lawn trimmers, blowers, and hedge cutters, as well as garden chain saws. Electrolux has hitherto chiefly manufactured professional and semi-professional chain saws where it is the world's second largest producer after Stihl of West Germany.

Sony to invest Lr25 billion in Italian cassette plant with plans to open by 1988 a 60,000 square metre plant in the Trentino region of Northern Italy to produce two million magnetic cassette tapes a month. Sony forecasts that sales of its Italian produced cassette tapes should generate Lr80 billion of revenuės a year. 25 percent of the Sony Italian production will be destined for export.

Japanese group to build copier plant in West Germany following the imposition of anti-dumping duties on imported Japanese photocopiers by the EEC. The company, Konishiroku Photo Industry, the camera, film, and copier company, plans to build a copier plant in Luneburg, Lower Saxony, West Germany. The factory will start production next year and will produce about 20,000 copiers per annum, initially two models in the Konica U-Bix range of copiers. It is likely to start making all the eight models sold by Konishiroku in Europe after two to three years, when output will probably rise substantially. Konishiroku claims about 8 percent of the copying market in Europe.

Telecommunications causes 42 percent second quarter rise in Plessey pre-tax profits increasing to £44 million on turnover of £350.5 million. The main advance was registered in Plessey's Telecommunications Division where operating profits for the first half increased by 59.2 percent to £38 million on turnover of £331 million. Operating profits in micro-electronics and components in the first half fell 9.7 percent to £6.5 million on sales of £71.7 million, which the company said was due to the downturn in the market worldwide.

Ford to close Michigan Tracter Plant and move production to Europe. The agricultural tractor operations will move to Basildon, Essex, United Kingdom. in 1987 and in 1988 the industrial tractors division will also be moved, probably to Charleville, France. In a parallel move, Scotland has been shortlisted along with Spain and Portugal as a potential location for a £50 million electronic components plant planned by Ford. It is understood that the new plant would produce mainly electronic components for Ford's engine management systems and would probably involve substantial export business to Ford plants worldwide.

Matsushita to produce VCRs in Barcelona with plans to invest Y400 million to start production at its existing factory. The company is also establishing a factory in France, and is transferring the production of hi-fi products from its U.K. factory in South Wales to the new plant. Activity at the U.K. factory would be maintained because of the imminent start-up of production of microwave ovens. These moves are the latest in a series by Matsushita to move more of its production overseas, partly to overcome the effects of the high Yen on manufacturing in Japan, and partly to defuse trade friction with the EEC and the United States. Matsusita already has a plant in West Germany producing about 40,000 VCRs a year.

AGA and L'Air Liquide to break-up joint ventures in West Germany, the Netherlands, Belgium, and Luxembourg. At the same time AGA said it was expecting group profits for the year to fall by between 5 and 10 percent. In West Germany, the largest European market for industrial gases, AGA is to take over around three quarters of the existing joint venture which has annual sales of some DM200 million. L'Air Liquide will acquire all of AGA's shares in the gas companies in Belgium and

Luxembourg, while AGA will take over 100 percent control of the Dutch company. L'Air Liquide has emerged this year as the world's biggest industrial gas company following the takeover of Big Three Industries in the United States.

<u>Telefonica to resume CGE talks</u> for participation in the latter's joint telecommunications project with ITT of the United States. Telefonica's interest cooled after the original agreement in July mainly because of disagreement on the future of ITT's industrial subsidiaries in Spain, in which Telefonica has a minority holding.

<u>Thomson sees earnings at FFr1 billion for 1986</u>, compared with the profit of FFr583 million last year and four consecutive losses totalling FFr3.65 billion between 1981/84. Thomson CSF, the group's main defence and professional electronics subsidiary, which has a bourse listing is expected to report profits of at least FFr2 billion compared with earnings of FFr960 million last year. The Thomson group results for this year will reflect losses in the consumer electronics division, Thomson Grand Public, which is not expected to be profitable until the 1987/88 time frame. The semiconductor division is expected to lose around FFr300 million this year and break even in 1987.

<u>EEC ministers call for ISDN access Europe-wide by 1993</u> signalling a degree of political commitment without which the new service probably would have remained on the drawing board. Providing the European Parliament agrees, the EEC's development plan for ISDN would provide for its gradual introduction across the existing copper wire telephone network from 1988. The aim is to have 5 million of Europe's 100 million telephone lines as ISDN lines by 1993, a 5 percent penetration which would initially address the needs of the community business users.

<u>Mitsubishi Electric starts operations</u> at its Y25,000 million VLSI plant at Kochi in Japan. The fully automated facility is producing 2 million IC's per month with 90 staff.

<u>Rolls Royce and GE and jet engine pact</u> because of increasing competition between the two companies. The pact was set up in 1984 to enable each company to gain a share of specific engine markets in which either was not already engaged or was behind in development, in order to expand sales, reduce development costs, and if possible, avoid competition. The pact, though highly successful technically, has not prevented competition emerging. Although the companies have agreed to end the pact, they recognised that there is still some merit in collaboration and existing contracts will continue along with options to consider further sub-contracting work to each other.

<u>Nixdorf earnings growth outstrips 17 percent sales gain</u> jumping 43 percent to DM172 million. Turnover increased 17 percent to DM2.8 billion in the first nine months of 1986. Capital expenditure is scheduled to be some 30 percent higher this year at DM600 million with a further 20 percent increase likely in 1987.

<u>AT&T acquires 51 percent of Danish Optical Fibre plant</u> of NKT, the Danish electro-technical group. Its optical fibre plant near Copenhagen has an output capacity of about 30,000 KM per annum, most of which is sold to the Danish Telecom Administration. Under the deal, AT&T will gain direct and immediate access to the EEC and Nordic markets, while for NKT the link-up will strengthen its position as an exporter.

Japanese Machine Tool Industry may seek aid with its restructuring programme. The industry's sales and profits have been hard hit this year by the rise in the Yen. Recently, under the threat of protectionist legislation in the United States, the industry has just agreed to reduce its shipments to the United States of machining centres, numerical controlled lathes, and four other types of machines back to its 1981 levels. Given that the industry exported more than a third of its Y1,008 billion output last year, half of which went to the United States, this will mean significant cutbacks.

GEC wins $72 million U.S. cockpit display order for the General Dynamics F-16C fighter aircraft. The head-up cockpit display system optically records flight information from instruments below onto the windscreen, enabling a pilot to look straight ahead. Since the late 1960s, the company has won orders worth £500 million from the United States for head-up display systems.

Siemens faces fresh threat to U.S. strategy following claims that it violated American local content laws on a Californian Railway rolling stock contract. Two senior congressmen have written to the U.S. transportation secretary calling for Siemens to be punished following a ruling in March by the Urban Mass Transportation Administration (UMTA), a federal agency, that Siemens broke U.S. "buy Americans" laws in its $24 million contract to supply 26 carriages for a Sacramento light railway project. Siemens effort to break into the U.S. telephone switching equipment market is already being investigated by another government agency, the Federal Communications Commission. The group has also come into conflict with U.S. authorities because of its bid for CGCT of France in which it is in direct competition with AT&T, the U.S. telecommunications group. The French government is expected to make its final choice in the international telecommunication battle for control of CGCT by December 20th.

Europe's whisky makers step up protest to Japan where they claim discriminatory Japanese taxes and import duties have priced their products out of a huge growth market. The whole issue has now been submitted to the General Agreement on Tariffs and Trade (GATT) by the EEC as a test case on the grounds that imported wines and spirits suffer unfair tariffs and taxes in relation to domestic products. Imported alcoholic drinks accounted for less than 1 percent of the Japanese market leaving a hugh potential unrealised.

Compaq to set up a plant in Scotland to make the full range Compaq's portable and desktop computers. The £16 million manufacturing plant will be sited at Erskine, West of Glasgow, and should be employing 350 people by 1990. Most of the output will be exported. The decision to locate in Scotland was partly market driven, the United Kingdom is the most developed personal computer market in Europe, and partly due to the balance of financial and commercial advantage. Construction will start soon and the plant should be operatational by next Autumn. Earlier this month Compaq announced it was setting up a plant in Singapore partly to circumvent the U.S.-Japanese semiconductor trade agreement. The Singapore plant, Compaq's first outside the United States will assemble components made in Japan and other countries in the Far East into printed circuit boards.

Hitachi to cut capital spending as profits slide 46 percent for the first half year down to Y46.6 billion. Sales were down 4 percent to Y2,434 billion. Capital spending will be reduced 21 percent to Y200 billion for the group worldwide, however the R&D budget is increased 5 percent to Y310 billion, representing a 6.5 percent of the total projected sales. The company blamed its poor showing on the strong value of the Yen and the semicondutor market slump.

Citizen Watch plans U.K. plant to build computer printers to serve the European market. Though no final decision has been made, a site at Corby, Northants, is understood to have emerged as the favourite location. Citizen is understood also to have talked to the French and West German Governments. The company said it was considering manufacturing in Europe as a way of avoiding possible trade friction and to overcome the strength of the Yen. Production by Citizen of computer printers in 1986 is expected to be three times its 1985 level. About 90 percent of the machines are exported to United States and Europe.

Ford and VW to merge in Brazil and Argentina to form a joint company that will dominate the Latin American automotive industry and will be one of the world's largest motor businesses. VW is to take 51% of the company, called Autolatina, which will have fifteen plants capable of producing 900,000 vehicles a year. The merged company will be managed jointly by Ford and VW.

STC in $350 million transatlantic cable contract, beating U.S., Japanese, and French competitors to supply the first private optical fibre transatlantic telecommunications cable. The 4,350 mile cable will be ready by June 1989, and will bring competition to transatlantic telephone services for the first time. It will be owned by Cable & Wireless, a U.K. international telecommunications group, and Tel Optik, a U.S. investment group.

South Korea prepares for chip war in a bid for a worldwide competitive stance against the Japanese IC manufacturers while simultaneously trying to hold onto a strong position in the United States where they see slower market growth in the coming years. The strategy includes a rapid increase in manufacturing finished products to absorb expanding domestic capacity for semiconductor production. Currently Hyundai and Samsung have the capacity to produce about 10 million 256K DRAM ICs per month. Both companies expect to be marketing 1Mbit DRAM chips by the middle of 1987.

Lex in £10.7 million deal to buy two U.S. electronics businesses from Cargill Inc, the privately owned U.S. grain trader. It is paying $14.5 million for the business and most of the assets of Tenant Electronics of United States, and £800,000 for Cargill Electronics based in Swindon, United Kingdom. The deal comes just three months after Lex bought Richley/Impact Electronics, a privately owned U.S. components distributor or $13.5 million. Tenant Electronics is based in Edwardsville, Kansas, and has branches in Long Island and Los Angeles. Nearly 90 percent of its business is in the distribution of connectors. In the year ending May 1986, Tenant recorded sales of $28.2 million and operating profits of $1.1 million. Cargill Electronics is a specialist connector and electromechanical distributor, with reported operating profits of £150,000 on sales of £3.5 million in the same year ending May.

Matsushita and Peking to build TV parts plant at a value of $100 million in Peking. The deal marks the largest manufacturing investment in China for a Japanese company. The move, Matsushita's first joint venture in China, comes as foreign investment and exports to China have been falling off, primarily because of China's restricted foreign exchange control. The new Peking plant will produce colour picture tubes initially for domestic consumption. Once operating fully in 1989, it is expected to produce 1.8 million tubes per year.

Ferranti advances 16 percent to £22 million at mid-term with a pre-tax profit increase from £18.9 million to £21.9 million. Turnover was up 7 percent at £298 million against £279 million. Depressed world market conditions for semiconductors allowed operating profits to increase only 3 percent to £22.4 million. Excluding the semiconductor activities, the increase would have been 19 percent.

EUROPEAN SEMICONDUCTOR DIVISION ACTIVITY REPORT

During November the key areas of activity were the preliminary 1986 market share estimates, company profile updates, and the quarterly consumption review.

Inputs for the provisional market share estimates were gathered and discussed during a worldwide coordination meeting in San Jose. These estimates will be published on Janaury 2nd 1987 as a Newsletter. By the end of December, the Volume III company profiles binder will have been completely revised and placed into our publication cycle.

The European quarterly consumption profile was reviewed and a best case/worst case scenario prepared. Whilst we do not intend to change our current (October 1986) forecast, under the present market conditions, be advised that this does represent our best case scenario. Right now we can only see a downside potential in these estimates.

November was particularly active on the conference front and Dataquest gave the keynote address at Electronica and was frequently acknowledged in the vendor presentations at the International Conference on Custom and Semicustom held at the Heathrow Penta, United Kingdom.

Looking ahead to December, we will begin collecting end use data from semiconductor materials and procurement managers. This data will be consolidated and form part of the European Semiconductor Application Market database during 1987.

Presently undergoing Beta site testing is the Dataquest "Monday Report". This tatical on-line service will offer clients bi-weekly updates on market intelligence and list, 1k, and 10k contract prices and lead times on industry bell-weather products. This data is inputted electronically from our International research centres in London, Tokyo, and Taipei and then consolidated and edited in San Jose.

The latest date for the anticipated office move for our London office is 19th December. For full details please watch for further announcements.

And finally on behalf of our European-based semiconductor staff, may we take this opportunity of thanking you for your continued support of our activites over the past, very difficult, business year and convey to you our best wishes for 1987

Jennifer Berg	Jim Beveridge	Lyn Cooke
Iza Hallberg	Byron Harding	Sandra Husbands
Kathleen Killian	Malcolm Penn	Peter Savage

THOUGHT FOR THE MONTH

Quality and reliability--the emerging new ASIC battleground? In the early days of ASIC, it was the fundamental technology that was the driving force. Software, service, and ease of design were the three major assets. Recently a new dimension has been added to the ASIC battleground, this time focussed on more mundane matters--reliability and quality issues. In this regard, this is an area whereby the traditional semiconductor houses are likely to have the advantage over the specialist ASIC vendors.

One by-product of the ASIC expansion has been to fuel in parallel an unprecedented move towards surface mounted packaging technology and high pin-count packages. This is espcially true in gate arrays where 200 plus pin-count packages are increasingly commonplace.

Plastic packaging is also a pre-requisite here, both for cost and weight considerations, and here is where the dilemma begins. We are now embracing state-of-the-art engineering technology with the well trodden path of past reliability issues with plastic packaging.

For example, using vapour phase soldering techniques with high pin-count plastic surface mount package and cause the package to crack due to thermal stress. And once cracked, apart from the obvious immediate failures, the possibility of long term failures, due to moisture ingress again rears its ugly head.

We are already aware of instances where users have experienced such problems and are of the opinion that this aspect could now substantially shift the balance of power in the ASIC competitive market place.

As ASIC's are used in increasing volume, the ability to turn samples in a matter of days, though important, pales into insignificance compared with the ability to ship larger volumes with the right quality and reliability.

We see this as just another step in the current maturing in the semiconductor industry and the move away from being (solely) technology led to an increasingly marketing (i.e. user) driven industry.

Malcolm Penn

FUTURE EVENTS DIARY

SEMICONDUCTOR CONFERENCES

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- Taiwan Semiconductor Industry Report--available first quarter 1987
- Hong Kong Semicounductor Industry Report--available first quarter 1987
- China Semiconductor Industry Report--available first quarter 1987
- 1986 News Digest--available first quarter 1987

NEWSLETTER SUBSCRIPTIONS

- IC ASIA
- IC U.S.A (available in English and Japanese)
- European Monthly Report

ON-LINE SERVICES

- Semiconductor Group Database: History, Forecast, Market Share and Geograhic Data
- SIA Database: Bluebook, Flash Report, Forecast
- DQ Monday: available first quarter 1987

For further information on the above items, please call your local DATAQUEST office.

Dataquest

a company of The Dun & Bradstreet Corporation

1290 Ridder Park Drive
San Jose, California 95131
(408) 971-9000
Telex: 171973
Fax: (408) 971-9003

Sales/Service offices:

UNITED KINGDOM
DATAQUEST UK Limited
144/146 New Bond Street
London W1Y 9FD
United Kingdom
(01) 409-1427
Telex: 266195
Fax: (01) 491-2790

GERMANY
DATAQUEST GmbH
Rosenkavalierplatz 17
D-8000 Munich 81
West Germany
(089) 91-1064
Telex: 5218070
Fax: (089) 91-2189

FRANCE
DATAQUEST SARL
41, rue Ybry
92522 Neuilly-sur-Seine Cedex
France
(1)47.58.12.40
Telex: 630842
Fax: (01)46.40.11.23

JAPAN
DATAQUEST Japan, Ltd.
Taiyo Ginza Building
7-14-16 Ginza, Chuo-ku
Tokyo 104, Japan
(03) 546-3191
Telex: J32768
Fax: (03) 546-3198

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EUROPEAN MONTHLY REPORT

ESIS Code: Vol. IV, Newsletters

EUROPEAN SEMICONDUCTOR DIVISION

NOVEMBER MONTHLY REPORT

STATE OF THE INDUSTRY

Conditions in the semiconductor industry continue to remain disappointing, especially in the United States. Overall the U.S. economic situation remains extremely sluggish and unresponsive to economic stimuli. In addition, many of the end equipment industries are weak--the combined result of the strong U.S. dollar (since 1980) and the import onslaught. In many respects, the U.S. is entering an era not dissimilar to that in Europe a decade and a half ago.

There is no early respite in sight. The two fundamental ingredients for growth are just not there; that is a strong economy and a strong end-user demand or product driver.

In addition, the manufacturing shift to the pacific basin will not be reversed in the medium term--that in turn means that the product driving momentum for the semiconductor industry will also continue to shift eastwards.

And one further dampening factor affecting the overall industry growth is the applications gap. Today's new IC's are simply too comlex to be absorbed into new high growth applications at the same rate as in the past. It now looks increasingly sure that the historic 17-18 percent compound annual growth rate that the semiconductor industry has enjoyed since its inception will slow substantially to around 12-13 percent.

And finally--the industry is starting to mature. The industry shakeout/consolidation is in progress (see also ESD Thought for the Month in this issue).

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144/146 New Bond Street / London W1Y 9FD England / (01) 409-1427 / Telex 266195

1290 Ridder Park Drive / San Jose, CA 95131 / (408) 971-9000 / Telex 171973

Tables 1 through 4 give DATAQUEST's latest forecast for the regional and product consumption estimates for 1985 through 1987.

Table 1

ESTIMATED WORLDWIDE SEMICONDUCTOR CONSUMPTION BY REGION
(Percent change in U.S. Dollars)

	1985	1986	1987
U.S.	(26.9%)	6.4%	12.0%
Japan	(2.8%)	40.6%	19.4%
Europe	(1.8%)	14.8%	14.5%
ROW	(17.4%)	53.9%	37.4%
Total	(14.7%)	23.4%	17.7%

Table 2

ESTIMATED WORLDWIDE SEMICONDUCTOR CONSUMPTION BY REGION
(Billions of U.S. Dollars)

	1985	1986	1987
U.S.	$9.6	$10.2	$11.4
Japan	$8.6	$12.1	$14.4
Europe	$4.7	$5.4	$6.2
ROW	$1.9	$2.9	$4.0
Total	$24.8	$30.6	$36.0

Source: Dataquest
October 1986

Table 3

ESTIMATED WORLDWIDE SEMICONDUCTOR CONSUMPTION BY PRODUCT
(Percent changes in U.S. Dollars)

	1985	1986	1987
Total Semiconductor	(14.7%)	23.4%	17.4%
Integrated Circuit	(16.5%)	23.8%	21.1%
Total Bipolar	(21.1%)	18.1%	15.4%
Total MOS	(19.9%)	23.7%	28.7%
Total Linear	(3.2%)	28.6%	9.3%
Discrete	(7.6%)	19.0%	5.8%
Optoelectronic	(9.0%)	35.4%	9.6%

Table 4

ESTIMATED WORLDWIDE SEMICONDUCTOR CONSUMPTION BY PRODUCT
(Billions of U.S. Dollars)

	1985	1986	1987
Total Semiconductor	$24.8	$30.6	$36.1
Integrated Circuit	$19.0	$23.5	$28.5
Total Bipolar	$ 3.8	$ 4.5	$ 5.2
Total MOS	$10.4	$12.9	$16.6
Total Linear	$ 4.8	$ 6.1	$ 6.7
Discrete	$ 4.7	$ 5.6	$ 5.9
Optoelectronic	$ 1.2	$ 1.6	$ 1.7

Source: Dataquest
October 1986

OTHER INDUSTRY COMMENTS

Ford and Fiat in moves over Alfa--the promise of a major battle over the future of Alfa Romeo flared into life at the beginning of October and dominated the news for most of the month. It began with Ford making a firm proposal early in the month on the future of the troubled Italian-owned car manufacturer. IRI-Fimmeccania, the state holding company which is Alfa's major shareholder, has committed itself to giving a formal response by November 7th. The proposals are believed to have called for Ford acquiring initially a 20 percent stake in the loss-making company leading to 51 percent and management control within three years.

This bid was followed almost immediately by a counter bid from Fiat which is believed to have suggested a proposed new car company linking Alfa-Romeo and Fiat's Lancia subsidiary. It is also believed that Fiat would be prepared to take immediately a minimum 51 percent stake or even full ownership from the outset if desired. The plan is to create a company specializing in high performance prestige cars with the sporty, aggressive characteristics of the Alfa and the luxury comfort of Lancia competing against such rivals as Daimler-Benz, BMW, VW-Audi, Porsche, and Saab.

At the time of writing this report, no decision had been announced, though on balance, Fiat would seem to be the clear favourite.

U.S./Japan trade accord dominates news--again, during October, the much publicized and often criticised, U.S./Japan trade agreement dominated the press with the SIA (Semiconductor Industry Association) becoming increasingly isolated in its support for the agreement.

After the powerful American Electronics Association voiced its opposition in September, October saw another of the semiconductor industry's allies, SEMI (Semiconductor Equipment and Materials Institute), proclaim that it too believed that the deal was hurting its member companies. It believes that uncertainties over the impact of the deal has resulted in further delays in capital spending, just at a time when the equipment industry is struggling with a major recession.

And in Europe, the EEC publically attacked the deal citing that the agreement could have "hair-raising consequences for European consumers and companies". And to make the point more clearly felt, at the same time, the EEC has challenged the legality of the deal under the GATT (general agreement on tariffs and trade). The EEC believes that the pact may violate GATT's anti-dumping code, and European manufacturers fear it will lead to Japan and the United States carving up the World semiconductor market leaving them only the crumbs.

Even the agreement itself is under criticism by its supporters with complaints that it does not have enough teeth in it to force the Japanese companies to comply--several times the U.S. have already warned the Japanese on alledged pact violations.

And, of course, the legal way around the deal still remains--to manufacture in the United States, hence the present acceleration by Japanese companies to produce devices offshore, or in the case of Fujitsu, to buy an existing U.S. semiconductor facility--Fairchild. (See also ESD Thought for the Month in this issue).

OCTOBER INDUSTRY HIGHLIGHTS

Amstrad report £55 million profit surge to $75.3 million, an increase of 273 percent on the £20.2 million announced one year ago. At the same time sales jumped by 123 percent to £304 million from £136 million. Much of the success was attributed to the launch of its PCW word processor a year ago. The group is also strongly represented in the video and audio markets where it has moved this year into compact discs, and has a range of home and personal computers, as well as its word processor and DMP 2000 printer.

Volkswagen anticipates record sales of 2.8 million vehicles in 1986 beating its previous 1979 record by 300,000. Worldwide daily production is currently more than 12,000 cars in the Volkswagen group.

Nixdorf issues rights issue to raise DM640 million bringing to nearly DM2 billion the funds that the company has raised in the capital markets in the past two years. Nixdorf plans the money to be used to fund new investment in plant and products and to help ease the group's interest burden which hovers at around DM100 million per year. The company has just won a breakthrough order in the U.S. market beating IBM to a $100 million order for 14,000 point of sale terminals and 500 computer systems for the Montgomery Ward retail chain.

Philips sets up Irish ASIC center, Irelands first commercial integrated circuit design company, representing a $2.5 million investment in ASIC design and software development. The new company, silicon and software systems, will be headed by Professor Whelan of Trinity College, Dublin, and a former employee with Philips in Eindhoven. Areas of activity will be ASIC design for image and digital signal processing, and tools for ASIC design.

Philips forges U.S. compact disc link with R R Donnelley and Sons, the largest printing company in the U.S. The two companies have launched a 50:50 joint venture to provide production services to publishers wanting to use compact disc interactive (CD-I) technology. The venture, called Optimage Interactive Services, is aimed at exploiting the rapid development of the two-way use of compact discs for information and entertainment, especially in the home. CD-I allows the user to select pictures, sound, data, and text from the information that is optically stored and read by a laser on the compact disc.

Test center planned for Europe's Information Technology, following the announcement by eight of Europe's leading information technology companies to set up common testing facilities that will validate compatible operating standards for a wide range of data processing and office automation equipment. By adapting a common standard, the European groups will be able to approach customers with products that will be compatible with equipment from other European manufacturers, a situation which will generate more open competition amongst them, but will also make it easier for clients to choose non-IBM products. The agreement embraces Bull, ICL, Nixdorf, Olivetti, Siemens, STET, Philips, and Thomson. All eight are members of Europe's Standards Promotion and Applications Group (SPAG) which was set up in March 1983 to propose common communications protocols to help customers build their information systems with products from different vendors.

IBM and Intel in technology pact which gives IBM the right to incorporate Intel's microprocessor and peripheral chip design into customized chips. IBM is expected to produce its proprietary version of the industry standard microprocessors to build a new generation of personal computers which cannot easily be copied by its competitors. The agreement also provides Intel with a major boost into the market for ASICs. Under the terms of the agreement, Intel will acquire the rights to IBM's gate array technology and in addition, IBM will provide Intel with a library of pre-designed cells. These will be combined with Intel's own chip designs in a semicustom macrocell offering.

Saint Globain set to double profits to more than FFr600 million for the six months compared with FFr325 million for the same period in 1985. Turnover rose from FFr31 billion to FFr38 billion. The profit improvement is in line with earlier forecasts. Saint Globain is one of the earlier candidates in France's privatization program.

Telefonica to sell cable venture stake as part of a new policy by the Spanish telephone monopoly towards its industrial holdings. Telefonica has a 49 percent stake in the joint venture--Cables de Comunicaciones--with General Cabel of the U.S. Last month, Telefonica confirmed it was holding talks with Ericsson of Sweden on pulling out of Intelsa, a company producing telephone exchanges and other equipment, in which the Spanish partner similarly holds 49 percent.

Jaguar unveils new XJ6 after £200 million investment program. The cars are planned to go on sale in the U.S. next spring and will be priced competitively with other models in that market. The company also expects to double its penetration in West Germany, the biggest luxury car market in Europe. The new cars make extensive use of electronics.

Earnings rise at Texas Instruments were reported following improved sales in the third quarter. At the same time, however, TI announced that it will lay off 1,000 workers in its efforts to cut costs further. Net earnings for the third quarter were $14 million compared to losses of $83 million for the same period last year.

Airbus arranges £2 billion sale of 100 aircraft to Northwest Airlines of the U.S. The agreement covers the latest A320-200 airliner and is one of the biggest airline orders in U.S. aviation history. The total value of the contract could reach £2.2 billion including spares and support equipment. The A320-200 is the first of the new generation of aircraft for the 1990s replacing existing fleets which are up to 25 years old. A possible competitor for the new airbus is Boeing 7J7 which is still on the drawing board. The new 150 seat airbus is due to make its first flight next Spring and offers sharply lower fuel consumption. Despite this success, worries over the financial outlook for Airbus Industrie have prompted the West German government to push further the idea of collaboration between Airbus and McDonnell Douglas of the U.S.

Japan faces anti-dumping suit within the EEC over ICs following a complaint shortly to be lodged with the European Commission. The dumping action, which is in its final stage of preparation, is being bought by the European Electronics Components Manufacturers Association (EECA). The products involved are the same kinds of memory IC as are the subject of a trade agreement signed last summer between the U.S. and Japan. Once filed, the IC anti-dumping complaint would follow a number of similar cases bought against the Japanese in the European Commission. The last two concerned Japanese imports of plain paper copiers and electronic typewriters. In both cases, the Commission found in favour of the European producers.

Tokyo fears more EEC curbs in the light of the rapid rise in Japan's trade surplus with the community so far this year. In the first nine months the surplus was $13 billion compared with $11.4 billion in the whole of 1985. The government is concerned that the expected downward trend has still not appeared and there are fears that the surplus for the full year could reach $17 billion.

Brussels to seek urgent ruling on Tokyo drinks tax under the general agreement on tariffs and trade (GATT) on alledged unfair Japanese taxation of imported wines and spirits in a test case intended as part of a deliberate escallation of European trade pressure on Japan. The EEC believes that 1985 exports at $170 million could have been doubled without tax and tariff systems penalizing products more expensive than local varieties. This is an area in which the competitiveness of EEC producers, both of wines and spirits, could not be questioned and European charges of discrimination are well founded.

Profits collapse at Fuji Electric, the leading Japanese electrical machinery maker in which Fujitsu and Siemens each have minority stakes. Profits have fallen 46 percent for the six months ending September to Y2.02 billion. For the full year, the company is predicting a 21 percent drop in pre-tax profits to Y4.5 billion.

U.K. market for car phones tops 100,000 installed base, indicating that the market is experiencing explosive growth. The pace of market growth has been fuelled by a mutually re-enforcing combination of technological improvement, falling prices, and rising volume. On the technology side, the industries ability to meet new challenges was demonstrated recently with the launch of the new phone by British Telecom Mobile, which dials a number in response to a spoken word. Predictably the declining prices is being accompanied by a steady rise in sales volume as well as increased competition. Ownership of cellular phones is also steadily expanding across a broader social base. Initially it was thought that the system would appeal mostly to professional people and senior executives, but it has swiftly caught on in a big way among managers at the sharp end; individuals running their own businesses, building sites managers and contractors who spend a large part of their time out of the office, and taxi drivers, all of whom use the device as a productivity tool.

Hitachi CD ROM disc system used by U.K. post office to store 24 million addresses such that anyone can be found from keyed in partial information in less than two seconds, up to twenty times faster than with conventional paper methods. All of the addresses can be stored on a single disc. A computer based search system looks for the complete name and address of a company for example if only one or two words in the name or address are known. The complete entry is then displayed on a workstation screen.

Glen Dimplex pays $120 million for U.S. kitchen appliance manufacturer, Hamilton Beach. The deal will more than double Glen Dimplex, Britain's largest domestic heating and small appliance company, annual revenues to £300 million and increase the workforce from 2,800 to over 4,000. It will also broaden the group's engineering range from its present base in heating to include motor driven appliances such as food processors. It also launches the privately owned company firmly into the biggest appliance market in the World with two factories in North Carolina and access to over 50,000 retail outlets.

Digital Equipment plan to create 1,000 jobs in the U.K. by next June because of the continuing expansion of the market for its VAX series of minicomputers. The job creation underlines the steady growth of the company since the VAX series began. About 100 of the new jobs will be on the production lines at the Ayr plant where DEC has its main high volume manufacturing unit for the VAX computer system in Europe. A further 120 will be in the R&D center attached to DEC's headquarters at Reading.

Intel reported steep third quarter losses and announced it will abandon its efforts in bubble memory technology. Third quarter losses totaled $114 million compared with a net loss of $4 million in the same quarter last year. Revenues rose to $324 million from $312 million in the third quarter of 1985. Losses for the first nine months of 1986 totaled $157 million compared with earnings of $16 million last year. Revenues for the period were $909 million down from $1 billion a year ago. Simultaneously Intel announced that it will phase out its bubble memory business and is actively seeking a buyer. About 240 jobs may be cut as a result of this action. Bubble memories failed to find widespread use as the cost of alternative technologies has fallen over the past few years. Intel said losses for the fourth quarter were higher than expected due to manufacturing problems encountered during the quarter.

Oki seeks factory in Europe in an attempt to relieve mounting trade friction between Japan and the EEC. The company is understood to be considering a site in West Germany, Britain, or France to produce printers in Europe. The EEC recently imposed anti-dumping duties on Japanese photocopiers, a move which has prompted most big copier makers to establish or boost production in Europe. Many Japanese executives fear that the EEC may impose a similar duty on printers.

Philips and PolyGram form company to make sound and vision discs. The company, European Interactive Media (EIM) is seeking joint ventures with publishers and video companies with materials suitable for convertion to the compact disc interactive (CD-I) format. EIM is the European counterpart to a company already set up by Philips and PolyGram in the U.S. for a similar purpose. In a similar move Pergamon, the publishing company chaired by Mr Robert Maxwell, announced a new CD ROM information publishing venture, called Compact Solution. The company aims to provide a one-stop shop for compact disc products for publishers and information providers. The first product to be put on compact disc will be the ten volume International Encyclopaedia of Education from Pergamon Press.

U.S. technology export curbs cuts electronics equipments sales at the expense of Japanese and other foreign competitors. The controls involve the licensing of a wide variety of exported technologies and products. They are intended to curb access by communist countries to technology which could be put to military use. In an effort to circumvent the controls, several leading electronic manufacturers are forced to redesign the products to incorporate fewer U.S. components. In addition complying with the controls is said to add about 25 percent to normal adminstrative overheads.

EEC details Ecu800 million telecom program aimed at developing advanced telecommunications systems in the community. Launched last December, the program called Research in Advanced Communications from Europe (RACE) has now nearly completed its first Ecu400 million definition phase, during which experts have been working out aims and objectives. The program is intended to create a common European basis for broad-band communications, in which voice, data, text, and pictures can be combined into one transmission.

Ford to invest £1.5 billion in the U.K. over the next five years. The investment includes £510 million for vehicle development and £550 million for engines and transmissions. Since 1979, the group has spent £1.6 billion in the U.K. Britain will become the centre of Ford's engine technology in Europe with more than 80 percent of British engine production exported.

Thomson first half profits surge to FFr1.2 billion compared with FFr336 million in the first half of 1985. Profits for the whole of 1986 were estimated at FFr2 billion compared with FFr960 million last year. The figures confirm the companies recovery after losses totaling nearly FFr3 billion between 1981 and 1983. First half year sales rose by 3.5 percent to FFr15.8 billion with the second half year expected to be even stronger largely as the result of its large Saudi Arabian defence contract.

NEC to produce ICs in Scotland, the first full production line for semiconductors by any Japanese company in Europe. The new facility, currently being constructed at a cost of more than £80 million, is expected to create between 400 and 500 jobs over the next three years. It will be built alongside a four year old plant which employs about 200 people assembling semiconductors from piece parts shipped in from NEC's overseas operations. Part of the reason to produce ICs in Scotland is because of the sharp appreciation of the Yen against other currencies in recent months. The decision comes however against a background of rising anti-dumping sentiment against Japanese IC manufacturers.

Hitachi cuts pay 5 percent for six months for 6,800 management level employees, effective immediately. The action, which reportedly is tied directly to a fall off in performance by the corporation's semiconductor operations, came after Hitachi said it expects a 40 percent decline in earnings this fiscal year. In imposing the wage reductions, Hitachi's board of twenty-four directors took a 10 percent cut in their own salaries. The pay cut is also intended as a psychological ploy to impress upon workers the severity of the current recession in both the semiconductor and computer businesses. Last April, Mitsubishi skipped scheduled pay increases for executives higher than the department manager level.

Samsung to set up in the U.K. and is planning to spend £25 million on developing a plant in Cleveland, becoming the first South Korean electronics company to manufacture in the U.K. The decision to invest in the U.K. reflects increased interest by large Korean groups in manufacturing overseas. Samsung intends to have about 20 percent of its products made overseas in the next five years, up from about 5 percent currently. This would reduce trade frictions with the West and improve Korea's access to Western technology. The project is understood to be in three phases. At first the plant will make microwave ovens followed by video recorders and subsequently colour televisions. Samsung's only other investment in Europe is in Portugal where a joint venture makes colour televisions, some of which are imported to the U.K.

Earnings plunge at NEC and Mitsubishi Electric primarily as a direct result of the surge in the Yen's value. NEC's pre-tax profits were down 67 percent to Y20.1 billion with net profits of Y15.9 billion down 50.3 percent. The earnings fall was also attributed to the drop in semiconductor prices. Half year sales rose by 6.6 percent to Y1,100 billion helped by steady shipments of computers both at home and abroad. NEC is amongst the few electronics companies which have reported a sales gain for the period, despite their relatively heavy dependence on exports for their income. At Mitsubishi Electric, half-year pre-tax profits plunged by 60.2 percent to Y11.3 billion and net profits were down by 44 percent to Y6.9 billion. Half-year were Y881 billion down 0.2 percent with exports down 14 percent. Sales of semiconductors, car components, wide screen television sets, and video cassette recorders all increased in the period.

French disc venture fails following run of losses at Alcatel-Thomson-Gigadisc, one of the largest venture capital operations ever launched in France. The venture, which was under the control of the Alcatel communications group, has just been wound up after plunging heavily into the red. The company was expected to lose FFr65 million this year on sales of FFr45 million, after an initial investment of about FFr200 million. The company has been losing money consistently since it was launched at the end of 1984. The company sought to manufacture and market worldwide an optical disk and a digital optical disk drive called Gigadisk for the mass storage of data. The company's products remained more expensive however than the conventional magnetic tape technology.

Japan raises European car sales with a record one million new cars sold in the 17 major West European markets in the first nine months of 1986, nearly 25 percent from the same period in 1985. The two biggest groups, Toyota and Nissan, both overtook BMW, the specialist West German producer, in the first nine months. The statistics provide clear evidence that the Japanese have substantially increased exports to Europe because they face considerable difficulties in the U.S., their biggest export market, following the steep rise in the value of the Yen against the dollar. West Germany has born the brunt of the Japanese attack where car sales have risen 30 percent in the first nine months of 1986 compared with 1985. The Japanese Ministry of International Trade and Industry (MITI) urged car manufacturers in June to cut the growth of exports to Europe, but this warning has had no effect on registrations as of the end of September.

Japan ready to bow to U.S. pressure on machine tool exports. The voluntary restraints, expected to be announced shortly in Washington, would mark the second time this year that Japan has agreed to U.S. demands for export controls on high technology equipment. This summer Japan agreed to monitor costs and prices of semiconductor exports in an effort to prevent dumping. In May, President Reagen asked Japan, West Germany, Taiwan, and Switzerland to limit voluntarily their sales to the U.S. of six categories of machine tools for the next five years. His request was in response to a 1983 petition by the national machine tool builders associations which requested quotas on the grounds that the industry was vital to U.S. national security.

Swiss wafer fab to upgrade to 6-inch CMOS wafers as part of an investment program to upgrade the wafer fab of Micro Electronic Marin (MEM) to a sufficient capability to handle the silicon fabrication requirements of the CAD which MEM licenses from U.S. ASIC vendor VLSI Technology. The investment is designed to bring the wafer fab up to a 2-micron double layer metal capability. The present facility is only capable of 4-micron lithography. First output is scheduled for the end of 1987 with full production early in 1988. The factory will have a capability of 1,500 wafers per week. The building will also house a design centre for VLSI Technology's European customers.

Sinclair firm set to sign memory deal with two Far Eastern semiconductor companies to use state-of-the-art silicon technology to make large capacity solid state mass memories for business computers. The company, Anamartic, plans to make memories that consist of stacks of uncut semiconductor wafers packaged so that they will plug into the slots for half-height Winchester disk drives. The use of wafer scale integration will make them 10 to 100 times faster than the equivalent Winchester disk drive. Anamartic will be testing the market next May when it launches a 5Mbyte product. This will be based on a stack of 10 4-inch wafers made by STC Semiconductors consisting 316 16K DRAM die. In 1988 the company plans to market a large capacity 160Mbyte device using 6-inch wafers. The target is for a 20Mbyte wafer, each wafer consisting of about 200 1Mbit DRAM chips.

Hitachi down 55 percent at mid-year having reported a larger than expected fall in pre-tax profits down to Y45.6 billion. Net profits declined 47 percent to Y26.5 billion on turnover which, at Y1,494 billion, was down 5 percent. The poor performance was blamed on the negative effects from the Yen's steep appreciation of Hitachi's exports, and slow sales of consumer electronic products and semiconductors. For the year as a whole, Hitachi foresees a much improved export climate but weakening domestic demand. The company is expected to incur an exchange loss of Y90 billion for the full year for which pre-tax profits are projected at Y92 billion, down 42 percent, with net profits of of Y64 billion, down 27 percent. Turnover is expected to emerge, at Y2,900 billion, some 3 percent below the previous year.

Bull forecasts earnings doubled to FFr220 million confirming its recovery after a series of heavy losses. Bull turned in losses of FFr489 million in 1984 and of FFr625 million in 1983. The improved financial situation was one of the main reasons why the government decided to reconfirm Mr Jacques Stern as Chairman of the group. Mr Stern was among twelve chairmen of nationalized groups appointed by the previous administration that were reconfirmed in their jobs by the present government last July.

Telefonica reviews CGE/ITT joint venture and is likely to withdraw its application for a 10 percent stake. The chief stumbling block has proved to be the future of Standard Electrica, the Spanish subsidiary of ITT in which Telefonica has a 20 percent stake, and of Marconi, its sister company. Both companies are undergoing costly financial reconstruction operations and CGE has warned that the Franco/American joint venture will not shoulder the costs. CGE, which will take the leading role in the venture, has also made clear to Telefonica that neither Standard Electrica nor Marconi will play any significant part in the production strategy of the CGE/ITT group.

Control of CGCT remains in doubt following the U.S. intervention to promote AT&T's move into France, a move the French and West Germans are trying to prevent. Washington is threatening to impede a U.S. sales drive by Siemens, the West German electronics group, which is believed to have received substantial backing from Bonn in a counterbid for CGCT. The U.S. Federal Communications Commission, the regulatory body for the U.S. telecommunications industry, recently sent a letter to the seven large Bell regional operating companies asking for details of purchases from Siemens and possible future deals. The eventual winner of the CGCT competition will gain a 16 percent foothold in the French public telephone exchange market. Although AT&T has been negotiating over CGCT for the past two years, Siemens has emerged in recent months as a serious contender, with Ericsson as a challenger in the background.

EUROPEAN SEMICONDUCTOR DIVISION ACTIVITY REPORT

October saw the republication of the European market estimates database in the European Semiconductor Industry Service binders. The few remaining sections will be shipped during November. All the published data will then be in line with the current revision level (05) of the DESTINY Database.

A preliminary analysis was also started on the telecommunications end-user market in Europe (in conjunction with the European Telecommunications Division) which when completed, will form a cornerstone for the European Semiconductor Application Market Service.

Research was also undertaken for the 1986 preliminary marketshare estimates which, as usual, will be published on January 2nd, 1987 as a newsletter. Looking ahead to November, the planned activities include finalizing the provisional marketshare estimates, reviewing our quarterly market consumption estimates (and adjusting as necessary), as well as attending Electronica. DATAQUEST will in fact be providing the keynote address at the 12th International Conference on Microelectronics at this event.

Also in November, we are anticipating moving offices. We have now substantially outgrown our present facility in New Bond Street and plan to take up occupancy in Centrepoint, one of London's landmark office blocks, from November 29th. For full details, please watch for further announcements.

THOUGHT FOR THE MONTH

"Fujitsu to acquire 80 percent of Fairchild"

"Fujitsu and Hitachi pursue original architectures 32-bit MPU joint venture".

Either of these announcements in their own right would deserve significant commentary--that both occurred within days of each other is even more profound.

In last month's thought for the month, you will recall I concentrated my editorial on the present metamorphosis of the worldwide semiconductor industry--if anyone was still in doubt that the industry shakeout is currently underway, then the significance of these two announcements should quash all doubts.

The Fujitsu acquisition of Fairchild represents a strategic move to create a global company that will be a dominant player in the 1990s. By joining forces, Fujitsu (number 7 in 1985) and Fairchild (number 13) jump into fifth place in the 1985 worldwide semiconductor rankings with combined revenues of $1.5 billion. Four out of the top six companies are now Japanes-owned. Furthermore, preliminary estimates of the 1986 worldwide marketshare estimates indicate that the top four semiconductor companies worldwide in 1986 will be Japanese-owned.

In two critical product areas (ECL and gate arrays), the combined strength of the two companies is awesome. Together, the new company would be the largest supplier of ECL logic devices with just under 50 percent Worldwide marketshare--a product critical in the emerging super computer market currently comprising of Amdahl, Cray, Control Data, Digital Equipment, Fujitsu, Hitachi, IBM and NEC.

Furthermore, this arrangement will enable Fujitsu to sell its products Worldwide under the Fairchild lable and will allow Fairchild to enter the Japanese market under Fujitsu. It will also enable Fujitsu to circumvent the U.S.-Japan semiconductor agreement by producing those devices covered by the agreement at Fairchild's plants in the U.S.

The significance of the disclosure by Fujitsu and Hitachi that they will be using proprietary architectures in their 32-bit microprocessor family soon to be announced is equally profound. Hitachi is going a step further by creating an entirely new series of proprietory microprocessors from eight to 32-bits.

Designated the H-series, Hitachi's new MPU line will comprise 100 percent CMOS devices using 1.0 to 1.3 micron design rules. The 8-bit MPUs will be aimed at the office equipment market whilst the 16-bit devices will be targeted at the wordprocessor, laser printer, robotics, and machine tool control market. The 32-bit MPU is expected to operate at 6 million instructions per second (MIPS) and will support UNIX and TRON (a real time operating system nucleus) developed in Japan. Samples are expected during 1987.

The joint development program will overlap individual microprocessor development programs ongoing at each company. Presently Hitachi is second-source for the Motorola 68000 family and Fujitsu for the Intel iAPX 86 series. At present, neither Intel nor Motorola have licensed their respective Japanese second-sources for the 32-bit microprocessor.

This development could have significant impact on the 1990's microprocessor market. TRON is currently promoted by eight Japanese companies (Fujitsu, Hitachi, Matsushita, Mitsubishi, NEC, NTT, Oki, and Toshiba) to accelerate the development of proprietary 32-bit microprocessor technology and alternative operating systems for next generation microcomponents, especially in the application areas of office automation equipment, real-time industrial systems, and networking with distributed multiprocessors. Being coded in C language, TRON will be hardware (MPU) tolerant.

Given this level of committment, it does not take too much imagination to foresee an Intel/Motorola free 32-bit microprocessor World in Japan in the not too distant future with alternative hardware readily available from local Japanese sources. In any microprocessor system, software is the key to success, and that is the focus now of Japan's efforts. Once the software is in place, the hardware follows naturally. Given then this strong local base, it does not stretch the imagination much to imagine the 32-bit microprocessor market dominated by proprietory Japanese architecture ICs towards the end of the next decade.

Malcolm Penn

FUTURE EVENTS DIARY

SEMICONDUCTOR CONFERENCES

- NOV 10, Semiconductor User and Application Conference
  Sheraton Harbor Island Hotel, San Diego, California
  "Military IC Procurement"

- FEB 4-6, Semiconductor User and Applications Conference
  Saddlebrook Resort, Tampa, Florida
  "Partnering in a Global Economy"

- APRIL 13-16, Japanese Semiconductor Industry Conference
  Miyako Hotel, Kyoto, Japan
  "VLSI Impact on Future Society"

- JUNE 3-5, European Semiconductor Industry Conference
  Madrid, Spain

SPECIAL REPORTS

- Korean Semiconductor Industry Report--available now
- IC Update '87--available now
- GaAs Market Update--available fourth quarter 1986
- DSP Market Update--fourth quarter 1986
- Taiwan Semiconductor Industry Report--available fourth quarter 1986
- Hong Kong Semicounductor Industry Report--available fourth quarter 1986
- China Semiconductor Industry Report--available fourth quarter 1986
- IC Start ups--available fourth quarter 1986

NEWSLETTER SUBSCRIPTIONS

- IC ASIA
- IC USA (available in English and Japanese)
- European Monthly Report

ON-LINE SERVICES

- Semiconductor Group Database: History, Forecast, Market Share and Geograhic Data
- SIA Database: Bluebook, Flash Report, Forecast

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Dataquest

a company of The Dun & Bradstreet Corporation

1290 Ridder Park Drive
San Jose, California 95131
(408) 971-9000
Telex: 171973
Fax: (408) 971-9003

Sales/Service offices:

UNITED KINGDOM
DATAQUEST UK Limited
144/146 New Bond Street
London W1Y 9FD
United Kingdom
(01) 409-1427
Telex: 266195
Fax: (01) 491-2790

GERMANY
DATAQUEST GmbH
Rosenkavalierplatz 17
D-8000 Munich 81
West Germany
(089) 91-1064
Telex: 5218070
Fax: (089) 91-2189

FRANCE
DATAQUEST SARL
41, rue Ybry
92522 Neuilly-sur-Seine Cedex
France
(1)47.58.12.40
Telex: 630842
Fax: (01)46.40.11.23

JAPAN
DATAQUEST Japan, Ltd.
Taiyo Ginza Building
7-14-16 Ginza, Chuo-ku
Tokyo 104, Japan
(03) 546-3191
Telex: J32768
Fax: (03) 546-3198

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EUROPEAN RESEARCH NEWSLETTER

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1986-36

PRELIMINARY 1986 MARKET SHARE ESTIMATES

SUMMARY

Dataquest's preliminary 1986 estimates of European semiconductor revenue for the 25 leading European, U.S., and Japanese suppliers totals US$4,768 million, compared to an estimated $4,110 million in 1985. This shows a growth of 16 percent. These 25 companies accounted for approximately 87 percent of the $4,720 million market in 1985 and should improve this share to 88 percent in 1986.

In local currencies, however, the revenue growth of the 25 companies shows a different picture. In terms of local currencies, the estimated 1986 revenue of the leading 25 suppliers declined approximately 6.1 percent against 1985 revenue. The phenomenon of the exchange rate tends to mask the real growth of the European suppliers that, on average, derive approximately 66 percent of their total worldwide semiconductor revenue in Europe.

During 1986, all European currencies strengthened against the U.S. dollar (see ESIS Volume IV, "Exchange Rate Quarterly Newsletter," for further details).

Dataquest's complete 1986 European market share estimates are scheduled for publication in May 1987.

SEMICONDUCTOR SUPPLIERS

Table 1 shows Dataquest's estimates of the 1986 IC, discrete, and optoelectronic revenues in Europe for the leading 25 suppliers. Of these 25 companies, 9 are European-based, 12 are U.S.-based, and 4 are Japanese-based. Table 2 compares the 1985 and 1986 estimated European semiconductor revenues of these companies.

Japanese suppliers continued to lose market share in 1986. Dataquest estimates that, overall, Japanese semiconductor revenue in Europe in 1986, at $612 million, declined as a percentage of the total European market to 11.2 percent compared to 11.3 percent in 1985.

144/146 New Bond Street / London W1Y 9FD United Kingdom / (01) 409-1427 / Telex 266195
1290 Ridder Park Drive / San Jose, CA 95131-2398 / (408) 971-9000 / Telex 171973

The penetration of Japanese companies in the bipolar digital, linear, and discrete markets improved slightly but their market share successes still remain almost exclusively in the MOS IC arena. In 1986 we estimate that 83.3 percent of the total revenues derived in Europe by Japanese companies was in MOS integrated circuits.

European-based companies gained approximately 4 percent market share from the Japanese and U.S.-based suppliers, which increased their market share to approximately 42 percent.

The U.S. and Japanese suppliers' continued loss of market share can be attributed to the continuing decline in the value of the commodity memory and logic markets, where the U.S. and Japanese companies generated much of their revenue in 1984 and 1985, and where European companies have not been major participants. The bipolar logic market, which is dominated by major U.S. companies, increased an estimated 10 percent in U.S. dollars in 1986, which in local currency terms reflects a decline of 12 percent compared to 1985. The MOS memory market, which is dominated by Japanese and U.S. companies declined by an estimated 2 percent in U.S. dollars reflecting still further the pricing pressures in a shrinking market addressed by vendors with excess capacity. It is because the European companies have less dependence on these products and have enjoyed higher levels of activity in the products that grew in 1986, that they were able to gain market share.

Table 3 shows Dataquest's estimates of the 1986 IC, discrete, and optoelectronic worldwide revenue for the leading 10 European suppliers, and Table 4 compares 1985 to the 1986 estimated worldwide revenue of these companies.

Dataquest's preliminary 1986 estimates of worldwide semiconductor revenue for the 10 leading European suppliers are $3,216 million compared to an estimated $2,654 million in 1985. This shows a 21.2 percent increase compared with our estimated 23.4 percent increase for the worldwide semiconductor market. These companies accounted for approximately 10.7 percent of the $24,823 million market in 1985, and decreased to 10.5 percent in 1986.

IC SUPPLIERS

Preliminary Dataquest estimates for the 15 leading IC suppliers in Europe in 1986 are shown in Table 5. Collectively, these companies show an estimated 15.3 percent IC revenue growth in 1986 compared to 1985, and represent approximately 79 percent of the estimated 1986 market. The major revenue gains, both in U.S. dollars and local currencies, were made by Toshiba, Philips-Signetics, Thomson, Siemens, and SGS Semiconductors. All other companies in the table can be considered to have lost market share.

BIPOLAR DIGITAL SUPPLIERS

Preliminary Dataquest estimates for the 15 leading bipolar IC suppliers in Europe in 1986 are shown in Table 6. The revenue estimates for bipolar memories and bipolar logic are shown in Tables 7 and 8 respectively.

We estimate that in a 1986 European bipolar digital market of $720 million, Texas Instruments supplied approximately 25 percent of the market. Philips-Signetics, the second largest bipolar digital supplier, supplied approximately 13 percent of the market. Monolithic Memories, National Semiconductor, and Siemens showed the most significant growth in this technology.

MOS SUPPLIERS

The 15 leading 1986 MOS IC suppliers in Europe accounted for approximately 79 percent of the estimated market, as shown in Table 9. This represents a 2 percent decline in market share from 1985. The dominance of the European MOS market changed hands in 1986. Intel was pushed into second place in this market sector by Philips-Signetics, which achieved approximately 11 percent market share, having previously held 8.3 percent of the European MOS IC market in 1985. The highest growth in this market sector, however, was achieved by Thomson at 73.3 percent followed by Philips-Signetics, Toshiba, National Semiconductor, SGS Semiconductors, and ITT, all of which exhibited above average market growth.

Tables 10, 11, and 12 show Dataquest's estimates of 1985 and 1986 revenue for leading suppliers of European MOS memory, MOS microprocessor, and MOS logic, respectively. Tables 13 and 14 show Dataquest's estimates of 1985 and 1986 European NMOS and CMOS revenues, respectively, for the leading suppliers.

LINEAR SUPPLIERS

Dataquest estimates that the 1986 European linear IC market reached $1,086 million, or approximately 27 percent of the total IC market. As shown in Table 15, the 15 leading 1986 linear suppliers in Europe accounted for approximately 91 percent of the market in 1986, an increase from approximately 89 percent in 1985. The major supplier, Philips-Signetics, remained unchanged with approximately 19 percent market share, compared to 15 percent market share held in 1985. Both Texas Instruments and National Semiconductor lost significant market share allowing SGS Semiconductors to move into third place and Siemens into fifth place.

In 1986, the European linear IC market was one of the stronger sectors, growing 21.5 percent in U.S. dollar terms from its 1985 level. This compares with the overall European total semiconductor and IC markets, which, in U.S. dollar terms, grew 15.3 percent and 14.2 percent, respectively.

DISCRETE SUPPLIERS

Table 16 shows our preliminary estimates of 1985 and 1986 European discrete revenues for the 16 leading suppliers. Collectively, these 16 suppliers accounted for approximately 90 percent of the total discrete market, an increase from 88.7 percent in 1985. As can be seen from the table there is only one Japanese-owned company among the leading suppliers. Philips-Signetics extended still further its market leadership with approximately 20 percent market share, leaving Motorola in second place with approximately 13 percent market share. Nine of the 16 leading suppliers are European-owned companies, accounting for approximately 59 percent of the total European market.

Optoelectronic Suppliers

Table 17 shows Dataquest's preliminary estimates of the 1986 European optoelectronic revenues, compared to those achieved in 1985, for the 15 leading suppliers. Siemens lost its leadership position to Telefunken Electronic and was beaten into third place by Hewlett-Packard. The European-based suppliers exhibited an overall market strength in optoelectronic with approximately 53 percent share of the total European market.

EXCHANGE RATES

Table 18 lists the 1985 and 1986 exchange rates used in compiling the attached market share estimates.

Peter Savage
Byron Harding

Table 1

ESTIMATED 1986 EUROPEAN REVENUES OF 25 LEADING SUPPLIERS
(Millions of U.S. Dollars)

Company	IC	Discrete	Opto	Total
Philips-Signetics	$549	$228	$25	$802
Signetics	$109	$ 0	$ 0	$109
Texas Instruments	$448	$ 27	$13	$488
Motorola	$275	$146	$ 4	$425
Siemens*	$192	$125	$40	$357
Thomson**	$198	$101	$ 3	$302
SGS Semiconductors	$192	$ 52	$ 0	$244
National Semiconductor	$233	$ 2	$ 1	$236
ITT	$115	$100	$ 0	$215
Intel	$214	$ 0	$ 0	$214
NEC	$193	$ 4	$ 1	$198
AMD	$172	$ 0	$ 0	$172
Telefunken Electronic	$ 52	$ 68	$44	$164
Hitachi	$151	$ 6	$ 3	$160
Toshiba	$ 82	$ 20	$ 8	$110
Fairchild	$ 95	$ 7	$ 0	$102
RCA	$ 64	$ 15	$ 6	$ 85
Plessey	$ 67	$ 0	$11	$ 78
Fujitsu	$ 70	$ 0	$ 0	$ 70
Ferranti	$ 53	$ 13	$ 0	$ 66
Analog Devices	$ 65	$ 0	$ 0	$ 65
Monolithic Memories	$ 48	$ 0	$ 0	$ 48
Hewlett-Packard	$ 0	$ 5	$41	$ 46
Semikron	$ 0	$ 43	$ 0	$ 43
Matra-Harris	$ 40	$ 0	$ 0	$ 40
Harris	$ 38	$ 0	$ 0	$ 38

*Includes Litronix
**Includes Mostek

Source: Dataquest
January 1987
Ref. 0187-06P

Table 2

ESTIMATED 1986 VERSUS 1985 EUROPEAN SEMICONDUCTOR REVENUES OF
25 LEADING SUPPLIERS
(Millions of U.S. Dollars)

Company	1985	1986	Annual Growth
Philips-Signetics	$596	$802	34.56%
Signetics	$100	$109	9.00%
Texas Instruments	$468	$488	4.27%
Motorola	$389	$425	9.25%
Siemens*	$270	$357	32.22%
Thomson**	$240	$302	25.83%
SGS Semiconductors	$201	$244	21.39%
National Semiconductor	$218	$236	8.26%
ITT	$185	$215	16.22%
Intel	$212	$214	0.94%
NEC	$174	$198	13.79%
AMD	$174	$172	(1.15%)
Telefunken Electronic	$133	$164	23.31%
Hitachi	$169	$160	(5.33%)
Toshiba	$ 72	$110	52.78%
Fairchild	$105	$102	(2.86%)
RCA	$ 80	$ 85	6.25%
Plessey	$ 66	$ 78	18.18%
Fujitsu	$ 64	$ 70	9.38%
Ferranti	$ 65	$ 66	1.54%
Analog Devices	$ 51	$ 65	27.45%
Monolithic Memories	$ 42	$ 48	14.29%
Hewlett-Packard	$ 39	$ 46	17.95%
Semikron	$ 30	$ 43	43.33%
Matra-Harris	$ 36	$ 40	11.11%
Harris	$ 31	$ 38	22.58%

*Includes Litronix
**Includes Mostek from 1986

Source: Dataquest
January 1987
Ref. 0187-06P

Table 3

ESTIMATED 1986 WORLDWIDE SEMICONDUCTOR REVENUES
10 LEADING EUROPEAN SUPPLIERS
(Millions of U.S. Dollars)

Company	IC	Discrete	Opto	Total
Philips-Signetics	$1,041	$288	$27	$1,356
Signetics	$ 530	$ 0	$ 0	$ 530
Thomson*	$ 293	$138	$ 5	$ 436
Siemens**	$ 216	$133	$80	$ 429
SGS Semiconductors	$ 291	$ 79	$ 0	$ 370
Telefunken	$ 82	$ 84	$53	$ 219
Plessey	$ 98	$ 0	$14	$ 112
Ferranti	$ 78	$ 17	$ 0	$ 95
Inmos	$ 80	$ 0	$ 0	$ 80
Semikron	$ 0	$ 72	$ 0	$ 72
Matra-Harris	$ 47	$ 0	$ 0	$ 47

*Includes Mostek from 1986
**Includes Litronix

Table 4

ESTIMATED 1986 VERSUS 1985 WORLDWIDE SEMICONDUCTOR
REVENUES OF 10 LEADING SUPPLIERS
(Millions of U.S. Dollars)

Company	1985	1986	Annual Growth
Philips-Signetics	$1,068	$1,356	26.97%
Signetics	$ 470	$ 530	12.77%
Thomson*	$ 324	$ 436	34.57%
Siemens**	$ 420	$ 429	2.14%
SGS Semiconductors	$ 300	$ 370	23.33%
Telefunken	$ 170	$ 219	28.82%
Plessey	$ 99	$ 112	13.13%
Ferranti	$ 98	$ 95	(3.06%)
Inmos	$ 85	$ 80	(5.88%)
Semikron	$ 48	$ 72	50.00%
Matra-Harris	$ 42	$ 47	11.90%

*Includes Mostek from 1986
**Includes Litronix

Source: Dataquest
January 1987
Ref. 0187-06P

Table 5

ESTIMATED 1986 VERSUS 1985 EUROPEAN INTEGRATED CIRCUIT
REVENUES OF 15 LEADING SUPPLIERS
(Millions of U.S. Dollars)

Company	1985	1986	Annual Growth
Philips-Signetics	$384	$549	42.97%
Signetics	$100	$109	9.00%
Texas Instruments	$434	$448	3.23%
Motorola	$265	$275	3.77%
National Semiconductor	$215	$233	8.37%
Intel	$212	$214	0.94%
NEC	$169	$193	14.20%
Thomson*	$147	$198	34.69%
SGS Semiconductors	$153	$192	25.49%
Siemens**	$145	$192	32.41%
AMD	$174	$172	(1.15%)
Hitachi	$161	$151	(6.21%)
ITT	$ 95	$115	21.05%
Fairchild	$ 95	$ 95	5.26%
Toshiba	$ 53	$ 82	54.72%
Fujitsu	$ 64	$ 70	9.38%

*Includes Mostek from 1986
**Includes Litronix

Source: Dataquest
January 1987
Ref. 0187-06P

Table 6

ESTIMATED 1986 VERSUS 1985 EUROPEAN BIPOLAR DIGITAL
REVENUES OF 15 LEADING SUPPLIERS
(Millions of U.S. Dollars)

Company	1985	1986	Annual Growth
Texas Instruments	$182	$183	0.55%
Philips-Signetics	$ 86	$ 96	11.63%
Signetics	$ 75	$ 66	(12.00%)
Motorola	$ 67	$ 66	(1.49%)
AMD	$ 56	$ 65	16.07%
Fairchild	$ 61	$ 63	3.28%
National Semiconductor	$ 41	$ 54	31.71%
Monolithic Memories	$ 39	$ 47	20.51%
Siemens*	$ 24	$ 30	25.00%
Ferranti	$ 28	$ 28	0.00%
Plessey	$ 13	$ 14	7.69%
SGS Semiconductors	$ 12	$ 13	8.33%
Intel	$ 10	$ 12	20.00%
Hitachi	$ 10	$ 10	0.00%
Fujitsu	$ 9	$ 9	0.00%
Thomson**	$ 17	$ 7	(58.82%)

*Includes Litronix
**Includes Mostek from 1986

Source: Dataquest
January 1987
Ref. 0187-06P

Table 7

ESTIMATED 1986 VERSUS 1985 EUROPEAN BIPOLAR MEMORY
REVENUES OF 13 LEADING SUPPLIERS
(Millions of U.S. Dollars)

Company	1985	1986	Annual Growth
Philips-Signetics	$23	$23	0.00%
Signetics	$23	$23	0.00%
AMD	$21	$22	4.76%
Texas Instruments	$20	$18	(10.00%)
Fairchild	$15	$14	(6.67%)
Monolithic Memories	$22	$ 9	(59.09%)
National Semiconductor	$ 4	$ 8	100.00%
Fujitsu	$ 5	$ 6	20.00%
Hitachi	$ 4	$ 4	0.00%
NEC	$ 4	$ 4	0.00%
Siemens*	$ 4	$ 4	0.00%
Thomson**	$10	$ 2	(80.00%)
Motorola	$ 2	$ 2	0.00%
Matra-Harris	$ 4	$ 1	(75.00%)

*Includes Litronix
**Includes Mostek from 1986

Source: Dataquest
January 1987
Ref. 0187-06P

Table 8

ESTIMATED 1986 VERSUS 1985 EUROPEAN BIPOLAR LOGIC
REVENUES OF 15 LEADING SUPPLIERS
(Millions of U.S. Dollars)

Company	1985	1986	Annual Growth
Texas Instruments	$162	$165	1.85%
Philips-Signetics	$ 63	$ 73	15.87%
Signetics	$ 52	$ 43	(17.31%)
Motorola	$ 65	$ 64	(1.54%)
Fairchild	$ 46	$ 49	6.52%
National Semiconductor	$ 37	$ 46	24.32%
AMD	$ 35	$ 43	22.86%
Monolithic Memories	$ 17	$ 38	123.53%
Ferranti	$ 28	$ 28	0.00%
Siemens*	$ 20	$ 26	30.00%
Plessey	$ 13	$ 14	7.69%
SGS Semiconductors	$ 12	$ 13	8.33%
Intel	$ 10	$ 12	20.00%
Hitachi	$ 6	$ 6	0.00%
Rifa	$ 9	$ 5	(44.44%)
Thomson**	$ 7	$ 5	(28.57%)

*Includes Litronix
**Includes Mostek from 1986

Source: Dataquest
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Ref. 0187-06P

Table 9

ESTIMATED 1986 VERSUS 1985 EUROPEAN MOS
REVENUES OF 15 LEADING SUPPLIERS
(Millions of U.S. Dollars)

Company	1985	1986	Annual Growth
Philips-Signetics	$162	$247	52.47%
Signetics	$ 11	$ 11	0.00%
Intel	$202	$202	0.00%
NEC	$157	$180	14.65%
Texas Instruments	$142	$157	10.56%
Hitachi	$147	$137	(6.80%)
Thomson*	$ 75	$130	73.33%
Motorola	$133	$129	(3.01%)
AMD	$101	$ 95	(5.94%)
National Semiconductor	$ 70	$ 89	27.14%
Siemens**	$ 70	$ 81	15.71%
SGS Semiconductors	$ 65	$ 79	21.54%
Toshiba	$ 51	$ 75	47.06%
ITT	$ 57	$ 69	21.05%
Fujitsu	$ 55	$ 61	10.91%
RCA	$ 51	$ 50	(1.96%)

*Includes Mostek from 1986
**Includes Litronix

Source: Dataquest
January 1987
Ref. 0187-06P

Table 10

ESTIMATED 1986 VERSUS 1985 EUROPEAN MOS MEMORY
REVENUES OF 15 LEADING SUPPLIERS
(Millions of U.S. Dollars)

Company	1985	1986	Annual Growth
Texas Instruments	$109	$110	0.92%
Hitachi	$109	$ 96	(11.93%)
Intel	$ 85	$ 86	1.18%
NEC	$ 77	$ 84	9.09%
Toshiba	$ 38	$ 53	39.47%
Fujitsu	$ 46	$ 49	6.52%
AMD	$ 45	$ 39	(13.33%)
Thomson*	$ 24	$ 38	58.33%
Siemens**	$ 24	$ 28	16.67%
Mitsubishi	$ 11	$ 23	109.09%
Matra-Harris	$ 13	$ 16	23.08%
SGS Semiconductors	$ 15	$ 12	(20.00%)
Inmos	$ 17	$ 12	(29.41%)
Oki	$ 16	$ 10	(37.50%)
National Semiconductor	$ 14	$ 10	(28.57%)

*Includes Mostek from 1986
**Includes Litronix

Source: Dataquest
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Ref. 0187-06P

Table 11

ESTIMATED 1986 VERSUS 1985 EUROPEAN MOS MICROPROCESSOR
REVENUES OF 15 LEADING SUPPLIERS
(Millions of U.S. Dollars)

Company	1985	1986	Annual Growth
Intel	$105	$102	(2.86%)
NEC	$ 64	$ 76	18.75%
Motorola	$ 47	$ 62	31.91%
Philips-Signetics	$ 33	$ 50	51.52%
Signetics	$ 0	$ 0	0.00%
Thomson*	$ 25	$ 41	64.00%
National Semiconductor	$ 29	$ 37	27.59%
Hitachi	$ 29	$ 32	10.34%
AMD	$ 30	$ 31	3.33%
Texas Instruments	$ 13	$ 23	76.92%
SGS Semiconductors	$ 13	$ 18	38.46%
Siemens**	$ 13	$ 16	23.08%
Matra-Harris	$ 11	$ 13	18.18%
ITT	$ 10	$ 12	20.00%
RCA	$ 8	$ 12	50.00%
Zilog	$ 9	$ 12	33.33%

*Includes Mostek from 1986
**Includes Litronix

Source: Dataquest
January 1987
Ref. 0187-06P

Table 12

ESTIMATED 1986 VERSUS 1985 EUROPEAN MOS LOGIC
REVENUES OF 15 LEADING SUPPLIERS
(Millions of U.S. Dollars)

Company	1985	1986	Annual Growth
Philips-Signetics	$119	$193	62.18%
Signetics	$ 0	$ 8	N/A
Motorola	$ 59	$ 59	0.00%
ITT	$ 47	$ 57	21.28%
Thomson*	$ 26	$ 51	96.15%
SGS Semiconductors	$ 37	$ 49	32.43%
National Semiconductor	$ 27	$ 42	55.56%
Siemens**	$ 33	$ 37	12.12%
RCA	$ 31	$ 33	6.45%
Plessey	$ 29	$ 32	10.34%
AMD	$ 26	$ 25	(3.85%)
Texas Instruments	$ 20	$ 24	20.00%
NEC	$ 16	$ 20	25.00%
ASEA	$ 15	$ 19	26.67%
AMI	$ 14	$ 17	21.43%
MEDL	$ 19	$ 16	(15.79%)

*Includes Mostek from 1986
**Includes Litronix
N/A = Not Applicable

Source: Dataquest
January 1987
Ref. 0187-06P

Table 13

ESTIMATED 1986 VERSUS 1985 EUROPEAN NMOS
REVENUES OF 15 LEADING SUPPLIERS
(Millions of U.S. Dollars)

Company	1985	1986	Annual Growth
Intel	$197	$192	(2.54%)
NEC	$130	$145	11.54%
Philips-Signetics	$ 81	$134	65.43%
Signetics	$ 11	$ 11	0.00%
Texas Instruments	$114	$127	11.40%
AMD	$ 95	$ 91	(4.21%)
Thomson*	$ 49	$ 79	61.22%
Siemens**	$ 67	$ 77	14.93%
Hitachi	$101	$ 51	(49.50%)
Motorola	$ 75	$ 48	(36.00%)
Fujitsu	$ 43	$ 44	2.33%
SGS Semiconductors	$ 38	$ 40	5.26%
ITT	$ 35	$ 35	0.00%
Toshiba	$ 12	$ 35	191.67%
Mitsubishi	$ 12	$ 22	83.33%
Plessey	$ 20	$ 14	(30.00%)

*Includes Mostek from 1986
**Includes Litronix

Source: Dataquest
January 1987
Ref. 0187-06P

Table 14

ESTIMATED 1986 VERSUS 1985 EUROPEAN CMOS
REVENUES OF 16 LEADING SUPPLIERS
(Millions of U.S. Dollars)

Company	1985	1986	Annual Growth
Philips-Signetics	$81	$113	39.51%
Signetics	$ 0	$ 0	N/A
Hitachi	$46	$ 86	86.96%
Motorola	$58	$ 81	39.66%
National Semiconductor	$54	$ 79	46.30%
Thomson*	$26	$ 51	96.15%
RCA	$51	$ 50	(1.96%)
Toshiba	$39	$ 40	2.56%
SGS Semiconductors	$27	$ 39	44.44%
NEC	$27	$ 35	29.63%
ITT	$18	$ 32	77.78%
Matra-Harris	$25	$ 32	28.00%
Texas Instruments	$25	$ 28	12.00%
ASEA	$15	$ 19	26.67%
MEDL	$17	$ 18	5.88%
Fujitsu	$12	$ 17	41.67%
Plessey	$ 7	$ 17	142.86%

*Includes Mostek from 1986
N/A = Not Applicable

Source: Dataquest
January 1987
Ref. 0187-06P

Table 15

ESTIMATED 1986 VERSUS 1985 EUROPEAN LINEAR
REVENUES OF 15 LEADING SUPPLIERS
(Millions of U.S. Dollars)

Company	1985	1986	Annual Growth
Philips-Signetics	$136	$206	51.47%
Signetics	$ 14	$ 32	128.57%
Texas Instruments	$110	$108	(1.82%)
SGS Semiconductors	$ 76	$100	31.58%
National Semiconductor	$104	$ 90	(13.46%)
Siemens*	$ 51	$ 81	58.82%
Motorola	$ 65	$ 80	23.08%
Analog Devices	$ 51	$ 65	27.45%
Thomson**	$ 55	$ 61	10.91%
ITT	$ 38	$ 46	21.05%
Telefunken Electronic	$ 35	$ 40	14.29%
Harris	$ 5	$ 24	380.00%
Siliconix	$ 17	$ 22	29.41%
Fairchild	$ 21	$ 21	0.00%
Plessey	$ 16	$ 21	31.25%
Ferranti	$ 18	$ 20	11.11%

*Includes Litronix
**Includes Mostek from 1986

Source: Dataquest
January 1987
Ref. 0187-06P

Table 16

ESTIMATED 1986 VERSUS 1985 EUROPEAN DISCRETE REVENUES OF 16 LEADING SUPPLIERS
(Millions of U.S. Dollars)

Company	1985	1986	Annual Growth
Philips-Signetics	$189	$228	20.63%
Signetics	$ 0	$ 0	N/A
Motorola	$121	$146	20.66%
Siemens*	$ 85	$125	47.06%
Thomson**	$ 91	$101	10.99%
ITT	$ 90	$100	11.11%
Telefunken Electronic	$ 53	$ 68	28.30%
SGS Semiconductors	$ 48	$ 52	8.33%
Semikron	$ 30	$ 43	43.33%
International Rectifier	$ 31	$ 36	16.13%
Brown-Boveri	$ 24	$ 29	20.83%
Texas Instruments	$ 23	$ 29	26.09%
Toshiba	$ 13	$ 20	53.85%
General Instrument	$ 12	$ 15	25.00%
RCA	$ 13	$ 15	15.38%
TAG	$ 12	$ 14	16.67%
MEDL	$ 11	$ 14	27.27%

*Includes Litronix
**Includes Mostek from 1986
N/A = Not Applicable

Source: Dataquest
January 1987
Ref. 0187-06P

Table 17

ESTIMATED 1986 VERSUS 1985 EUROPEAN OPTOELECTRONIC
REVENUES OF 15 LEADING SUPPLIERS
(Millions of U.S. Dollars)

Company	1985	1986	Annual Growth
Telefunken Electronic	$34	$44	29.41%
Hewlett-Packard	$34	$41	20.59%
Siemens*	$40	$40	0.00%
Philips-Signetics	$23	$25	8.70%
Signetics	$ 0	$ 0	N/A
Texas Instruments	$11	$13	18.18%
Plessey	$ 8	$11	37.50%
TRW	$ 8	$ 9	12.50%
Toshiba	$ 6	$ 8	33.33%
General Instrument	$ 9	$ 7	(22.22%)
ASEA	$ 5	$ 6	20.00%
RCA	$ 3	$ 6	100.00%
G.E.-Intersil	$ 6	$ 5	(16.67%)
Motorola	$ 3	$ 4	33.33%
Hitachi	$ 2	$ 3	50.00%
Thomson**	$ 2	$ 3	50.00%

*Includes Litronix
**Includes Mostek from 1986
N/A = Not Applicable

Source: Dataquest
January 1987
Ref. 0187-06P

Table 18

AVERAGE 1985 AND 1986 EXCHANGE RATES
(Local Currency per U.S. Dollar)

Country	1985	1986
Austria	20.69	15.65
Belgium	59.41	45.63
Denmark	10.60	8.26
Finland	6.20	5.46
France	8.98	7.06
Ireland	0.94	0.74
Italy	1909.50	1524.10
Luxembourg	59.38	48.49
Netherlands	3.32	2.51
Norway	8.60	7.42
Portugal	170.40	150.07
Spain	170.05	141.40
Sweden	8.60	7.18
Switzerland	2.46	1.83
United Kingdom	0.77	0.67
West Germany	2.94	2.23
Japan	238.54	168.83

Note: 1986 exchange rates based on July 1986 YTD

Source: Dataquest
January 1987
Ref. 0187-06P

Dataquest

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Business Computer Systems

CAD/CAM

Computer Storage—Rigid Disks

Computer Storage—Flexible Disks

Computer Storage—Tape Drives

Copying and Duplicating

Display Terminal

Electronic Printer

Electronic Publishing

Electronic Typewriter

Electronic Whiteboard

European Semiconductor*

European Telecommunications

Gallium Arsenide

Graphics

Imaging Supplies

Japanese Semiconductor*

Office Systems

Personal Computer

Personal Computer—Worldwide Shipments and Forecasts

Robotics

Semiconductor*

Semiconductor Application Markets*

Semiconductor Equipment and Materials*

Semiconductor User Information*

Software—Artificial Intelligence

Software—Personal Computer

Software—UNIX

Technical Computer Systems

Technical Computer Systems—Minisupercomputers

Telecommunications

Western European Printer

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Corporate Alliance Program

Coporate Technology Program

Financial Services Program

Strategic Executive Service

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European PC Monitor

First Copy

Home Row

I.C. ASIA

I.C. USA

Focus Reports

The European PC Market 1985-1992

European PC Retail Pricing

PC Distribution in Europe

PC Software Markets in Europe

PC Local Area Networking Markets in Europe

The Education Market for PCs in Europe

Japanese Corporations in the European PC Markets

Home Markets for PCs in Europe

Integrated Office Systems—The Market and Its Requirements

European Market for Text Processing

Image Processing in the Office

Work Group Computing

Translation Systems

Vendor Support

The IBM 3270 Market: 1986 and Beyond

Korean Semiconductor Industry Analysis

Diskettes—The Market and Its Requirements

Directory Products

I.C. Start-Ups—1987

SpecCheck—Competitive Copier Guide

SpecCheck—Competitive Electronic Typewriter Guide

SpecCheck—Competitive Whiteboard Guide

Who's Who in CAD/CAM 1986

Future Products

- Industry Services
  - Manufacturing Automation
  - Computer Storage—Optical
  - Computer Storage—Subsystems
- Focus Reports
  - Japanese Printer Strategy
  - Japanese Telecommunications Strategy
  - Canon CX Laser—User Survey
  - Digital Signal Processing
  - PC-based Publishing
  - Taiwan Semiconductor Industry Analysis
  - China Semiconductor Industry Analysis
  - PC Distribution Channels
- Directory Products
  - SpecCheck—Competitive Facsimile Guide
  - SpecCheck—Competitive Electronic Printer Guide

*On-line delivery option available

For further information about these products, please contact your Dataquest sales representative or the Direct Marketing Group at (408) 971-9661.

Dataquest

Conference Schedule

1986

Semiconductor	October 20-22	Hotel Inter-Continental San Diego, California
Technical Computer	November 3-5	Silverado Country Club Napa, California
Asian Peripherals	November 5-7	Hotel Okura Tokyo, Japan
Semiconductor Users/ Semiconductor Application Markets	November 10	Sheraton Harbor Island San Diego, California
Electronic Publishing	November 17-18	Westin Copley Place Boston, Massachusetts
CAD/CAM EDA	December 4-5	Santa Clara Marriott Santa Clara, California

1987

Semiconductor Users/ Semiconductor Application Markets	February 4-6	Saddlebrook Resort Tampa, Florida
Copying and Duplicating	February 23-25	San Diego Hilton Resort San Diego, California
Electronic Printer	March 23-25	Silverado Country Club Napa, California
Japanese Semiconductor	April 13-14	The Miyako Kyoto, Japan
Telecommunications	April 13-15	Silverado Country Club Napa, California
CAD/CAM	May 14-15	Hyatt Regency Monterey Monterey, California
Display Terminals	May 20-22	San Diego Hilton Resort San Diego, California
European Semiconductor	June 4-5	Palace Hotel Madrid, Spain
European Copying and Duplicating	June 25-26	The Ritz Hotel Lisbon, Portugal
Financial Services	August 17-18	Silverado Country Club Napa, California
Western European Printer	September 9-11	Palace Hotel Madrid, Spain
European Telecommunications	October 1-2	Monte Carlo, Monaco
Semiconductor	October 19-21	The Pointe Resort Phoenix, Arizona
Office Equipment Dealers	November 5-6	Hyatt Regency Monterey, California
Electronic Publishing	November 16-17	Stouffer Hotel Bedford, Massachusetts
CAD/CAM EDA	December 10-11	Santa Clara Marriott Santa Clara, California

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EUROPEAN
RESEARCH
NEWSLETTER

ESIS Code: Vol. IV, Newsletters
1986-35

EUROPEAN COMMUNICATIONS EQUIPMENT--SEMICONDUCTOR MARKET ANALYSIS

INTRODUCTION

As the range of semiconductor applications continues to become increasingly complex, so too has the task of examining and forecasting semiconductor consumption from an electronic equipment perspective.

Dataquest has developed a new service--Semiconductor Application Markets (SAM)--that provides a complete analysis of semiconductor consumption by application market segments. The aim of this product is to assist decision makers who must take a tactical or strategic approach in their analysis of the semiconductor market from an application, demand-side, or end-use perspective.

This newsletter provides European Semiconductor Industry Service (ESIS) and European Telecommunications Industry Service (ETCIS) clients with a brief look at the methodology used and an example of the research and analysis provided by this new service. SAM concentrates on the U.S. market; however, for the purpose of this newsletter, we have taken for an example the European communications equipment market.

METHODOLOGY

Market Segmentation

Dataquest's European Semiconductor Industry Service has traditionally broken out its end-use analysis into six market segments, as follows:

- Automotive
- Computer
- Consumer

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- Industrial
- Government and military
- Telecommunications

SAM uses a slightly different market segmentation, splitting electronic equipment into the following markets:

- Data processing
- Communications
- Industrial
- Consumer
- Military
- Transportation

Data processing comprises all equipment with flexible information processing as its main function. Included in this segment are all personal computers, regardless of price, distribution, or use in the office, education, or home environment.

Within the communications market, Dataquest classifies telecommunications as a subsegment that consists of customer premises and public telecommunications equipment. The other communications categories include radio, studio, and broadcast equipment.

The industrial segment comprises all manufacturing-related equipment, including scientific, medical, and dedicated systems.

The consumer segment comprises equipment that is designed primarily for home or personal use, with a primary function other than flexible information processing. Audio and video equipment and appliances are typical examples of equipment that is classified in the consumer application market.

Military equipment is primarily defense-oriented electronic equipment and is classified by major budget area. It does not include all electronic equipment procured by the government because such a breakout would double-count equipment that logically belongs in other market segments.

Finally, transportation consists mainly of automotive and light truck electronics. This designation leaves room to analyze other markets, such as off-highway equipment, that are potentially large users of semiconductors.

Full definitions of these segments are included in the Semiconductor Application Markets binders.

Research

The scope of SAM research includes:

- Information on electronic equipment manufacturers in the United States, with emphasis on revenue and semiconductor consumption
- U.S. electronic equipment forecasts by application market, according to equipment type and year
- U.S. semiconductor consumption forecasts by application market, organized by product, technology, and region
- Detailed service sections covering market trends and semiconductor analyses within each of the major application markets

ANALYSIS

The following paragraphs illustrate the kind of information that is available through a subscription to SAM.

Dataquest's European Telecommunications Industry Service (ETCIS) has shared its perspective with ESIS on many key areas of the European communications market. ETCIS analyzes the following areas:

- Terminal equipment
- Business communications equipment
- Data communications equipment
- Local area networks
- Public switching equipment

Within the European countries, there is growing pressure on the state-controlled telecommunications authorities dominating the markets, to adapt to competition and changing market needs. This pressure is mainly due to the international competition in equipment and services fueled by U.S. deregulation and the break up of American Telephone and Telegraph.

Table 1 shows Dataquest's forecast for the European communications equipment market. The customer premise market is the largest portion of the European communications segment. We estimate that the market for customer premises equipment will reach $6,490 million by 1990, growing at a compound annual growth rate (CAGR) of 7.0 percent for 1985 through 1990.

Table 1

EUROPEAN COMMUNICATIONS EQUIPMENT MARKET FORECAST
(Millions of Dollars)

	1985	1986	1987	1988	1989	1990	1991
Customer Premise	$ 4,633	$ 4,938	$ 5,258	$ 5,616	$ 6,069	$ 6,490	$ 7,503
Public Telecommunications	4,233	4,054	4,040	4,033	4,030	4,045	4,233
Radio	1,862	1,995	2,139	2,358	2,639	2,952	3,438
Broadcast & Studio	1,361	1,413	1,467	1,523	1,591	1,642	1,704
Other	783	877	982	1,100	1,254	1,429	1,688
Total	$12,872	$13,277	$13,886	$14,630	$15,583	$16,558	$18,566

Source: Dataquest
December 1986
Ref. 1086-05

Table 2 shows Dataquest's forecast for European semiconductor consumption for communications equipment. Between 1985 and 1986, the communications semiconductor market grew approximately 16.0 percent. This is slightly higher than the overall semiconductor market, which we estimate to be growing at 14.8 percent. Within the communications market, all segments experienced growth during this period.

Table 2

ESTIMATED EUROPEAN SEMICONDUCTOR CONSUMPTION
FOR COMMUNICATIONS EQUIPMENT
(Millions of Dollars)

	1985	1986	1987	1988	1989	1990	1991
Customer Premises	$ 481	$ 590	$ 694	$ 868	$ 973	$1,102	$1,489
Public Telecommunications	360	373	408	497	491	508	595
Radio	166	198	233	307	334	390	516
Broadcast & Studio	129	150	162	204	207	236	268
Other	65	82	101	140	149	183	241
Total	$1,201	$1,393	$1,598	$2,016	$2,154	$2,419	$3,109

Source: Dataquest
December 1986
Ref. 1086-05

Table 3 shows Dataquest's forecast for European Input/Output (I/O) ratios for communications equipment. The I/O ratio represents the value of the semiconductors divided by the value of the electronic equipment expressed as a percentage.

Table 3

ESTIMATED EUROPEAN INPUT/OUTPUT RATIOS
FOR COMMUNICATIONS EQUIPMENT
(Percent Based on Dollar Values)

	1985	1986	1987	1988	1989	1990	1991
Customer Premises	10.38%	11.94%	13.20%	15.43%	16.05%	17.00%	19.85%
Public Telecommunications	8.50%	9.20%	10.10%	12.32%	12.20%	12.55%	14.05%
Radio	8.90%	9.90%	10.90%	13.00%	12.65%	13.20%	15.00%
Broadcast & Studio	9.45%	10.65%	11.05%	13.40%	13.00%	14.40%	15.70%
Other	8.35%	9.30%	10.30%	12.70%	11.85%	12.80%	14.30%
Average Percentage	9.33%	10.49%	11.51%	13.77%	13.78%	14.62%	16.75%

Source: Dataquest
December 1986
Ref. 1086-05

Table 4 shows Dataquest's estimates for the European modem market. Dataquest defines a modem as an electronic device that provides modulation and demodulation functions of transmitted data signals over telephone lines, converting digital data signals to analog signals for transmission over leased lines or the analog public-switched telephone network. A number of other features are available on modems.

Table 4

ESTIMATED EUROPEAN MODEM MARKET
(Thousands of Dollars)

	1985	1986	1987	1988	1989	1990
V21	$ 11,161	$ 10,708	$ 10,263	$ 9,752	$ 9,219	$ 8,669
V23	29,087	30,601	29,963	27,256	23,042	19,685
V22	53,673	57,814	61,927	66,299	72,899	81,230
V22bis	29,185	40,813	53,158	67,292	82,238	98,835
V26	39,851	36,323	31,649	26,364	20,562	14,506
V27	29,553	25,223	20,490	14,175	8,674	4,807
V29 Basic	121,059	115,724	116,940	117,391	117,204	117,569
V29 Premium	38,467	39,984	40,186	40,312	39,908	39,614
V32	15,022	108,083	168,653	232,405	271,691	323,130
14.4 Kbps	12,017	13,446	15,376	16,362	18,186	20,157
16.0/16.8 Kbps	5,896	6,333	6,731	7,156	7,606	8,091
19.2 Kbps	3,687	6,052	6,785	7,342	7,793	8,193
Total	$388,658	$491,104	$562,121	$632,106	$679,022	$744,486
I/O Ratio	13.1%	13.5%	14.2%	14.6%	14.8%	14.9%
Est. S/C Content	$ 50,914	$ 66,299	$ 79,821	$ 92,287	$100,495	$110,928

Source: Dataquest
December 1986
Ref. 1086-05

We estimate that the European modem market will grow at a CAGR of 11.1 percent between 1985 and 1990. The fastest-growing segments are V22bis and V32 modems, growing at a CAGR of 24.7 percent and 31.5 percent, respectively. Technology trends affecting future modem products basically relate to design integration. The benefits resulting from the integration of modem functions are lower costs, increased features, and greater reliability. In our opinion, modems will become increasingly software driven with menu capabilities; thus, they will make switches obsolete.

The full advantage of the methodology detailed above is realized by applying I/O ratios to these modem estimates. This demonstrates that the estimated semiconductor consumption of European modems will grow from $50,914 in 1985 to $110,928 in 1990, at a CAGR of 16.9 percent. Semiconductor components of integral modems will be increasingly miniaturized, we believe, and there will be a continuing move toward the incorporation of digital signal processing techniques.

Jennifer Berg
Ted Richardson

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EUROPEAN RESEARCH NEWSLETTER

ESIS Code: Vol. IV, Newsletters
1986-33

EXCHANGE RATE QUARTERLY NEWSLETTER

THIRD QUARTER 1986

Dataquest exchange rate tables involve data from many countries, each of which has different and variable exchange rates against the U.S. dollar. As far as possible, Dataquest estimates are prepared in terms of local currencies before conversion, when necessary, to U.S. dollars. Dataquest uses International Monetary Fund (IMF) average foreign exchange rates for historical data.

All forecasts are prepared assuming no changes in any exchange rate from the last complete historical year--in this case, 1985. During the course of the current year, as local currency exchange rates vary, the appropriate U.S. dollar value changes accordingly. To maintain consistency across all its analyses, Dataquest does not make ongoing adjustments to its forecasts for these currency changes during the current year.

As a result of this policy, as the year progresses the forecast numbers could become distorted, in dollars, should the European currencies deviate substantially from the previous year's rates.

Dataquest monitors the exchange rates on a weekly basis using IMF exchange rates supported by Financial Times exchange rates where IMF data are not yet available. (Financial Times is the accepted U.K. newspaper giving daily updates.) Each month effective exchange rates for the current year are calculated. This information is then used to assess the local currency's impact on U.S. dollar forecasts.

The purpose of this Newsletter, which will be updated quarterly, is to record these changes, and thus allow the reader to make any necessary adjustments when interpreting the data according to local practice. For each European region, Table 1 gives the local currency per U.S. dollar for 1985, second quarter 1986, and third quarter 1986, together with the latest estimate for the whole of 1986. Also shown, for reference purposes, are the same figures for the Japanese yen. As can be seen from this table, the weighted average for all the European currencies for 1986

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has so far increased 20.2 percent with respect to the U.S. dollar compared with 1985. This represents an increase of 1.9 percent in the exchange rate since second quarter 1986. Table 2 shows the quarterly values for 1986 for the same regions.

Table 3 gives an example of how to interpret the effect of the currency shifts on the Dataquest forecast numbers. The table shows, for example, that the constant dollar forecast 1986 total European semiconductor market of $4,321, when adjusted to take account of the change in European currencies vis-à-vis the U.S. dollar, becomes $5,417.

Table 4 shows the monthly value of local currency per U.S. dollar for each European region and Japan in 1986.

Jennifer Berg

Table 1

EUROPEAN CURRENCIES--1985 TO 1986
(Local Currency per U.S. Dollar)

Region	1985	Q2 1986	Percent Change Q2-Q3	Q3 1986	Latest Estimate 1986	Percent Change 1985-86
Austria	20.69	15.78	7.3	14.63	15.24	26.3
Belgium	59.41	45.86	6.2	43.02	44.59	24.9
Denmark	10.60	8.31	5.7	7.83	8.08	23.8
Finland	6.20	5.14	3.3	4.97	5.06	18.3
France	8.98	7.15	5.3	6.77	6.92	23.0
Ireland	0.94	0.74	0.4	0.73	0.74	20.8
Italy	1,909.45	1,539.03	6.8	1,433.71	1,487.91	22.1
Luxembourg	59.38	45.86	6.1	43.06	44.60	24.9
Netherlands	3.32	2.53	7.2	2.35	2.45	26.3
Norway	8.60	7.40	0.3	7.38	7.36	14.4
Portugal	170.40	150.03	2.1	146.90	149.08	12.5
Spain	170.05	142.83	5.4	135.11	139.50	18.0
Sweden	8.60	7.20	3.3	6.96	7.11	17.4
Switzerland	2.46	1.87	9.6	1.69	1.79	27.1
United Kingdom	0.77	0.66	(1.4)	0.67	0.68	11.6
West Germany	2.94	2.25	7.5	2.08	2.17	26.3
Weighted Average (Base 1980 = 100)	182.64	148.48	4.8	141.34	145.68	20.2
Japan	238.54	170.13	8.5	155.60	167.39	29.8

Source: IMF
Dataquest
November 1986
Ref. 1086

Table 2

EUROPEAN CURRENCIES--1986 BY QUARTER
(Local Currency per U.S. Dollar)

Region	1986 Q1	Q2	Q3	Q4*	Total Year
Austria	16.49	15.78	14.63	14.05	15.24
Belgium	48.02	45.86	43.02	41.44	44.59
Denmark	8.64	8.31	7.83	7.53	8.08
Finland	5.26	5.14	4.97	4.88	5.06
France	7.21	7.15	6.77	6.54	6.92
Ireland	0.77	0.74	0.73	0.73	0.74
Italy	1,598.27	1,539.03	1,433.71	1,380.63	1,487.91
Luxembourg	48.02	45.86	43.06	41.44	44.60
Netherlands	2.65	2.53	2.35	2.26	2.45
Norway	7.32	7.40	7.38	7.35	7.36
Portugal	152.89	150.03	146.90	146.50	149.08
Spain	147.40	142.83	135.11	132.68	139.50
Sweden	7.41	7.20	6.96	6.86	7.11
Switzerland	1.98	1.87	1.69	1.63	1.79
United Kingdom	0.69	0.66	0.67	0.70	0.68
West Germany	2.35	2.25	2.08	2.00	2.17
Weighted Average (Base 1980 = 100)	154.15	148.48	141.34	138.75	145.68
Japan	187.88	170.13	155.60	155.96	167.39

*Forecast

Source: IMF
Dataquest
November 1986
Ref. 1086

Table 3

EFFECT OF CHANGES IN EUROPEAN CURRENCIES PER U.S. DOLLAR ON DATAQUEST FORECASTS--1985 VERSUS 1986 (Millions of Dollars)

	1985	1986	Percent Change 1985-86
European Semiconductor Consumption (At constant 1985 exchange rates)	$4,720	$4,321	(8.4)
Weighted European Currency (Assumed) (Base 1980 = 100)	182.64	182.64	N/A
Weighted European Currency (Latest Estimates)	182.64	145.68	20.2
Effective Consumption (At September YTD exchange rates)	$4,720	$5,417	14.8

N/A = Not Applicable

Source: Dataquest
November 1986
Ref. 1086

Table 4

EUROPEAN CURRENCIES--1986 BY MONTH
(Local Currency per U.S. Dollar)

Region	Jan.	Feb.	Mar.	Apr.	May	June	FT July	FT Aug.	FT Sept.	FT Oct.	FT Nov.*	FT Dec.*	1986*	Percent Std. Dev.	1985	Percent Change 1985-86
Austria	17.17	16.41	15.89	15.97	15.66	15.71	15.14	14.48	14.27	14.05	14.05	14.05	15.24	7	20.69	26.3
Belgium	49.95	47.76	46.36	46.28	45.62	45.69	44.34	42.57	42.15	41.44	41.44	41.44	44.59	6	59.41	24.9
Denmark	8.95	8.61	8.35	8.39	8.25	8.28	8.05	7.75	7.70	7.53	7.53	7.53	8.08	6	10.60	23.8
Finland	5.41	5.25	5.12	5.12	5.10	5.19	5.07	4.94	4.90	4.88	4.88	4.88	5.06	3	6.20	18.3
France	7.50	7.16	6.96	7.20	7.11	7.13	6.93	6.71	6.67	6.54	6.54	6.54	6.92	5	8.98	23.0
Ireland	0.80	0.77	0.75	0.75	0.73	0.73	0.72	0.74	0.74	0.73	0.73	0.73	0.74	3	0.94	20.8
Italy	1,664.5	1,588.0	1,542.3	1,556.9	1,528.7	1,531.5	1,470.4	1,416.4	1,406.4	1,380.6	1,380.6	1,380.6	1,487.9	6	1,909.5	22.1
Luxembourg	49.95	47.76	46.36	46.28	45.62	45.69	44.34	42.57	42.26	41.44	41.44	41.44	44.60	6	59.38	24.9
Netherlands	2.75	2.64	2.56	2.56	2.51	2.52	2.43	2.32	2.30	2.26	2.26	2.26	2.45	7	3.32	26.3
Norway	7.55	7.29	7.12	7.15	7.44	7.61	7.47	7.34	7.32	7.35	7.35	7.35	7.36	2	8.60	14.4
Portugal	157.57	152.28	148.81	149.99	148.93	151.17	148.43	145.90	146.38	146.50	146.50	146.50	149.08	2	170.40	12.5
Spain	152.85	146.97	142.37	143.73	141.85	142.92	137.57	134.06	133.71	132.68	132.68	132.68	139.50	5	170.05	18.0
Sweden	7.59	7.40	7.23	7.24	7.15	7.21	7.06	6.92	6.90	6.86	6.86	6.86	7.11	3	8.60	17.4
Switzerland	2.07	1.96	1.91	1.91	1.85	1.84	1.75	1.66	1.65	1.63	1.63	1.63	1.79	8	2.46	27.1
United Kingdom	0.70	0.70	0.68	0.67	0.66	0.66	0.66	0.67	0.68	0.70	0.70	0.70	0.68	3	0.77	11.6
West Germany	2.44	2.33	2.26	2.27	2.23	2.24	2.15	2.06	2.03	2.00	2.00	2.00	2.17	7	2.94	26.3
Weighted Average (Base 1980 = 100)	--	--	--	--	--	--	--	--	--	--	--	--	145.68	5	182.64	20.2
Japan	200.07	184.64	178.93	175.62	166.83	167.95	158.60	153.92	154.29	155.96	155.96	155.96	167.39	9	238.54	29.8

*Forecast

Source: Dataquest
November 1986
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EUROPEAN
RESEARCH
NEWSLETTER

ESIS Code: Vol. IV, Newsletters
1986-32

THE 1Mb DRAM: AN ENVIRONMENTAL ANALYSIS

As the leading edge DRAM, the 1Mb DRAM has assumed a very visible role in the semiconductor arena. This environmental analysis will discuss the major environmental areas related to the 1Mb DRAM and the issues involved. These areas are: market size and growth, influence of FMV prices, growing product diversity, and the changing supplier base.

MARKET OUTLOOK

Currently, Dataquest expects the 1986 1Mb DRAM market to hit $126 million, with shipments of 3.5 million units. During the last quarter of 1985, expectations for growth of this market were much higher. With the depressed prices of the 256K DRAM, many manufacturers were looking to the 1Mb DRAM as a profitable alternative.

But reality set in. Most manufacturers did not hit their targeted production schedules. The intended price decrease, toward an early price-per-bit crossover, was interrupted by tariff penalties for Japan-made devices and subsequently, by the U.S.-Japan semiconductor trade arrangement. Major OEMs were not as quick to use the part because of the new pinout and package.

Nevertheless, 1Mb DRAM prospects remain bright, as shown in Table 1. Dataquest expects the 1Mb DRAM market to grow to more than $2 billion by 1990, with total shipments of 900 million units. We believe that the 1Mb DRAM market will differ from that of the 256K in certain aspects.

- CMOS DRAMs will dominate from the beginning, accounting for 95 percent of total 1Mb DRAM revenue in 1990. Although many manufacturers have introduced NMOS 1Mb DRAMs, they have indicated that they will produce CMOS versions within 1987.

- Surface-mount package and ZIP usage is anticipated to be larger than DIP in 1989.

144/146 New Bond Street / London W1Y 9FD United Kingdom / (01) 409-1427 / Telex 266195
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- The 1Mbx1 DRAM is expected to be only 67 percent of the total 1Mb DRAM market in the peak year, 1990, while the 256Kx1 DRAM is expected to be 80 percent of the total 256K DRAM market in the peak year, 1987. The change is due to an anticipated preference for the 256Kx4. Many 256Kx1 and 64Kx4 users are expected to upgrade to the 256Kx4 for better flexibility in configuring their system memories.

Table 1

1Mb DRAM FORECAST

	1986	1987	1990
Total 1Mb Units (Millions)	3.5	40	900
ASP ($)	$36.00	$17.14	$ 2.43
Dollars (Millions)	$ 126	$ 685	$ 2,183
Units (Millions)			
1Mbx1	3.5	36	666
256Kx4		3.6	207
Others		0.4	27
NMOS	0.6	4	45
CMOS	2.9	36	855
DIP	3.4	25	396
SOJ/ZIP/Others	0.1	15	504

Source: Dataquest
November 1986

PRICES AND THE INFLUENCE OF FMVs

Dataquest expects the FMV prices determined by the U.S. Department of Commerce as part of the U.S.-Japan semiconductor trade arrangement to play a significant role in the development of the 1Mb DRAM market and its competitive profile. Future FMV prices can change the forecast given above, since they affect the Japan-based companies that are expected to account for 91 percent of 1Mb DRAM supply by the end of 1986.

Two factors have already influenced the market:

- The first round of FMV prices raised preagreement price quotes by more than 100 percent--from $20-to-$30 to $50-to-$60--between mid-July and mid-October. The price-per-bit crossover schedule has shifted by about six months and is now expected to occur in the beginning of 1988.

- Since the FMV prices are released every quarter, forward pricing beyond a quarter has been made more difficult. Forward pricing is an industry tool to encourage users to design in and purchase a new device early by showing them the projected decrease in price until a per-bit crossover occurs. This has worked well in helping markets ramp for new densities. Japan-based suppliers no longer possess control of actual prices that they can give in the future.

The FMV price determination is also likely to influence the competitive makeup of the 1Mb DRAM market. Except for Toshiba, which is ahead by far in the learning curve, the six-month lead of other Japan-based manufacturers may diminish vis-a-vis the Korean, U.S., and European suppliers that are not constrained by the agreement.

PRODUCT DIVERSITY

The 1Mb DRAM market will have a proliferation of versions. These versions parallel those of the 256K DRAM. However, unlike the 256K DRAM market, they will be available early in the 1Mb DRAM product life, standards have been defined, and OEMs are familiar with them. The versions will be different combinations of packaging, mode, organization, process technology, and specialty features, as shown in Table 2. This product diversity will segment customer needs further and alter the nature of competition.

Table 2

1Mb DRAM VERSIONS

By Process	By Organization	By Package	By Mode	By Features
CMOS	1Mbx1	DIP	Page	Dual Port
NMOS	256Kx4	SOJ	Nibble	FIFO
	128Kx8	ZIP	Static Column	
		SIP		
		SIMM		

Source: Dataquest
November 1986

THE MARKET PLAYERS

The number of 1Mb DRAM suppliers is expected to be just as high as that of the 256K DRAMs. Including those currently in production; 16 manufacturers have already indicated that they will be producing 1Mb DRAMs in 1987. One-half of the 16 suppliers are Japanese companies. Of the companies already in production, only one company, AT&T, is not a Japanese firm.

It will be interesting to note the performance of a few relatively new entrants into the 256K DRAM market who hope to penetrate the 1Mb DRAM field early. These companies include Hyundai, NMB Semiconductors, Samsung, Siemens, and Vitelic.

The relative positions of 1Mb DRAM suppliers have changed compared with those of the 64K and 256K DRAMs, which have been dominated by Hitachi, NEC, and Fujitsu. Toshiba has gained a firm lead in 1Mb volume production and its position in the cost curve. Its licensing agreement with Siemens has helped defray development costs. The FMV price determination has so far been advantageous to Toshiba because of the company's cost lead and because it prevents other Japan-based companies from matching Toshiba's price to ramp volume. Contrast that with Toshiba's number four position in 256K DRAMs and number twelve position in 64K DRAMs at the end of 1985.

DATAQUEST CONCLUSIONS

Dataquest believes that:

- The race for 1Mb DRAM leadership is not yet clear. The true test will be in bringing up and sustaining high-volume production at the lowest cost. Japan-based suppliers have to also consider capacity utilization as an important element in gaining leadership, since the FMV price determination is closely tied to it. Several manufacturers, including those already in production, seem to still be coping with the complexities of 1-micron geometries.

- The product diversity of the 1Mb DRAM will allow relatively smaller manufacturers to compete effectively in the market. Large OEMs will be hard pressed to efficiently manufacture every version for everyone.

The 1Mb DRAM market is still unfolding. This product, its suppliers, and its users have to contend with factors that were not present in the same stage of the 256K DRAM's product life: the growing influence of both U.S. and Japanese governments, the changing supplier base, and the diversity of product versions. DRAM manufacturers now have to observe the transforming market environment more closely than ever.

Jim Beveridge
Victor G. de Dios

Dataquest

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EUROPEAN RESEARCH NEWSLETTER

ESIS Code: Vol. IV, Newsletters
1986-31

12TH INTERNATIONAL CONFERENCE ON MICROELECTRONICS--ELECTRONICA

On Monday, November 10, Malcolm Penn, Dataquest Vice President and Director of European Operations, presented the opening address at the 12th International Conference on Microelectronics held at Electronica, Munich, West Germany. For the benefit of all of Dataquest's European Semiconductor Industry Service clients, a copy of the speech is attached.

Malcolm Penn

144/146 New Bond Street / London W1Y 9FD United Kingdom / (01) 409-1427 / Telex 266195
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MICROELECTRONICS--WORLD MARKET AND TECHNOLOGIES

Mr Chairman, Ladies and Gentlemen, it is indeed a great pleasure for me to be with you here this afternoon at this 12th International Conference on Microelectronics. What I would like to present to you during the next 30 minutes or so is Dataquest's perspective on the world market and technologies for microelectronics, a fascinating topic I am sure you will all agree.

From the Conference programme you will be hearing about many very interesting areas in the microelectronics industry, including detailed presentations, views, and opinions on such topics as sub-micron bipolar ICs, gallium arsenide, the full spectrum of digital signal processing techniques, several papers covering all aspects of packaging, and of course a similar number focused on application-specific ICs. In anticipation, what I would like to do in this session, is to pull all of these together, to step back and look at some of the broader trends and key issues.

Let us first turn to the reality today.

Clearly, the semiconductor industry is in a state of transition. Now that we have hopefully left the worst recession that the industry has ever seen, many aspects are different. Business conditions, market conditions, and technology itself are all changing; and very rapidly at that.

Competition has increased dramatically on a worldwide basis. This is not only true for semiconductor suppliers, but also for electronic equipment manufacturers.

Today, more than ever, technology moves at a pace that is unyielding. This accelerating change forces users to stay abreast of the latest developments or face being uncompetitive. Shorter product life cycles, a variety of new design solutions, and increased competition all complicate product definition and affect end product viability, with an immediate impact on profit margins.

Additionally, the current economic situation in the United States and in most other countries has a pronounced impact on the electronics industry. An example is the current tax reform in the United States, which is affecting capital purchases.

The semiconductor business is certainly known for its volatility, making it very cyclical in nature. A short time ago it was thought that the industry's size would not permit these types of swings. Yet we have just experienced the worst recession in its history.

When measured over the longer-term, growth is extremely strong at around 17 percent compounded per year. But the short-term is stricken with brutal 3-5 year business cycles. Semiconductor companies are forced to operate at the limits of technology and with a very fast 3-5 year technology and equipment obsolescence rate. You need to invest between 25 to 30 percent continually in capital and R&D just to keep pace.

Though today still only of modest financial size, it is an industry that exerts tremendous leverage on the whole fabric of industry and society, a leverage that is out of all proportion to its intrinsic worth. There is no long-term price inelasticity in the industry. The constantly declining price per function continues to fuel electronic opportunities and hence, new markets, for semiconductor devices. These include, for examplé, re-engineered existing products that utilise electronics for the first time, new products that did not previously exist but are now made possible by the availability of low cost electronic components or products that are just more electronics or feature, intensive. It is this equipment growth and the pervasion aspects that provides the long-term growth in semiconductor demand. Short-term, however, demand is driven by commodity pricing which in turn is driven by capacity investment, and really has no reliable predictor; hence, the wildly cyclical nature of the industry that has been so typical since its beginning.

Right now the semiconductor industry is slowly emerging from one of the worst recessions ever in its 35 year history. What made this particular recession even more dramatic was that it occurred during a period of economic stability. Its cause can be traced back to the dramatic and euphoric over-investment in capital and new equipment in the early 1980s, fuelled in turn by over-optimistic expectations of the electronic end equipment demand.

Right now we believe the pace of the recovery is paced by three significant factors. Firstly, the weak US economy, primarily as a result of its budget deficit, a strong dollar, and a gradual erosion of the traditional US work ethic, which collectively have caused a trend towards increasing uncompetitiveness of the US manufacturing industries.

Secondly, there is an overall lack of confidence and uncertainty in the global environment at present. For example, the Chernobyl disaster, increased terrorist activities, increased in protectionism trends, and the computer industry metamorphosis are all contributing to the present level of business uncertainty.

One of the biggest unknowns in the present economic scenario is the effects of disinflation and the apparent changing effects it is having on business and consumer spending habits, especially when coupled with the general overall business uncertainties. Deflation tends to generate expectations of further deflation with the result that people do not rush out to buy. Instead people and businesses tend to keep their cash in the bank or the financial markets rather than buy or make products that may well cost less tomorrow.

Furthermore, from a business point of view, there is the added concern of why invest in new plant and equipment, or hire more staff, when you are not sure if anybody will actually buy the extra output.

And thirdly, there is an increasing trend in inventory reduction amongst all of the electronic equipment OEMs. This effects all work-in-progress and not just piece parts. Apart from the obvious fashion reasons of "just-in-time" and "ship-to-stock" programs which have provided a focus on this activity, the real underlying motive is to ensure competitiveness both from a cost and design flexibility point of view.

ESTIMATED WORLDWIDE SEMICONDUCTOR CONSUMPTION
(Millions of U.S. Dollars)

	1985	1986	Growth
Total Worldwide	$24,823	$30,712	23.7%
United States	$ 9,607	$10,300	7.2%
Japan	$ 8,599	$12,087	40.6%
Europe	$ 4,720	$ 5,417	14.8%
ROW	$ 1,897	$ 2,908	53.3%

Source: Dataquest
October 1986

This chart quantifies the worldwide trends as we currently view them and gives our latest estimates of the semiconductor consumption by major region for 1985 and 1986. The first thing that strikes you is the apparent strength in the numbers, for example 40-50 percent growth rates in the Far East, and even a 14.8 percent growth rate in Europe. Together we expect the worldwide growth average to be around 24 percent. The obvious question is how can that possibly be considered sluggish especially given that in 1985 the market shrank 12 percent.

The answer, of course, lies in the exchange rate phenomena. The apparent 14.8 percent positive growth in Europe is in reality a negative 7.3 percent when measured in local currencies. Even more dramatically in Japan, the 40 percent growth is really zero to a small negative. But not so in the rest of the world. In the first half of 1986, the Rest of the World region grew 50 percent in real terms--fuelled by the accelerating electronics industry production shift to the Far East. Overall this region will grow 52 percent in real terms, 1986 over 1985.

Looked at on a quarter by quarter basis, effectively this new forecast postpones the anticipated recovery by at least two quarters from our earlier May 1986 estimate. The pace of recovery that began in the latter part of 1985 has proved unsustainable in the second quarter of 1986, especially in the wake of a simultaneous deterioration in the overall economic and end user performance. Our revised forecast reflects this adjustment.

A major reason for this softness in semiconductor demand stems from the fact that since the Spring of 1986, end user demand just did not improve. As a result, the anticipated reversal in the OEM inventory liquidation process did not occur. To the contrary, since the April time frame, fuelled by concerns about the health of the economy and their end markets, especially in the United States, most OEMs embarked on a program to pare inventories even further. As a result, new bookings slowed substantially and this, coupled with the traditionally weak third quarter vacation period, effectivelly killed any real hopes of a strong second half year semiconductor performance.

The assumptions behind our previous forecast however still hold true and we still believe that the current softness in the European semiconductor market is a timing issue as opposed to a lack of faith in the overall semiconductor industry fundamentals. Firmer pricing in the wake of the United States/Japan trade agreement and the return of OEM unit orders back to their current usage levels must inevitably work their way through the system. This could come without a substantial strengthening in the economy--all that is needed is for the industry to continue bumping along at the present rate together with a cessation of the OEM inventory liquidation process. Unfortunately the opposite is not true. Any further worsening of the economic situtation could easily push the recovery out still further.

Any significant positive momentum either in the cyclical outlook or in improved end user demand, especially in the US computer market, could however easily spark an explosion in the volume of semiconductor component bookings and subsequent billings--the inevitable dichotomy in the semiconductor market. The key to this is end user vitality--let us therefore look at some of today's emerging end user markets.

MARKET OPPORTUNITIES

- Integrated voice/data workstations
- Local area networks
- Cellular mobile radio (CMR)
- Robotics
- Nonimpact printers
- Personal computers*
- Sub-5.25-Inch rigid disk drives

*Exception

Source: Dataquest
November 1986

Listed here are seven product areas that have been identified as being potential high growth areas and therefore substantial semiconductor consumption possibilities. These segments have annual growth rates ranging from 13 pecent to more than 30 percent, and with higher than average content of semiconductor components. Although these markets are relatively small at the moment, they are estimated to be in the billion dollar region by 1990.

Focusing more on today rather than tomorrow, a look at the ranking of the major end products, as measured by semiconductor consumption, shows VCRs at No 1, general purpose computers No 2, office computers No 3, personal computers No 4, tape recorders No 5, and colour TVs No 6. Consumer products still dominate the top 10 and in particular this is essentially a Japanese dominated industry. There are some important ramifications on this for the semiconductor industry because it is a true mass market and permits the (mostly Japanese) semiconductor manufacturers to build increasingly complex ICs in mass volume and drive down costs quickly.

This experience can readily be transferred to other production areas to help provide a strategic edge in the overall semiconductor market. Though consumer-dominated now, the Japanese market is moving quickly toward leading edge products for personal and office use. Telecommunications and office automation are becoming larger portions of the end market in Japan. This will continue as more efficiency and productivity are stressed in the job environment.

Two of the hottest end markets for semiconductors are office automation products, that is word processers and facsimile machines. The biggest hot product of all though is a consumer product, the digital audio disc player, which contains, in total, several hundred thousand transistors--even more dramatic when one appreciates that its replacement, the record deck, contains zero.

Turning now to one of the traditional semiconductor market applications -- computers, the collapse of which in the United States in 1985 helped push the semiconductor market into global recession. Clearly the computer industry is undergoing a rapid period of adjustment. Only the technical computer market has remained buoyant throughout this last recession a particular strength of Digital Equipment Corporation. Several factors combined to make 1985 one of the worst year on record. For example, IBM experienced several setbacks to some of its programs, severe price cutting was typical in the industry, and the interconnectivity issue finally surfaced as the major problem. The year was typified by product deficiencies, high expectations of the users coupled with confusion and fear and an overall "indigestion" of computer technology by the user. What was lacking was solutions; what was in abundance was equipment.

It has been a period of rationalisation, and many influences are now starting to become apparent in 1986. For example, there is an increase in integration of the PC into the office and there is the adoption of local area networking amongst many companies. Perhaps more important though, there is an increase in understanding of how to manage the work group and departmental computing environment. All of this should ensure that there will a reasonable period of growth in the computer industry over the remainder of this decade at least, though not perhaps at the same euphoric levels as in the 70s and early part of the 80s.

Two critical areas that will drive the growth for the next decade are in the area of work group computing and on-line transaction processing.

Let us look first at the area of work group computing. Dataquest defines this as the ability to electronically share and access common data, applications, and resources in support of the data processing and office computing needs of the work group. This is a relatively new phenomena and really grew out of the personal computing era which began in the 1980s. Typical applications include text processing, document retrieval, electronic mail, spreadsheets, presentation graphics, calendar management, data base access, and meeting scheduling. The key players in the work group computing market are the major minicomputer vendors, the PC vendors and specialist LAN vendors. Interconnectivity is the key to this environment, and tied with interconnectivity is the need for standards. Standards are slow to emerge but necessarily will become the name of the game for success. Let us look now at the other key area, that is of on-line transaction processing.

Dataquest defines on-line transaction processing as the execution of applications that are characterised by a high volume of inputs from terminals that cause heavy data base access and some resulting response to the terminal typically in a very few seconds.

Typical on-line transaction processing applications include order entry, reservation systems, library circulation, bank automatic telling machines, directory assistance, telemarketing, retail point of sale, and inventory management. Key players in the on-line transaction processing market are the fault tolerance system vendors, multiprocessor system vendors, IBM, minicomputer vendors, and vendors of special purpose processors for terminal handling and data base management.

Personal computers were mentioned earlier as being one of the major growth opportunities for the semiconductor market. Of course, the personal computer market was one of the prime culprits in causing the present semiconductor recession, but we believe tomorrow's personal computer of the future will be far more sophisticated and more mature. Typically it will work in the one to four MIPs range, have a substantial memory size of up to 6 megabytes, it will incorporate virtual storage, integral communications, database support, and a high level of input output capability--much more akin to a typical advanced minicomputer of today.

Looking beyond 1990, demand for more powerful computers will remain and will be driven by primarily the integration of mixed data modes (voice text, graphics, images, and numbers) as well as the implementation of artificial intelligence techniques and the development of natural user interfaces. All of these are software dependent and that will prove to be the major restraining factor on the growth of the computer market and therefore the semiconductor market that serves it.

Having now looked at the consumer market and the computer markets in some detail, the third significant market worthy of mention is telecommunications, and in particular ISDN (Integrated Service Digital Network). ISDN promises universal integrated access ports, adaptive services, and transport efficiency. ISDN proponents include the telephone operating companies, both to counter competitive threats as well as to provide new network services and products, telecommunications equipment manufacturers, looking for extended market opportunity, and the semiconductor manufacturers themselves, who perceive the obvious new market opportunity.

Today's perception is that ISDN is largely technology driven. Users have an awareness of ISDN and its promise and are making some investments today. There appears to be more industry concensus than disagreement about the viability of ISDN. However, many elements of risk remain such as uncertain market demand, unproven technology, uncertain costs, uncertain pricing, and uncertain regulatory climate. I am sure, however, these risks will be overcome, though it is important to remember this is not a short-term program. At the time of its conception, ISDN was viewed as a 40 year transition phase from the start of implementation. Rapid progress in the past two to three years, however, points to an acceleration of this schedule of about 20 years. ISDN will undoubtedly mean a great opportunity.

Back to the land of semiconductor devices, one can hardly talk on worldwide trends in microelectronics without looking at the memory market. Since its inception in about 1970, memory market growth has been outstanding. Over the last 15 years, the bit growth rate has averaged nearly 100 percent per year. This means that in any given year, as many memory bits were shipped as were shipped in the entire previous history of the product. The market has been driven by products like home and personal computers, main frame and minicomputers, together with some small impact in consumer products, in particular video games. Even in 1985, the number of bits shipped exceeded those in 1984 by about 40 percent, which was the lowest growth that the market had experienced in all of its 15 year history.

Looking out for the next decade, we believe that the outlook is no less outstanding from both a bit growth and bit shipped level; for the rest of the decade we can look at an annual bit growth rate of around 80 percent or perhaps a little more. In the first half of the decade of the 90s, we are looking at somewhere in the 50 to 60 percent growth rate year to year. Some of the markets that we expect to be the key drivers during this next decade are bit-map graphics that show up on digital TVs, video recorders, imaging applications, and signal processing applications. We expect to see another wave of personal computers and office equipment automation applications, IC cards, and applications in simulation. All of this on top of the basic core amount into main frames, minicomputers, and business computers.

Finally, I would like to look at the alchemist's dream - designing systems in silicon. Customised silicon circuitry has been available since the very beginnings of integrated circuits--at a price. Today application specific ICs are available to the masses, be it gate array or programmable logic device at the one end of the spectrum or standard cell and full custom devices at the other end. A key underlying trend here is silicon compilation. True silicon compilation will lead to the ultimate single chip system solution. The over-riding advantage that silicon compilation has over the present design methodologies is that it provides a shared method of satisfying the design demands of both system engineers and IC designers, providing the means of communicating IC design methodology in terms understood by each class of user. This then will allow the user to choose the appropriate design methodology on a per-design, rather than a per work station, basis. What is apparent today is the trend towards specialised compilable cells. Today, device complexity and functionality are far ahead of the designer's ability to find applications. For example, what are the applications for a 50,000 gate array? It is the vendor of such a product that must provide the insight to answer this question. We believe that anticipating these future applications and directing the use of IC design tools and ASIC products in the end user markets will be critical in determining success.

Clearly the world semiconductor industry is in transition. The future business climax includes more complex devices, an increasing in-house design capability, learning curve pricing will remain a driving force, surface mount packaging will become commonplace, and CMOS will remain the dominant technology. There will be an increasing trend of alliances but with many more vendors to choose from and many more companies buying semiconductor components. Some of the issues yet to be successfully addresssed are such areas as education and training for the 90s, government and industrial relationships, strategies for successful exploitation of innovative technology, living with the increased demand for productivity and quality, and defining new procurement strategies to cope with the changing environment.

Leadership in electronics will only be achieved through the profitable application of semiconductor technology. That means world class research and development programs, design, manufacturing, and marketing. That is the gauntlet that technology throws down to us today. Are you prepared to pick up the challenge?

Thank you for your attention.

Dataquest

Conference Schedule

1986

Semiconductor	October 20–22	Hotel Inter-Continental San Diego, California
Technical Computer	November 3–5	Silverado Country Club Napa, California
Asian Peripherals	November 5–7	Hotel Okura Tokyo, Japan
Semiconductor Users/ Semiconductor Application Markets	November 10	Sheraton Harbor Island San Diego, California
Electronic Publishing	November 17–18	Westin Copley Place Boston, Massachusetts
CAD/CAM EDA	December 4–5	Santa Clara Marriott Santa Clara, California

1987

Semiconductor Users/ Semiconductor Application Markets	February 4–6	Saddlebrook Resort Tampa, Florida
Copying and Duplicating	February 23–25	San Diego Hilton Resort San Diego, California
Electronic Printer	March 23–25	Silverado Country Club Napa, California
Japanese Semiconductor	April 13–14	The Miyako Kyoto, Japan
Telecommunications	April 13–15	Silverado Country Club Napa, California
CAD/CAM	May 14–15	Hyatt Regency Monterey Monterey, California
Display Terminals	May 20–22	San Diego Hilton Resort San Diego, California
European Semiconductor	June 4–5	Palace Hotel Madrid, Spain
European Copying and Duplicating	June 25–26	The Ritz Hotel Lisbon, Portugal
Financial Services	August 17–18	Silverado Country Club Napa, California
Western European Printer	September 9–11	Palace Hotel Madrid, Spain
European Telecommunications	October 1–2	Monte Carlo, Monaco
Semiconductor	October 19–21	The Pointe Resort Phoenix, Arizona
Office Equipment Dealers	November 5–6	Hyatt Regency Monterey, California
Electronic Publishing	November 16–17	Stouffer Hotel Bedford, Massachusetts
CAD/CAM EDA	December 10–11	Santa Clara Marriott Santa Clara, California

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Product Offerings

Industry Services

Business Computer Systems
CAD/CAM
Computer Storage—Rigid Disks
Computer Storage—Flexible Disks
Computer Storage—Tape Drives
Copying and Duplicating
Display Terminal
Electronic Printer
Electronic Publishing
Electronic Typewriter
Electronic Whiteboard
European Semiconductor*
European Telecommunications
Gallium Arsenide
Graphics
Imaging Supplies
Japanese Semiconductor*
Office Systems
Personal Computer
Personal Computer—Worldwide Shipments and Forecasts
Robotics
Semiconductor*
Semiconductor Application Markets*
Semiconductor Equipment and Materials*
Semiconductor User Information*
Software—Artificial Intelligence
Software—Personal Computer
Software—UNIX
Technical Computer Systems
Technical Computer Systems—Minisupercomputers
Telecommunications
Western European Printer

Executive and Financial Programs

Corporate Alliance Program
Coporate Technology Program
Financial Services Program
Strategic Executive Service

Newsletters

European PC Monitor
First Copy
Home Row
I.C. ASIA
I.C. USA

Focus Reports

The European PC Market 1985–1992
European PC Retail Pricing
PC Distribution in Europe
PC Software Markets in Europe
PC Local Area Networking Markets in Europe
The Education Market for PCs in Europe
Japanese Corporations in the European PC Markets
Home Markets for PCs in Europe
Integrated Office Systems—The Market and Its Requirements
European Market for Text Processing
Image Processing in the Office
Work Group Computing
Translation Systems
Vendor Support
The IBM 3270 Market: 1986 and Beyond
Korean Semiconductor Industry Analysis
Diskettes—The Market and Its Requirements

Directory Products

I.C. Start-Ups—1987
SpecCheck—Competitive Copier Guide
SpecCheck—Competitive Electronic Typewriter Guide
SpecCheck—Competitive Whiteboard Guide
Who's Who in CAD/CAM 1986

Future Products

- Industry Services
  - Manufacturing Automation
  - Computer Storage—Optical
  - Computer Storage—Subsystems
- Focus Reports
  - Japanese Printer Strategy
  - Japanese Telecommunications Strategy
  - Canon CX Laser—User Survey
  - Digital Signal Processing
  - PC-based Publishing
  - Taiwan Semiconductor Industry Analysis
  - China Semiconductor Industry Analysis
  - PC Distribution Channels
- Directory Products
  - SpecCheck—Competitive Facsimile Guide
  - SpecCheck—Competitive Electronic Printer Guide

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EUROPEAN RESEARCH NEWSLETTER

ESIS Code: Vol. IV, Newsletters
1986-30

INTERNEPCON 1986--FOCUS ON SURFACE-MOUNT TECHNOLOGY

OVERVIEW

The Annual Electronic Packaging Show and Conference (Internepcon) was held this year on October 7 through 9 in Brighton, England. The show provided a good opportunity to see at first hand the trends taking place in electronic packaging. Approximately 400 companies exhibited a wide selection of products covering the very latest in components, connectors, wire and cable, racks, enclosures, and PCBs.

In addition to the exhibition, a full conference program of 12 technical sessions was held, covering the latest advances in electronic packaging technology. The course sessions covered a diverse range of subjects including:

- Interconnection techniques
- New substrate materials
- Encapsulation
- Hybrid microelectronics
- Surface-mount technology (SMT)

The conference program also included professional advancement courses covering multilayer PCBs and design management for internal problems.

SURFACE-MOUNT TECHNOLOGY

Small-outline (SO) packages and surface-mount techniques were developed in Europe for the Swiss watch industry in the late 1960s. SMT emerged in the United States in the mid-1960s in the form of surface-attached flatpacks for use in missile-guidance computers. Japanese manufacturers adopted SMT in the early 1970s, as the need for miniaturization and cost reduction arose in consumer products such as watches and calculators.

144/146 New Bond Street / London W1Y 9FD United Kingdom / (01) 409-1427 / Telex 266195
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In the past, the principal concern of the electronics industry has been the miniaturization of the actual IC. Packaging and the associated interconnections have not received "star billing," until now.

Considerable emphasis is now being placed on increasing packing density through the use of surface-mount devices (SMDs). This in turn has meant that suppliers are having to rethink their package and connector designs and to employ new technologies.

The growing importance of SMDs and SMT can be ascertained from the fact that out of some 400 exhibitors, approximately 60 were offering SMD and/or advice on SMT. Some of these exhibitors are shown in Table 1.

Surface-Mount Technology--Where Is It Going?

Although there has been a tremendous amount of enthusiasm for surface-mount technology, implementation of SMT is taking longer than anticipated--definitely a case of more interest and development than momentum. Concentrated use of surface-mounted devices is occurring in applications where small size and weight are the primary issues, such as:

- Portable consumer products
- Automobile radio and engine control modules
- Disk drive head controllers
- Aircraft cockpit controllers, satellite and missile systems
- Very high-density memory products

Table 2 lists our estimates of the end uses of surface-mount technology by geographical region.

DATAQUEST CONCLUSION

Dataquest is of the opinion that SMDs and their associated SMT will grow steadily over the coming years. Much will depend on the end equipment designer's awareness of the requirements that will be imposed on the designers and the increasing availability of SMDs. While SMT offers a number of advantages over standard dual-in-line technology (i.e., components can be attached to both sides of the PCB), a crucial factor for their wider acceptance may be that SMT will accommodate devices with pin-counts of up to 124--considerably higher than the present 64-pin maximum available using existing technology.

Kathleen Killian

Table 1

SELECTED EXHIBITORS AT INTERNEPCON 1986

Company	Feature
A B Electronics	SMT assemblies
Cambridge Electronic Industries:	
Keltek	SM pick and place, screen printing of adhesives, solder pastes, and VP soldering
MTL Microtech Semiconductors	Custom packaging, etc.
Newmarket Microsystems	SM assemblies; solving circuit packaging problems
Dage	Various SMDs, pick and place machine; solving SM problems
Dau	Fully sealed SMDs
Groatmoor	Pick and place machine for SMDs
HB Electronics	SMD removal and remount equipment, various SMDs
ICI	ICI Array Technology Inc., CA USA; leading company in SMT
ITT Cannon (UK)	SM connectors, etc.
Marconi Electronic Devices	SM assemblies
Molex	SMT
Oxley	SMT and SM test point and filters
Plessey Hybrids	SM hybrids, ceramic substrates for SM, SMT
Radamec Microsystems	SMT; design and assembly
VSI	SMT

Source: Dataquest
November 1986

Table 2

SURFACE-MOUNT TECHNOLOGY--END USES
1985

	Japan	Europe	United States
End Use	Consumer	Telecommunications	Computers
Driving Force	Small size	Reliability	Cost reduction
Percent of ICs Consumed Worldwide	35%	18%	41%
Percent of ICs in SMT	16.7%	1.8%	1.6%
Dominant SMT Approach	TAB/COB	SO	COB/SO/CC/TAB

Source: Rose Associates
Dataquest
November 1986

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Industry Services

- Business Computer Systems
- CAD/CAM
- Computer Storage—Rigid Disks
- Computer Storage—Flexible Disks
- Computer Storage—Tape Drives
- Copying and Duplicating
- Display Terminal
- Electronic Printer
- Electronic Publishing
- Electronic Typewriter
- Electronic Whiteboard
- European Semiconductor*
- European Telecommunications
- Gallium Arsenide
- Graphics
- Imaging Supplies
- Japanese Semiconductor*
- Office Systems
- Personal Computer
- Personal Computer—Worldwide Shipments and Forecasts
- Robotics
- Semiconductor*
- Semiconductor Application Markets*
- Semiconductor Equipment and Materials*
- Semiconductor User Information*
- Software—Artificial Intelligence
- Software—Personal Computer
- Software—UNIX
- Technical Computer Systems
- Technical Computer Systems—Minisupercomputers
- Telecommunications
- Western European Printer

Executive and Financial Programs

- Corporate Alliance Program
- Coporate Technology Program
- Financial Services Program
- Strategic Executive Service

Newsletters

- *European PC Monitor*
- *First Copy*
- *Home Row*
- *I.C. ASIA*
- *I.C. USA*

Focus Reports

- The European PC Market 1985-1992
- European PC Retail Pricing
- PC Distribution in Europe
- PC Software Markets in Europe
- PC Local Area Networking Markets in Europe
- The Education Market for PCs in Europe
- Japanese Corporations in the European PC Markets
- Home Markets for PCs in Europe
- Integrated Office Systems—The Market and Its Requirements
- European Market for Text Processing
- Image Processing in the Office
- Work Group Computing
- Translation Systems
- Vendor Support
- The IBM 3270 Market: 1986 and Beyond
- Korean Semiconductor Industry Analysis
- Diskettes—The Market and Its Requirements

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- I.C. Start-Ups—1987
- SpecCheck—Competitive Copier Guide
- SpecCheck—Competitive Electronic Typewriter Guide
- SpecCheck—Competitive Whiteboard Guide
- Who's Who in CAD/CAM 1986

Future Products

- Industry Services
  - Manufacturing Automation
  - Computer Storage—Optical
  - Computer Storage—Subsystems
- Focus Reports
  - Japanese Printer Strategy
  - Japanese Telecommunications Strategy
  - Canon CX Laser—User Survey
  - Digital Signal Processing
  - PC-based Publishing
  - Taiwan Semiconductor Industry Analysis
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ESIS Code: Vol. IV, Newsletters
1986-29

THE SEMICONDUCTOR AGREEMENT: INTENTIONS AND REALITY

SUMMARY

This newsletter concerns the near- and long-term pricing repercussions of the U.S.-Japan semiconductor agreement reached on July 31, 1986. It reviews the agreement's main points and the potential effects and resulting strategies for semiconductor manufacturers and users. It analyzes the agreement's intentions and potential near- and long-term effects and concludes with specific suggestions for how the situation can best be managed.

AGREEMENT OVERVIEW

The semiconductor agreement between the United States and Japan revolves around two key issues:

- Cost/price monitoring of semiconductor devices to insure that prices of semiconductors exported into the United States do not fall below costs
- Increased Japanese market access by U.S. semiconductor manufacturers

Cost/Price Monitoring

The agreement resulted in the suspension of dumping charges on all EPROMs and 256K and 1Mb DRAMs by the U.S. Department of Commerce (DOC). Instead, the DOC will monitor on a quarterly basis the prices and costs of certain Japanese-manufactured and exported semiconductor products.

144/146 New Bond Street / London W1Y 9FD United Kingdom / (01) 409-1427 / Telex 266195
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The DOC uses a formula to construct the quarterly Foreign Market Values (FMVs). This formula (A + B + C + D = Foreign Market Value) is made up of the following four parts:

- Material costs, including some R&D
- Fabrication costs
- General sales and administration expenses, including some R&D (not less than 10 percent of the above two costs)
- Profit (not less than 8 percent of the above three costs)

The formula is applied on a company-by-company basis using proprietary cost information to determine the minimum price of each company's products. This method uses real-time fabrication cost data in determining FMVs. The capacity utilization of a given company at a given time will determine in large part what that company's FMV will be. A company running at 80 percent capacity will have lower fabrication costs per unit than a company running at 50 percent capacity. The initial capacity utilization rate used can determine which companies will be continually competitive and which will continue to be uncompetitive, since a profit always has to be added to a higher manufacturing cost. Using these same guidelines, Japan's Ministry of International Trade and Industry (MITI) has agreed to monitor the following volume Japanese-exported semiconductors:

- MOS SRAMs
- ECL RAMs
- 8- and 16-bit microprocessors
- 8-bit microcontrollers
- ECL logic
- Gate arrays
- Standard cells

<u>Market Access</u>

The second part of the agreement facilitates greater access by U.S. semiconductor manufacturers to the Japanese market, which a Japanese governmental organization has been formed to support. The organization will:

- Provide sales assistance for foreign semiconductor producers as they attempt to penetrate the Japanese market
- Make quality assessments of foreign semiconductor products, upon request, and organize such things as research fellowship programs, seminars, and exhibitions for foreign firms

- Promote long-term relationships between Japanese semiconductor purchasers and foreign producers, including joint product development with Japanese customers

AGREEMENT EFFECTS

The effect of capacity utilization on price is illustrated by the cost model shown in Table 1.

The first round of FMVs created significant problems for Japanese semiconductor companies and for users in the United States. Larger users appeared to have managed to source product from U.S.-based suppliers or to be prebuying before the September 15, 1986, deadline. Many smaller users got caught in the crossfire.

Table 1

CONSTRUCTED PRICES FOR 256K DRAM

	Capacity			
	100%	75%	50%	25%
Processed-Wafer Cost	$178.00	$220.00	$280.00	$500.00
Cost/Chip	$ .27	$ .33	$ .42	$ .75
Test Cost/Hour	$ 27.00	$ 34.00	$ 54.00	$100.00
Wafer Probe Cost/Chip	$ .07	$ .10	$ .15	$ .28
Wafer Probe Yield	70%	70%	70%	70%
Cost/Good Chip	$ .49	$ .61	$ .81	$ 1.47
Assembly Cost	$ .14	$ .19	$ .24	$ .36
Assembly Yield	85%	85%	85%	85%
Assembly Chip Cost	$ .74	$ .94	$ 1.24	$ 2.15
Test Cost/Pkg.	$ .25	$ .36	$ .54	$ 1.01
Test Yield	90%	90%	90%	90%
Tested Device Cost	$ 1.10	$ 1.44	$ 1.98	$ 3.51
Mark, Pack, Ship	$ .20	$ .20	$ .20	$ .20
Total Mfg. Cost/Unit	$ 1.30	$ 1.64	$ 2.18	$ 3.71
R&D Expense (15%)	$ .20	$ .25	$ .33	$ .56
SG&A Expense (10%)	$ .15	$ .19	$ .25	$ .43
Profit (8%)	$ .13	$ .17	$ .22	$ .38
Foreign Market Value	$ 1.78	$ 2.25	$ 2.98	$ 5.08

Source: Dataquest
October 1986

Japan-based semiconductor companies have seen their exports to the United States decrease as prices based on yen have continued to drop in Japan, impacting company profits. The price for 256K DRAMs was ¥450 in 1985. Today the price is ¥289. The agreement has helped yen-based average selling prices increase to ¥375 or higher for sales made into the U.S. market.

It appears that the new FMVs that will become effective on October 15 will be much more palatable to customers. We expect 256K DRAMs to range in price from $2.50 to $4.00, and we expect 1Mb DRAMs to be in the $20 to $25 range for the lowest-cost suppliers. EPROM prices are outlined in our recent Research Newsletter number 1986-28, "Pricing and the Market at Odds: Revised EPROM and 256K DRAM Estimates."

Dataquest believes that the new FMVs will make life easier for U.S. buyers. The new prices indicate that buyers may expect prices to continue to decrease throughout 1987. By the end of 1987 we expect 256K DRAM prices to be close to $2.20, as shown below:

	1986		1987			
	Q3	Q4	Q1	Q2	Q3	Q4
256K DRAMs	$2.85	$2.85	$2.85	$2.50	$2.35	$2.20

We also expect 1Mb DRAMs to return to more competitive pricing than we had previously expected. We now believe that they will approach the crossover point by the end of 1987.

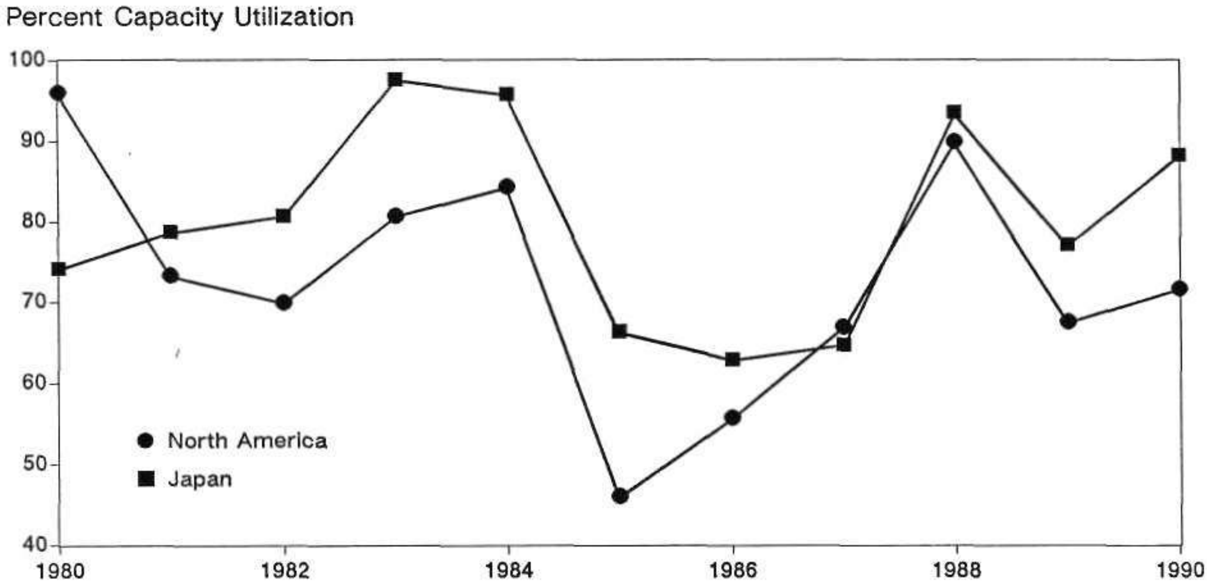
As prices in the United States reach more stable levels, the focus of the program is expected to move to other regions. We expect the Department of Commerce to take up this issue with MITI in the near future. Dataquest surveys prices in Europe, Japan, and Taiwan every two weeks, and prices in Europe and Taiwan have remained at $2.00 or less during the last month. However, our European research indicates that prices in Europe will increase from current levels in the next two quarters.

LONG-TERM IMPLICATIONS OF THE AGREEMENT

This agreement presents interesting opportunities for users and semiconductor manufacturers. Because the models used to determine the FMVs are based on capacity utilization, FMVs will decrease during market growth periods and increase during recessions when capacity utilization drops. Figure 1 shows our projection of capacity utilization for the industry for the next five years. By combining this with the data shown in Table 1, we can analyze the impact of the business cycle on FMVs. As capacity utilization drops, FMVs will tend to increase; this will effectively remove uneconomic foreign capacity from the U.S. market as demand declines and will direct more business toward U.S.-based suppliers who are not affected by the FMVs. Our current forecasts project that this will occur in 1989.

Figure 1

CAPACITY UTILIZATION--NORTH AMERICA VERSUS JAPAN



Source: Dataquest
October 1986

Another concern arising from the first round of FMVs was the price of new technologies--in this case, the 1Mb DRAM. Third quarter FMVs were double the prior market price. This had the impact of delaying the introduction of the latest technology into U.S.-manufactured equipment, giving Japanese companies a lead in this area. The long-term implications of this are far more important than any other action resulting from the agreement.

New technology has far greater impact on system cost than declining prices. Figure 2 shows how this works. Cost per function can decline by a factor of five or more for a much smaller decrease in price. Figure 3 shows how it works for memories. Each new level of cost occurs when the next generation of memory enters the market. Each new generation decreases the cost from the previous generation by a factor of five. A one-year lag in pricing causes a one-year lag in system technology. The anticipated 1Mb FMVs will prevent a near-term U.S. versus Japan system technology dichotomy.

The new FMVs of $20 to $25 for 1Mb DRAMs should correct this situation, but the impact on future generations of DRAMs remains to be seen. This is not a problem with EPROMs, however, because U.S. companies are leaders in introducing next-generation EPROMs.

Figure 2

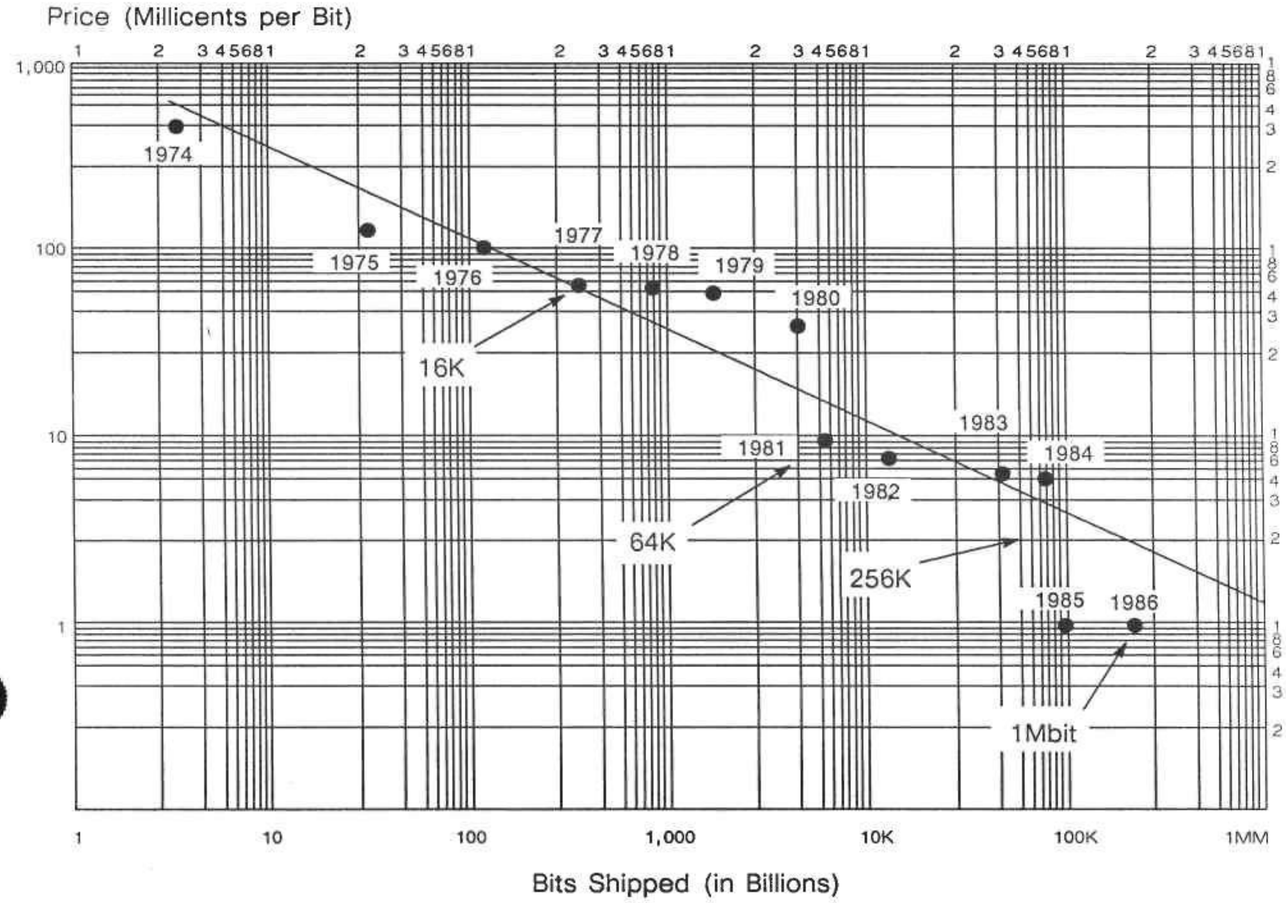
HYPOTHETICAL CHIP COST MODEL

	1984	1986
Minimum dimension	3 microns	2 microns
Wafer size	4 in.	6 in.
Processing cost	$140	$220
Chip size (mils per side)	200	250
Yield	30%	50%
Chip cost to product cost	4X	4X
Good chips	100	200
Finished chip cost	$1.49	$1.10
Finished package cost	$5.96	$4.40
Transistors/chip	50,000	211,000
Cost/transistor	9.9m¢	2.1m¢

Source: Dataquest
October 1986

Figure 3

DRAM EXPERIENCE CURVE



Source: Dataquest
October 1986

STRATEGIES FOR THE TRADE-AGREEMENT ENVIRONMENT

The trade agreement has precipitated a number of responses by semiconductor users. These responses and their implications are discussed in the following paragraphs.

Some U.S. companies are considering having memory PC boards manufactured in Japan and exported to the United States. Through this transformation of product, the FMVs are avoided. This is a good plan, but the government could close this loophole if it becomes a serious impediment to making the agreement work.

A number of users have benefited from agreements with NEC, which has manufacturing capacity in both the United States and Japan. The short-term effect obviously has been to lower prices. This will not appear to be so important with the new FMVs, but we believe that all users should develop a balanced U.S./Japanese supply base. It will enable them to shift sourcing during recessionary periods, when we expect the FMVs to increase as capacity utilization decreases. This will minimize the price impact on customers during down markets.

Moving to offshore manufacturing is another possible strategy. However, we believe that companies should be very careful with this, as the agreement could equalize prices worldwide (except in Japan) if it works as intended.

Korean suppliers offer another opportunity for lower prices, but this should be considered a short-term strategy. Korea currently supplies a small part of the market. If the U.S. government becomes interested in controlling Korean suppliers as a major source of DRAMs, we believe that Korean FMVs would be substantially higher than current prices.

DATAQUEST CONCLUSIONS

Procurement strategies under the trade agreement should remain extremely flexible. Companies should balance U.S. sources with foreign sources to be able to adjust to changes in the current business environment. Any actions taken to get around the agreement could be affected by government actions to close loopholes that could affect the intent of the agreement. We believe that the major negative effects of the agreement will subside when the new FMVs are released on October 15. The groundwork has to be done now for dealing with the long-term effects of the agreement.

Jim Beveridge
Stan Bruederle

Dataquest

Conference Schedule

1986

Semiconductor	October 20–22	Hotel Inter-Continental San Diego, California
Technical Computer	November 3–5	Silverado Country Club Napa, California
Asian Peripherals	November 5–7	Hotel Okura Tokyo, Japan
Semiconductor Users/ Semiconductor Application Markets	November 10	Sheraton Harbor Island San Diego, California
Electronic Publishing	November 17–18	Westin Copley Place Boston, Massachusetts
CAD/CAM EDA	December 4–5	Santa Clara Marriott Santa Clara, California

1987

Semiconductor Users/ Semiconductor Application Markets	February 4–6	Saddlebrook Resort Tampa, Florida
Copying and Duplicating	February 23–25	San Diego Hilton Resort San Diego, California
Electronic Printer	March 23–25	Silverado Country Club Napa, California
Japanese Semiconductor	April 13–14	The Miyako Kyoto, Japan
Telecommunications	April 13–15	Silverado Country Club Napa, California
CAD/CAM	May 14–15	Hyatt Regency Monterey Monterey, California
Display Terminals	May 20–22	San Diego Hilton Resort San Diego, California
European Semiconductor	June 4–5	Palace Hotel Madrid, Spain
European Copying and Duplicating	June 25–26	The Ritz Hotel Lisbon, Portugal
Financial Services	August 17–18	Silverado Country Club Napa, California
Western European Printer	September 9–11	Palace Hotel Madrid, Spain
European Telecommunications	October 1–2	Monte Carlo, Monaco
Semiconductor	October 19–21	The Pointe Resort Phoenix, Arizona
Office Equipment Dealers	November 5–6	Hyatt Regency Monterey, California
Electronic Publishing	November 16–17	Stouffer Hotel Bedford, Massachusetts
CAD/CAM EDA	December 10–11	Santa Clara Marriott Santa Clara, California

Dataquest

Product Offerings

Industry Services

Business Computer Systems

CAD/CAM

Computer Storage—Rigid Disks

Computer Storage—Flexible Disks

Computer Storage—Tape Drives

Copying and Duplicating

Display Terminal

Electronic Printer

Electronic Publishing

Electronic Typewriter

Electronic Whiteboard

European Semiconductor*

European Telecommunications

Gallium Arsenide

Graphics

Imaging Supplies

Japanese Semiconductor*

Office Systems

Personal Computer

Personal Computer—Worldwide Shipments and Forecasts

Robotics

Semiconductor*

Semiconductor Application Markets*

Semiconductor Equipment and Materials*

Semiconductor User Information*

Software—Artificial Intelligence

Software—Personal Computer

Software—UNIX

Technical Computer Systems

Technical Computer Systems—Minisupercomputers

Telecommunications

Western European Printer

Executive and Financial Programs

Corporate Alliance Program

Coporate Technology Program

Financial Services Program

Strategic Executive Service

Newsletters

European PC Monitor

First Copy

Home Row

I.C. ASIA

I.C. USA

Focus Reports

The European PC Market 1985-1992

European PC Retail Pricing

PC Distribution in Europe

PC Software Markets in Europe

PC Local Area Networking Markets in Europe

The Education Market for PCs in Europe

Japanese Corporations in the European PC Markets

Home Markets for PCs in Europe

Integrated Office Systems—The Market and Its Requirements

European Market for Text Processing

Image Processing in the Office

Work Group Computing

Translation Systems

Vendor Support

The IBM 3270 Market: 1986 and Beyond

Korean Semiconductor Industry Analysis

Diskettes—The Market and Its Requirements

Directory Products

I.C. Start-Ups—1987

SpecCheck—Competitive Copier Guide

SpecCheck—Competitive Electronic Typewriter Guide

SpecCheck—Competitive Whiteboard Guide

Who's Who in CAD/CAM 1986

Future Products

- Industry Services
  - Manufacturing Automation
  - Computer Storage—Optical
  - Computer Storage—Subsystems
- Focus Reports
  - Japanese Printer Strategy
  - Japanese Telecommunications Strategy
  - Canon CX Laser—User Survey
  - Digital Signal Processing
  - PC-based Publishing
  - Taiwan Semiconductor Industry Analysis
  - China Semiconductor Industry Analysis
  - PC Distribution Channels
- Directory Products
  - SpecCheck—Competitive Facsimile Guide
  - SpecCheck—Competitive Electronic Printer Guide

*On-line delivery option available

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EUROPEAN MONTHLY REPORT

ESIS Code: Vol. IV, Newsletters

EUROPEAN SEMICONDUCTOR DIVISION

OCTOBER MONTHLY REPORT

STATE OF THE INDUSTRY

The fourth quarter outlook continues to look bleak whichever way you look at it:

- o September bookings were disappointing (especially for a 5 week month).
- o Distribution inventory remains stubbornly high (especially in the UK and Germany).
- o OEMs continue to resist placing long-term contracts.
- o Pricing remains depressed (despite the US-Japan trade agreement).
- o OEM inventory/work-in-progress purge continues to take priority.

As a result, we believe a number of semiconductor manufacturers will find it extremely difficult to pull their fourth quarter billings (in local currency terms) above third quarter levels. Traditionally distribution has helped billings by its high fourth quarter turns demand, coupled with a high stocking demand in anticipation of a strong first quarter.

The uncertainty of the industry remains and with the US Department of Commerce set to refix floor prices on memory devices by October 16, right now no-one seems anxious to do anything. The decision of the EEC to challenge the legality of the US-Japan trade agreement with GATT has also added yet another level of confusion and uncertainty in what was already a very depressed market situation.

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144/146 New Bond Street / London W1Y 9FD England / (01) 409-1427 / Telex 266195

1290 Ridder Park Drive / San Jose, CA 95131 / (408) 971-9000 / Telex 171973

Without a doubt, the present almost frenzied focus on inventory/work-in-progress reduction goes way beyond just-in-time (in practise OEM stock reduction). Its true focus stems from:

- o The need to reduce overall costs.
- o Flexibility issues, i.e. responding to their own customers varied needs.
- o Reduced product life cycle at the equipment level.
- o Depressed forward view of demand for their end-equipment.

All these are valid requirements and in the interests of a healthy OEM industry, and are healthy in the long-term. Unfortunately, in the short-term, they are extremely painful for the semiconductor suppliers to live through.

They are however a one-time hit; once the inventory has been depleted, or pushed back to the vendor (just-in-time), and OEM production cycle times reduced, with consequent reduction in work-in-progress, the OEMs will eventually have to resume ordering volume parts in line with their own end equipment shipment levels.

In the meanwhile, until there is a real pickup in demand of the end-user markets, especially in the US, the short-term outlook for the semiconductor industry remains bleak.

Our present forecasts show a 2 percent fourth quarter growth over the third quarter and this must be considered best case. Similarly, our 1987 projection currently stands at plus 14.8% vs 1986 in local currency terms. That too must be considered best case. Unless the situation starts to show real positive signs of improvement shortly, the reality could easily turn out to be zero growth in Q4-1986 and only 7 percent growth in 1987. Whilst we are not yet prepared to finally downgrade our current forecasts, this downside risk potential must be kept firmly in mind. Regrettably, right now, the potential for optimism on the upside is negligible.

OTHER INDUSTRY COMMENTS

Amstrad launches IBM PC Compatible--in what is seen as a daring gamble into the PC-compatible market. Amstrad in the beginning of September launched a family of PC-compatible computers. Previously, Amstrad had confined its activities to the home/low-end business end of the market. Its most notable success to date has been the PC-based dedicated wordprocessor system which comes bundled complete with a printer and software for £399 and has proved extremely popular with both small business and the private individual alike.

The new PC-compatible series comprises at the low end a single floppy machine, through to a 20Mbyte hard disk machine at the top end. 512K of memory is standard, upgradable to 640K, and comes with either a monochrome or colour monitor. The fully loaded machine with colour monitor costs just £949. All machines come complete with microsoft's MS DOS 3.2 and Digital Research's GEM software.

Monthly output of the machines, which are manufactured in Korea, is targetted for 70,000 initially, increasing to 100,000 once the machines are launched in the US next January. The 8086-based machine uses ASIC technology extensively as a means of substantially reducing the chip count and hence manufacturing costs.

US/Japan chip deal sails into heavy waters--less than 6 weeks after the historic semiconductor trade pact between the US and Japan was signed, major headaches for the electronics industry have surfaced worldwide.

Whilst initially heralded as a major step forward, and still is said to be in many quarters (especially in the US), the end equipment industry is increasingly angry and sceptical of the agreement. Of concern is that whilst, short-term, it may relieve the pressure on the US semiconductor industry, its effect on the rest of the non-Japanese electronics industry is harmful. Higher chip prices inevitably lead to higher end-equipment production costs, and that will force the non-Japanese electronics companies into a substantially more difficult competitive situation.

Whilst there is some scope for cushioning the effects of higher cost and higher selling prices in the domestic markets, e.g. by further import restrictions and other protectionist-like measures, any attempt to put up prices in export markets can only lead to market sacrifice--to compete successfully in international markets, the need to remain competitive remains pre-eminent.

And all this comes on top of a five year dollar assault on the world markets which in itself has proved dramatic in driving the US electronics companies into increasing uncompetitiveness. Whilst this has abated in the last 12 months, the dollar is still 50 percent higher on average than it was in 1980 compared with the European currencies.

Whatever the final outcome, it now seems increasingly unlikely that the trade deal will yield the positive benefits expected. It also seems ironic that the US government is attempting to impose a discipline on the semiconductor market that has never been practiced by the US manufacturers (see also ESD July monthly report--Thought for the Month).

Swiss toolmaker, Agie, hones its competitive edge--in the face of intense competition from Japan, Agie, a Losone-based manufacturer of electric discharge machines (EDM) has secured 15 percent of the world market dominated by Japan.

EDM, or spark erosion technology, allows specially hardened metals or plastics to be shaped with great accuracy. It is a market that is growing at between 10 percent and 15 percent annually. Currently Mitsubishi and Fanuc, both of Japan, dominate the world market. Yet Agie is the technology leader and manages to sell its machines into the Japanese market at premium prices.

Following a disastrous flood in 1978, Agie was able to re-equip its facility and take a healthy technological lead over its rivals. This enabled it to expand sales faster than its competitors and to sell machines at the top end of the market where profits were highest. The flood also marked a change in management philosophy. A more aggressive international marketing style was pursued coupled with a commitment to maintain its technological lead. The third element of the revival program was a policy of solving customers' problems, i.e. to define the customers' real needs and servicing them. Though expensive in the short-term, the combination of a closer approach to the customer plus technical performance has proved a winner.

SEPTEMBER INDUSTRY HIGHLIGHTS

Plessey scores international success with intelligent payphone now being installed by 25 telephone companies in 18 countries. Sales have climbed to $60 million in the last twelve months with no signs yet of growth abating. At present there are just over six million payphones in the world of which the US and Japan each have two million. They are mostly used for local calls and nearly all based on old technology--all the sophisticated electronics is in the telephone exchange. In its new vandal proof design, coupled with highly advanced technology, the new Plessey phones enable international direct dialling to be achieved with the consequent increase in revenue generation. The robust construction of the phone--it takes a full 22 minutes to break into it using axes and sledgehammers, has made it possible to risk installing sophisticated electronic circuity into the box providing such features as international direct dialling, a self-monitoring system that signals for maintenance if anything goes wrong, signals to the exchange should it come under attack, and signals when its coin box is 70 percent full to have someone empty it.

Acorn and Apricot return to profit during the first half of 1986. Acorn, which was twice rescued by Olivetti during 1985, announced a half year operating profit of £298,000 on turnover of £19.6 million, compared with a loss of £10 million in 1985. Apricot has also been trading profitably for the first four months of its fiscal year. Both companies were amongst the most noted casualties of the 1985 UK electronics industry downturn.

Thomson and Toshiba in microwave oven venture to launch a new company in South West France. The new company, Cefemco, is the latest of a string of European-Japanese joint ventures and will cost Y1.5 billion to set up. Projected annual output is targetted at 300,000 units per year. The company will be owned 51 percent by Thomson, and 49 percent by Toshiba. In a separate joint venture, in the wake of the recent EEC anti-dumping duties recently imposed by the EEC on Japan, Toshiba plans to produce photocopiers in France with Rhone-Poulenc by the end of 1986.

Nissan predicts first loss in 30 years due to the harsh effects of the high Yen. The main reasons for the projected loss for the year ending March 1987 stems from the company's reluctance to raise prices in line with the Yen's appreciation, a strategy being used by most Japanese exporters who are unwilling to sacrifice overseas market share.

IBM declares war on PC-clones following the introduction of a high-powered computer for business users. IBM's share of the personal computer market has eroded over the past few years and increasingly it has started to lose business amongst its corporate customers. Apart from lowering prices on its existing models, the company announced a new machine, the XT Model 286 as a technological move against the clones. Basically an updated version of the PC XT, the standard business-type personal computer in IBM's product range, the model offers higher performance than most IBM-compatible machines.

Personal computer makers hit back at IBM with Compaq, Sperry and Digital Equipment all announcing new systems that will go head to head with the new IBM personal computer. Compaq, the leading IBM-compatible personal computer manufacturer, introduced a new version of its Deskpro 286 with features that mirror that of the IBM XT Model 286. Sperry's PC Micro IT, also using the Intel 80286 microprocessor, offers higher performance but at similar cost, and Digital announced an IBM compatible machine, the Vaxmate, aimed primarily at its existing minicomputer customers. The Vaxmate incorporates communication capabilities that easily link it to Digital's computers and to a local area network.

De Benedetti aims to raise $600 million in a further expansion of his financial and industrial empire. The Italian entrepreneur has already raised about $2 billion on the international markets this year following $750 million in 1985.

Rolls Royce and Pratt & Whitney in joint study for advanced engine for a new supersonic vertical and short take-off and landing (V/STOL) aircraft. The study could lead to eventual development of an advanced V/STOL propulsion system in the late 1990s for a new version of the Harrier vertical take-off and landing fighter now being built both in the US and UK.

European groups agree on $50 million NATO radar project to provide the next generation of radar for their respective navies under the NATO frigate replacement program for the 1990s. The program, which calls for the development of the European multi-function, phased array radar, involved Marconi Radar Systems, UK, Selenia, Italy, and Thomson-CSF, France.

Volkswagen tops European car output league in 1985 with its Golf/Jetta car range. General Motor's new Opel Kadett/Vauxhall Astra was in second place having overtaken Reanult's R9/11 range and Ford's Escort/Orion. The Fiat Uno also make substantial progress to finish third. Peugeot managed to break into the top 10 for the first time last year with its 205 series.

US Treasury calls Japan to trade imbalance talks against a background of increasingly strident warnings from the US that coordinated international action is required to try to begin to correct the huge international trade and current account imbalances. High on the list of the agenda is to pressurize Japan to lower its discount rate.

Mercury and BT poised for price way in the UK's newly liberated telecommunications market. Mercury, the sole competitor to BT's main network, seems set to announce complementary price cuts following BTs recently announced price changes. BT had made it clear that some of its price cuts were in response to Mercury's tariffs, though both competitors deny their intention to battle in a price war. Mercury is particularly concerned about BT's price cuts on long distance trunk routes which it fears may almost remove Mercury's price advantage over BT for small and medium size businesses.

Matra in mobile phone link up with Nokia, a Finnish company, aimed at developing and commercializing mobile telephones in France and other countries. The two companies are setting up a French-based joint venture to pool efforts in the cellular radio-telephone sector for business and individual users. Nokia-Mobira is Europe's leading cellular radio-telephone company with factories in Europe and the Far East. Matra officially launched its Radiocom 2000 radio-telephone system earlier this year.

Compaq announces 32-bit based PC, the first large manufacturer of IBM-compatible business personal computers to do so. It uses a new generation of microprocessors, the Intel 80386. This puts further pressure on IBM at the top end of the IBM-compatible market. The new machine is capable of running existing software two to three times faster than existing personal computers, though as yet, no software yet exists specifically designed for the 80386 processor.

French groups face privatization under plans recently announced by the French Government. Early targets include Saint-Gobain, Compagnier Financiere de Paribas, and Assurance Generales de France (AGF). All three concerns stand to gain by the privatization move.

Olivetti to market AT&T System 75 telephone switching equipment under an exclusive distribution agreement in Italy. This marks the first joint move by AT&T and Olivetti to offer an AT&T PABX on the European market. System 75, aimed at medium-size users, uses digital switching techniques and software to combine voice and data transmission in an integrated system. Olivetti also sells two PABX systems designed for large users, the ICS 4000, own designed, and the ICS 6000 which it manufacturers and sells under licence from Northern Telecom.

Philips and Du Pont Optical, the optical-media joint venture, plans to invest FFr 250 million to convert a Polygram record and cassette factory in Louviers, France, into a compact disc plant. The plant will have a capacity of 30 million discs a year starting in 1987.

AMD to cut back across the board in bid to stem continuing loss. Apart from abandoning its no lay-off policy, AMD will also cut back some production lines and pare back spending in R&D. AMD hopes to return to profitability early in 1987. The company has reported losses for each of the past four quarters with operating losses for the year reaching around $78 million.

Grundig cuts losses sharply beating its own forecast and reinforcing its aim of returning to profitability in 1986. The loss for the past fiscal year fell from DM 185 million to DM49 compared with a forecast of DM80 million loss. The company hopes to be operating profitably during the fourth quarter to end up showing a profit for the whole of the fiscal year.

IBM plans to cut US workforce by 12,000 in line with the downturn in demand for its products and increasing competition. The company announced a program to encourage early retirement, has severely restricted new hiring, and slashed overtime.

EEC seeks to limit digital tape threat from Japanese imports. One option likely to be pursued by the Commission is legalisation requiring DAT machines and tapes be fitted with an anti-copying device known as a spoiler. Also being studied is the possibility of levies on all blank DAT tapes and tariffs on imported DAT recorders.

European HQ for Fujitsu at Stockley Park, near Heathrow, UK. The proposed new centre will service Fujitsu customers throughout Europe and will include a class 100 clean room allowing the repair of Winchester discs. Currently Fujitsu only has this facility in Japan, the company will move existing 100-strong staff currently located in three separate offices in and around London to its new headquarters as well as hiring around 25-30 additional staff.

Memec hit by difficult trading conditions suffering a decline in pretax profits from £3.3 million to £2.5 million. Turnover was also down from £2.62 million to £25.5 million. The company did not expect trading conditions to improve significantly in the short-term.

Plessey, UK, develops wrist watch pager in conjunction with AT&E. The paging system, designed by three-year old San Fransisco start-up, AT&E, is set to go on trial early in 1987 ready for commercial launch one year later. Plessey will produce two ASICs designed for receiving and transmitting messages and processing them into a visual form that can be displayed on the watch face. Both bipolar and CMOS technology will be used.

Ericsson joins DEC in banking system venture to combine their joint resources in a bid to secure an increased share of the world market for banking information systems. The two companies will set up an R&D venture later this year to develop integrated software and systems for the banking market.

Ford set to buy 20 percent stake in Alfa Romeo, the state-owned Italian motor group, in a deal which would lead to Ford assuming 51 percent majority control within three years. The provisional agreement with SRI-Finmeccanica, the Italian state holding company, calls for Ford to pay $96 million for the initial stake. Its move to majority control would be automatic and not an option. However, even at this late stage, Fiat is still attempting to snatch Alfa Romeo from Ford and is expected to unveil a counterproposal shortly.

Italtel and Plessey approach France over CGCT in a move to increase their presence in the European Telecommunications market. At the same time, Plessey disclosed that it will sign an agreement with L M Ericsson, the Swedish telecommunications and electronics group, for joint development of the next generation optical fibre transmission systems. Because the purchase of CGCT would carry with it 16 percent of the French public switching market, the entry of AT&T, another prospective buyer, has been staunchly resisted by some sectors within the French administration.

Siemens, one of the other potential bidders, has irritated the French administration by attempting to leverage the proposed ITT/CGE merger such that the two deals are mutually dependant. Because of the present confusion, no early decision is anticipated.

Sony income falls 59 percent in third quarter to Y7.1 billion compared with 17.5 billion in the third quarter last year. At the same time, the group lowered its income forecast for the current fiscal year (ending October) to Y46 billion versus its original projection of Y62 billion, approximately 35 percent down on last year.

Telefonica seeks to pull out of Intelsa, Industries de Telecommunication, which makes public and private telephone exchanges, telex, and other equipment. Intelsa is a joint venture between Telefonica (49 percent) and Ericsson (51 percent). Telefonica also want to withdraw as a direct shareholder of ITT's subsidiaries in Spain if and when they became part of the planned new grouping by ITT and CGE.

Europe fastest growing optical fibre markets representing 34 percent of the total world by 1991, compared with 22 percent at present. The driving force is the use by most countries of large amounts of optical fibre in telephone networks. Optical fibre use in data communications, military, and video technologies will also contribute to the surge.

Siemens to supply central office switch to Ameritech, the third supplier to be signed up, under a three year contract announced recently. Siemens EWSD switch will be supplied by Siemens Communications Systems, Boca Raton, Florida. Purchases will involve between 35 and 50 digital central office switches annually, valued at approximately $450 million over the length of the contract.

Philips in joint venture talks with Whirlpool, the US white goods major appliance manufacturer. The proposed joint venture would mark a further step in the rapid consolidation of the world domestic appliance industry. Both comanies enter the talks from a position of strength. Philips is the second largest domestic appliance manufacturer in Europe after Electrolux, while Whirlpool is the US market leader in the same field, just slightly ahead of GE.

Libya to sell its 15.2 percent Fiat stake through an equity placing in the European equity market where shares are placed globally through Eurobond underwriting and syndication techniques. The deal is expected to be worth $3.2 billion, one of the largest yet in the European equity market, and will further strengthen Mr Gianni Agnelli's, Fiat's Chairman, grip on the Company.

Plessey runs first 150mm wafers at Roborough, UK, near Plymouth with production wafers targetted for the end of the year. This marks a further milestone in Plessey's semiconductor recovery program where revenues have nearly doubled from $53 million in 1982 to around $100 million in 1985.

British Telecom (BT) faces more competition in telephone system installation once private customers are allowed to compete in fitting the sockets needed to install extension phones in private homes. However, BT retains its monopoly regarding the master socket - the telephone entry point into the home.

<u>Belgians close microchip memory gap</u> following a chemical breakthrough in semiconductor manufacturing by UCB, a Belgian Company. The new technique called Plasmask will allow feature size reduction well below the present 0.8 micron limit using conventional positive photoresist processing. Developed in close cooperation with IMEC, Belgium's Inter-university Microelectronics Centre in Leuven, Plasmark is a new photoresist, or chemical resin, which will allow users to continue to use their existing photolithographic production lines rather than resort to UV, X-Ray, or E-beam lithography.

<u>Canon aims to raise copier market share in the UK</u> to 40 percent at the top end within 12 months. Eight of the ten models will be produced in Canon's expanded factories in West Germany and France. Canon presently claims 30 percent of the UK market. Output at Canon's Giessen plant in West Germany will rise from 2,500 to 7,000 copiers per month.

<u>France to sell 11 percent of Elf Aquitaine stake</u>, the state oil group, as part of an overall capital market package raising an immediate FFr4.6 billion for the state and the company. The move is the first in the Government's ambitious privatization program. The plan will eventually leave slightly more than 50 percent of Elf's capital in Government's hands, versus 66.8 percent at present.

<u>GEC and Plessey in System X talks</u> which may eventually lead to the establishment of a joint telecommunications subsidiary. The proposed unfriendly takeover bid was blocked last month by the UK Monopolies and Mergers Commission. The merger of the two company's overlapping interests in System X was however supported by the Commmission.

<u>Honeywell proposes $2 billion systems link with NEC and Bull</u>, the first attempt at a worldwide joint venture between US, European, and Japanese computer giants. The announcement late in September came after weeks of speculation about the company's computer busines. Ironically NEC, the world's largest manufacturer of semiconductors, entered the computer market originally with the aid of a technology exchange agreement with Honeywell dating back to 1962. Today NEC manufactures the DPS-90 top-of-the-line mainframe computer for Honeywell. Bull, which was taken into public ownership in 1982, was originally a joint venture in which Honeywell held a 47 percent stake. Relationships have continued to be close since the rationalization with Bull producing the DPS-7 mid-range computer which Honeywell markets in the US. Unlike the recent Burroughs/Sperry merger, the most important benefit of this proposed joint venture is the compatability of most of the computers produced by all three companies, since they are all based originally on Honeywell computer architecture.

<u>EUROPEAN SEMICONDUCTOR DIVISION ACTIVITY REPORT</u>

September saw the staging of the annual European Seminars, "IC Outlook 1987" which this year were staged in seven European capitals, Paris, Milan, Munich, Frankfurt, Stockholm, London and Edinburgh. Copies of the proceedings are available from our London office, please contact Lyn Cooke for details.

The complete European market estimates database was updated during the month and a summary research bulletin published "European Semiconductor Recovery Freewheels Through Balance of 1986". The forecasts contained in the ESIS binders are now outdated and are in the process of being republished. Hard copy printouts of the detailed tables are available on request by clients who require earlier access. The data are also available electronically either in floppy disk format, via the Destiny Datadisks, issue 05, or via the on-line service.

And finally, Kathleen Killian joined the group as Industry analyst. Kathleen, a native of Ohio, US, has spent the past four years working in Europe primarily for INMOS, UK. Previously with INMOS and NCR Microelectronics in the US, Kathleen brings with her a substantial breadth of semiconductor experience. Her background is in quality assurance and wafer fabrication which will enable us to develop this aspect of our database and service much more extensively over the coming months.

THOUGHT FOR THE MONTH

Without a doubt, we are currently living through a period of metamorphasis in the semiconductor industry, and each day that passes, the moment of truth gets closer. The industrial environment has changed substantially in the last decade and that is having its own repercussive effect on the components industry.

For example, ten years ago, there were far fewer companies, fewer products, longer equipment design and production cycle times, and far fewer technologies. This has now exploded into dozens of narrow niches complimented by several major segments that have become even more competitive. As an example of the latter, in 1985 there were approximately 150 PC-clones, 240 personal computer companies, 60 5.25 inch disk drive companies and more than 350 semiconductor companies, nearly half of which didn't exist ten years ago.

The semiconductor industry is increasingly market driven versus technology driven and will continue to accelerate in this direction as the trend towards ASIC and integrated end-user/vendor manufacturing programs (ship-to-stock, just-in-time, cost-of-ownership, etc) gather momentum. Of course, an advanced technological capability, both in processing and CAD, is mandatory, but it is not any more sufficient.

The industry has become increasingly competitive with many new players entering the field. Market leaders have come and gone away again, and some companies have already fallen by the wayside. Many more are in a radically weaker position than they were even five years ago and are unlikely to ever regain their former positions.

The industrial stakes, that is the cost and productivity issues of staying in the business, are also getting higher. In 1980, a typical new wafer fabrication module used 100mm wafers and would produce around $35-40 million of product per year. Today that same module uses 150mm wafers producing $100-150 million of output. By the end of the 1990s, we will undoubtedly be running on 300mm wafers in which case the corresponding output will be at least half a billion dollars--more than the entire revenues of many of today's semiconductor companies. Even today's leaders would only require three such modules to produce their entire needs today.

Clearly the big will get bigger and of course, the small to medium size companies will find sufficient vertical niches that are entirely viable business areas in their own right. But equally so, many of today's companies either won't survive at all; they will either cease trading altogether, be acquired, or will merge with a friendly partner to leverage their combined strength to achieve market pre-eminence.

New realities have changed the semiconductor industry forever. The shift in manufacturing from initially Europe to the US, and now to the Far East will not readily be reversed, though Europe is now demonstrating that there is ample scope to regain a vibrant part of this manufacturing pie.

Furthermore, the increased foreign competition is not likely to diminish and with it comes the gradual realization of the growing inability of the US semiconductor companies to compete in the commodity markets.

And an added burden for the larger US semiconductor companies has been the gradual erosion of their technical competence to the start-ups which, whilst extremely entrepreneurial and in the best spirits of US culture, does have the damaging side-effect of seriously delaying the parent company's own activities in these new areas with consequent jeopardy on their own longer-term technical viability. The Japanese, on the other hand, have not had the same problem.

At the OEM level, the effects of relinquishing markets to foreign competition is perhaps no more profound than in the consumer area. Consumer is a Japanese stronghold and (increasingly) electronics intensive. There are some important ramifications here for the semiconductor industry because it is a true mass market and has allowed the Japanese manufacturers to build increasingly complex ICs in mass volume and drive down costs quickly. It has also allowed them to explore new assembly techniques, for example, surface mount and chip-on-board techniques to build up the experience, quality, and reliability of these techniques. This experience can be readily transferred to other production areas to help provide a strategic edge in the overall semiconductor market. Though consumer-dominated now, the Japanese market is moving quickly toward leading edge products for personal and office use.

We have mentioned before the likelihood of the decreasing viability of a pure semiconductor company being able to remain, amongst the top rankings worldwide, though individually they will of course remain a significant part of the overall semiconductor environment. Vertical integration and strategic alliances we believe will be critical elements in survival, especially in tomorrow's billion dollar semiconductor R&D and capital investment environment.

The industry is undergoing a shake out right now, and although this is healthy in broad terms in the long-term, it will be extremely difficult to live through.

FUTURE EVENTS DIARY

SEMICONDUCTOR CONFERENCES

- OCT 8-10, European Telecommunications Industry Conference
  Hilton International, Vienna, Austria
  "Strategy for the 1990s"

- OCT 20-22, Semiconductor Industry Conference
  Hotel Intercontinental, San Diego, California, USA
  "Recovery: Managing the New Industry Structure"

Plus in 1987

- FEB 5-7, Semiconductor User Information Conference
  Tampa, Florida, U.S.A.

- JUNE 3-5, European Semiconductor Industry Conference
  Madrid, Spain

SPECIAL REPORTS

- Korean Semiconductor Industry Report--available now
- IC Update '85--available now
- 1985 News Digest--available now
- GaAs Market Update--available fourth quarter 1986
- DSP Market Update--fourth quarter 1986
- Taiwan Semiconductor Industry Report--available fourth quarter 1986
- Hong Kong Semicounductor Industry Report--available fourth quarter 1986
- China Semiconductor Industry Report--available fourth quarter 1986
- IC Start ups--available fourth quarter 1986

NEWSLETTER SUBSCRIPTIONS

- IC ASIA
- IC JAPAN
- European Monthly Report

ON-LINE SERVICES

- ITT Dialcom Worldwide Electronic Mail (74:DQE002)
- Semiconductor Group Database History, Forecast & Market Share Data, Europe, Far East, Worldwide
- SIA Database, Bluebook, Flash Report, Forecast

For further information on the above items or any other aspect of DATAQUEST services please contact your local DATAQUEST office.

Dataquest

a company of The Dun & Bradstreet Corporation

1290 Ridder Park Drive
San Jose, California 95131-2398
(408) 971-9000
Telex: 171973
Fax: (408) 971-9003

Sales/Service offices:

UNITED KINGDOM
DATAQUEST UK Limited
144/146 New Bond Street
London W1Y 9FD
United Kingdom
(01) 409-1427
Telex: 266195
Fax: (01) 491-2790

GERMANY
DATAQUEST GmbH
Rosenkavalierplatz 17
D-8000 Munich 81
West Germany
(089) 91-1064
Telex: 5218070
Fax: (089) 91-2189

FRANCE
DATAQUEST SARL
100, Avenue Charles de Gaulle
92200 Neuilly Sur Seine
France
(1)47.38.13.12
Telex: 611982
Fax: (01)47.38.11.23

JAPAN
DATAQUEST Japan, Ltd.
Taiyo Ginza Building
7-14-16 Ginza, Chuo-ku
Tokyo 104, Japan
(03) 546-3191
Telex: J32768
Fax: (03) 546-3198

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RESEARCH BULLETIN

ESIS Code: Vol. II, Newsletters 1986-28

NATIONAL CAPTIVATES ITS REPS

In a dramatic move on Monday, October 13, 1986, National Semiconductor made an offer to purchase its entire force of 150 to 200 U.S. sales representatives. Dataquest believes that this is an excellent move on the part of National and that it is also significant to the industry at large.

Currently, National's U.S. sales are almost exclusively through reps, while its European and Asian sales are handled by company employees. National is well along in its transition from a "jellybean" house to a firm with a broad line of proprietary products. Currently, more than 75 percent of National's new products are proprietary, and 18 of the top-selling 20 products are proprietary. National's component R&D expenditures have grown at a compound rate of 29 percent for the last three fiscal years and now stand at an estimated 19 percent of component revenue.

The acquisition of its North American sales force will permit National to better control its customer relations. This move represents a major push at National, where the corporate mission is to "provide service second to none--resulting in long-term National Semiconductor/customer partnerships." Under National, this sales force should be able to better support the increasing complexity of the company's proprietary products and more effectively work with customers during long design-in cycles. Additionally, this offer is well timed because many reps are currently somewhat disheartened with their businesses. National should be able to acquire a direct sales force for much less than it could recruit and train one.

This action by National is worthy of note by other semiconductor firms since reps that sell National products no longer will sell other firms' products. Dataquest believes that the semiconductor industry is becoming more "globalized," with U.S. firms striving to enter the Japanese market and Japanese and European firms striving to enter the North American market. Given this increasingly competitive situation, access to a captive sales force could be a major advantage.

Jim Beveridge
Howard Z. Bogert

Dataquest Incorporated, 1290 Ridder Park Drive, San Jose, CA 95131-2398, (408) 971-9000, Telex 171973

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EUROPEAN RESEARCH NEWSLETTER

ESIS Code: Vol. IV, Newsletters
1986-27

GALLIUM ARSENIDE ICs--FACT OR FANCY?

It has been said that the quantity of paper published on gallium arsenide (GaAs) technology outweighs the shipments of chips, and this certainly holds true for GaAs ICs. Dataquest recently analyzed the industry to determine the extent of activity in this field and to gain insight into the reality of the emerging markets for GaAs semiconductors.

A CRITICAL MASS OF PLAYERS AND INVESTMENTS

Dataquest estimates the number of participants in the GaAs industry to be:

- 28 merchant market suppliers of GaAs ICs
- 26 additional companies supplying discretes
- 21 captive-only producers of GaAs chips
- More than 20 merchant suppliers of GaAs wafers, plus 10 or more suppliers of other III-V compound wafers such as InP
- 10 merchant foundries
- 11 IC start-ups not included above, with planned shipments starting in 1986 or 1987
- 30 Japanese companies in MITI-supported projects funded at $348 million

Additionally, more than 60 universities in the free world are involved in III-V compound semiconductor R&D, many with fabrication facilities. The number of professionals with degrees in this field is rapidly approaching 10,000. Analog GaAs ICs for TVRO applications are now available at ASPs

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1290 Ridder Park Drive / San Jose, CA 95131-2398 / (408) 971-9000 / Telex 171973

of less than $20. Vitesse Electronics Corporation has announced a 2900-type bit slice family of digital ICs that includes a 1Kx4 SRAM and are based on a 1.2u E/D MESFET process. Dataquest estimates that capital infusion into the GaAs IC field exceeded $330 million in 1985.

WHAT IS THE FUTURE OF THE GaAs IC INDUSTRY?

A recent Dataquest analysis of available high-speed ICs shows that silicon technology is evolving rapidly on several fronts. CMOS processes are now pushing critical dimensions (CDs) to less than 1.5 and, in some cases, below 1.0 , resulting in subnanosecond gate delays. ECL gate arrays based on sub-u CDs are now in limited volume production and feature gate delays of less than 300 picoseconds. This progress, coupled with product schedule slippages at several major GaAs digital houses, has raised some doubt as to the viability of using GaAs digital ICs in new systems now being developed, especially at bottom-line-sensitive U.S. computer houses. This situation has also inspired many U.S.-based silicon IC suppliers to maintain the status quo of evolutionary progress in silicon as opposed to extending themselves by risking investment in GaAs.

Dataquest observed during this analysis that all of the Japanese GaAs IC suppliers are vertically integrated, supplying communications and EDP equipment; many also produce their own wafers. This contrasts sharply with the typical U.S. GaAs IC start-up, which is a "chips-only" company.

Despite the number of players in the GaAs arena, wafer defect densities are still excessive with respect to LSI chip fab requirements. This problem and the problem of gate threshold control have, to date, prevented the introduction of cost-effective GaAs chips into commercial systems. However, these problems are resolvable with the appropriate application of presently understood technology. The GaAs IC situation today is not unlike the Si NMOS situation in 1971, when the industry struggled to produce the standard 1K DRAM, the 1103. At that time, Burroughs, NCR, and others took leadership positions by designing the 1103 into systems and pressuring the U.S. industry to rise to the occasion, which it did. Today, to Dataquest's knowledge, only one U.S. systems house is applying similar pressure to potential GaAs RAM suppliers. If history is any indicator, the GaAs IC industry needs several more courageous champions within systems houses demanding tens of millions of GaAs LSI chips and backing their demands with purchase orders and multiyear schedules. It now appears that if such a situation evolves, it will do so in Japan, leading to a further demise of U.S. EDP houses in the world marketplace.

DATAQUEST CONCLUSIONS

While the U.S. Department of Defense appears to be pushing the U.S. industry very hard for viable merchant GaAs IC sourcing, many potential suppliers are limited by the lack of adequate additional demand from the commercial sector. This shortfall in demand is preventing a sufficiently rapid buildup of volume, making it difficult, if not impossible, to achieve the minimum efficiency of scale required for the success of the GaAs IC industry. The MITI-backed effort at vertically integrated Japanese firms does not face the same limitation; the net effect may be the eventual domination of the emerging worldwide GaAs IC market by Japanese firms. However, the race has just started, with only two Japanese suppliers of merchant GaAs ICs at present; a few courageous "drivers" in U.S. systems houses could have a major impact on the outcome.

Peter Savage
Gene Miles

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EUROPEAN RESEARCH NEWSLETTER

ESIS Code: Vol. IV, Newsletters
1986-26

THE NEC/INTEL TRIAL: THE INDUSTRY WINS A VICTORY--OR DOES IT?

On Monday, September 22, 1986, U.S. District Court Justice William Ingram handed down the first court decision to come out of the NEC/Intel copyright lawsuit. In what has been hailed a landmark event in the protection of intellectual property, Judge Ingram declared that Intel possessed "good, valid, and existing copyrights on its 8086/8088 microcode."

Of greater significance to the semiconductor industry as a whole, and to manufacturers of microdevices in particular, is the court's stated position on the legal nature of that form of intellectual property known as microcode--the implementation of macroinstruction sets in silicon. In accordance with the 1980 amendment to the Copyright Act, which extends protection to computer software, Judge Ingram's decision included the following observations:

- "The loading of an 8086 program into a ROM is accomplished in the same manner as would attend upon the loading of an application program into a ROM."
- "The methodology employed in the creation of microcode is to the court indistinguishable from that employed in the creation of any computer program."

From Intel's point of view, Judge Ingram's decision marks a resounding victory in the war to protect intellectual property. Regardless of the outcome of its infringement suit over the use of 8088/8086 microcode in NEC's V-Series microprocessors (the V-20 through V-50), Intel maintains that the industry may now rest secure that its investments in microcode development are protected, in the words of its General Counsel, against the "predatory practice of copying."

It is Dataquest's position, however, that any major victory celebrations are premature on the part of either Intel or the industry. While the court has decided that microcode does indeed fall within the domain of copyright law, just how effectively it can be protected is difficult to assess until Judge Ingram decides on the infringement issue. In reaching a decision, the court will likely establish a criterion for infringement. This criterion will prove more crucial to the industry than the acknowledgment alone that copyright is applicable to microcode. However, such a decision may still be several months away.

To the semiconductor industry, the court's initial decision comes more as a confirmation than a revelation. Since the 1980 amendment to the Copyright Act and the passage four years later of the Semiconductor Chip Protection Act (SCPA), the semiconductor industry has operated under the assumption that microcode is copyrightable. The landmark nature of Judge Ingram's announcement is that it represents the first real test of this assumption in a court of law.

In the short term, the U.S. District Court's decision makes it unlikely that a microdevice manufacturer will produce a product that is software compatible and pin compatible with a competitor's product without first negotiating a license for that code. Assessment of the long-term effects of the decision await Judge Ingram's verdict on Intel's infringement claims against NEC. Looking at both ends of the possibility spectrum, Dataquest concludes the following:

- If the infringement criterion is rigidly interpreted to mean literal copying, successfully proving infringement will be very difficult for any copyright holder. With regard to the NEC/Intel trial, similarities between NEC's V-Series microcode and Intel's 8088/8086 code could be judged the result of "functional constraint" rather than copying. In this case, NEC would very likely be found innocent of infringement.

- If the infringement criterion is more loosely interpreted, any degree of similarity, whether the result of plagiarism or independent development, could be enough to constitute an infringement. Such a precedent would give copyright holders much greater influence in their markets through more effective control of alternate sources. With regard to the NEC/Intel trial, Intel would be more likely to win an injunction against the shipment of V-Series microprocessors into the United States, and/or the payment of royalties by NEC for V-Series devices sold.

Peter Savage
Michael Boss

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EUROPEAN RESEARCH NEWSLETTER

ESIS Code: Vol. IV, Newsletters
1986-25

MONSANTO SHOWS FIRST EUROPEAN SILICON FACILITY

SUMMARY

On Monday September 22, 1986, Monsanto Electronic Materials Company (MEMC) welcomed invited guests to view its silicon wafer research and manufacturing facility at Milton Keynes, Buckinghamshire, the United Kingdom. The primary points of interest were as follows:

- Sample shipments of Czochralski (CZ) polished silicon began in April 1986.
- This £15 million initial phase of the highly automated facility is already near production capacity. The company plans to expand production capability over the near term.
- Front-end (crystal-pulling) capability will be added in the near term.
- Current volume will allow MEMC to supply 20 percent of the 1986 European requirement for CZ silicon.
- The Research Centre adjacent to the production unit is Monsanto's first for electronic materials outside the United States. It will bring technology and industry support closer to European IC design, device, and process engineering requirements.

THE FACILITY

The 4,500-square-meter building is located on a 10-acre site at Wolverton Mill in Milton Keynes. Initially, manufacturing focuses on polishing wafers imported from other MEMC plants in the United States and Malaysia, with a 250-square-meter clean room dedicated to wafer final cleaning and packaging. Production runs 24 hours per day, 5 days per week, with a staff of 100 people. As the site ramps to a 7-day-per-week operation (by January 1987), staff will increase to 120.

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MEMC currently provides 3,000 wafers per day to European IC manufacturers. Composed of a mix of 100, 125, and 150mm product, the site is equipped to fabricate 20 million square inches of silicon per year. With further planned investment of up to £35 million, production will increase to 60 million square inches of silicon annually by the end of the decade. MEMC Milton Keynes will then employ an estimated 400 people.

COMPANY BACKGROUND

Monsanto has invested more than $250 million worldwide in silicon wafer fabrication facilities and associated equipment over the past five years. The company has upgraded its existing plant and equipment in the United States and Malaysia, and has added a second world scale facility in South Carolina, the United States. In addition to the new site in Milton Keynes, two more silicon manufacturing plants are scheduled to come on-line by the end of 1986--one in Japan and one in Korea.

Monsanto is devoting an increasing amount of R&D to advanced silicon technology. As IC geometries become more dense and line widths pass through the 1.0-micron barrier, the physical properties of silicon become predominant in determining electronic device performance. To understand the silicon phenomena, Monsanto has spent $25 million in research over the past two years and has increased its customer interface by having some of its professional engineers work in the field at IC fabrication sites. The R&D center at Milton Keynes will collaborate with IC manufacturers and universities in the United Kingdom and throughout Europe. It will focus on developing the near-perfect crystal structures necessary to produce the next generation of "silicon brain cells" that are essential for developing advanced robots, computers, and communications products.

THE EUROPEAN SUBSTRATE SCENARIO

In general, semiconductor substrates correlate to technology as follows:

- Czochralski (CZ) silicon for bipolar digital, MOS, linear
- Float-zone silicon (FZ) for discretes
- Gallium arsenide/indium phosphide (III-V) for optoelectric devices and increasingly for advanced high-speed ICs

Dataquest's estimates of European silicon substrate consumption by technology are shown in Table 1. Table 2 gives Dataquest's estimates of the European wafer consumption trend by wafer diameter.

Table 1

EUROPEAN SUBSTRATE CONSUMPTION ESTIMATES BY TECHNOLOGY
(Millions of Square Inches)

Technology	1986	1990
Total Substrate	172	370
Total IC	120	310
Bipolar	33	55
MOS	52	195
Linear	35	60
Total Discrete	49	54
Total Opto	3	6

Source: Dataquest
October 1986

Table 2

EUROPEAN SILICON CONSUMPTION ESTIMATES BY WAFER SIZE

Diameter	1986	1990
2 inches	2%	10%
3 inches	21%	10%
100mm	60%	36%
125mm	13%	25%
150mm	4%	27%
200mm	0%	2%

Source: Dataquest
October 1986

OUTLOOK

Historically, Wacker in Germany has been the major indigenous European volume producer of silicon substrates. More recently, Dynamit-Nobel in Italy (a subsidiary of Morton-Thiokol) has assertively entered the market. In 1985, Shin-Etsu-Handotai from Japan established a silicon facility in Scotland to serve European needs.

Monsanto's presence in England means that high-volume IC manufacturers in Europe now have access to a broad range of local substrate suppliers. We believe that the key areas that will determine market share are:

- The supplier's ability to produce defect free, dopant consistent product

- The supplier's ability to communicate well with semiconductor manufacturers to serve their substrate requirements

Dataquest believes that Monsanto's investment in equipment and plant and its commitment to provide the correct silicon for the device (through effective feedback from the R&D group) means that Monsanto will be able to continue to provide proper service to the highly competitive European market.

Kathleen Killian
Malcolm Penn

Dataquest

Conference Schedule

1986

Semiconductor	October 20–22	Hotel Inter-Continental San Diego, California
Technical Computer	November 3–5	Silverado Country Club Napa, California
Asian Peripherals	November 5–7	Hotel Okura Tokyo, Japan
Semiconductor Users/ Semiconductor Application Markets	November 10	Sheraton Harbor Island San Diego, California
Electronic Publishing	November 17–18	Westin Copley Place Boston, Massachusetts
CAD/CAM EDA	December 4–5	Santa Clara Marriott Santa Clara, California

1987

Semiconductor Users/ Semiconductor Application Markets	February 4–6	Saddlebrook Resort Tampa, Florida
Copying and Duplicating	February 23–25	San Diego Hilton Resort San Diego, California
Electronic Printer	March 23–25	Silverado Country Club Napa, California
Japanese Semiconductor	April 13–14	The Miyako Kyoto, Japan
Telecommunications	April 13–15	Silverado Country Club Napa, California
CAD/CAM	May 14–15	Hyatt Regency Monterey Monterey, California
Display Terminals	May 20–22	San Diego Hilton Resort San Diego, California
European Semiconductor	June 4–5	Palace Hotel Madrid, Spain
European Copying and Duplicating	June 25–26	The Ritz Hotel Lisbon, Portugal
Financial Services	August 17–18	Silverado Country Club Napa, California
Western European Printer	September 9–11	Palace Hotel Madrid, Spain
European Telecommunications	October 1–2	Monte Carlo, Monaco
Semiconductor	October 19–21	The Pointe Resort Phoenix, Arizona
Office Equipment Dealers	November 5–6	Hyatt Regency Monterey, California
Electronic Publishing	November 16–17	Stouffer Hotel Bedford, Massachusetts
CAD/CAM EDA	December 10–11	Santa Clara Marriott Santa Clara, California

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Product Offerings

Industry Services

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CAD/CAM

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Computer Storage—Flexible Disks

Computer Storage—Tape Drives

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Electronic Publishing

Electronic Typewriter

Electronic Whiteboard

European Semiconductor*

European Telecommunications

Gallium Arsenide

Graphics

Imaging Supplies

Japanese Semiconductor*

Office Systems

Personal Computer

Personal Computer—Worldwide Shipments and Forecasts

Robotics

Semiconductor*

Semiconductor Application Markets*

Semiconductor Equipment and Materials*

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Software—Artificial Intelligence

Software—Personal Computer

Software—UNIX

Technical Computer Systems

Technical Computer Systems—Minisupercomputers

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Coporate Technology Program

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I.C. USA

Focus Reports

The European PC Market 1985-1992

European PC Retail Pricing

PC Distribution in Europe

PC Software Markets in Europe

PC Local Area Networking Markets in Europe

The Education Market for PCs in Europe

Japanese Corporations in the European PC Markets

Home Markets for PCs in Europe

Integrated Office Systems—The Market and Its Requirements

European Market for Text Processing

Image Processing in the Office

Work Group Computing

Translation Systems

Vendor Support

The IBM 3270 Market: 1986 and Beyond

Korean Semiconductor Industry Analysis

Diskettes—The Market and Its Requirements

Directory Products

I.C. Start-Ups—1987

SpecCheck—Competitive Copier Guide

SpecCheck—Competitive Electronic Typewriter Guide

SpecCheck—Competitive Whiteboard Guide

Who's Who in CAD/CAM 1986

Future Products

- Industry Services
  - Manufacturing Automation
  - Computer Storage—Optical
  - Computer Storage—Subsystems
- Focus Reports
  - Japanese Printer Strategy
  - Japanese Telecommunications Strategy
  - Canon CX Laser—User Survey
  - Digital Signal Processing
  - PC-based Publishing
  - Taiwan Semiconductor Industry Analysis
  - China Semiconductor Industry Analysis
  - PC Distribution Channels
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RESEARCH BULLETIN

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1986-24

EUROPEAN SEMICONDUCTOR RECOVERY FREEWHEELS THROUGH BALANCE OF 1986

EXECUTIVE SUMMARY

The previously expected second-half-year upswing in semiconductor demand in 1986 is now postponed--at least until the first half of 1987. The outlook for the rest of 1986 now looks slow and sluggish, as the continuing uncertainty in the worldwide economic and business environment favors a wait-and-see attitude. Our revised forecasts downgrade the 1986 local currency growth rate estimates from a positive 6.3 percent growth to a negative 7.3 percent. Due to the substantial decline of the U.S. dollar against all the European currencies, the growth rate measured in U.S. dollars actually increases from 6.3 percent to 14.8 percent.

Table 1 shows the latest forecast for European semiconductor consumption in U.S. dollars from 1984 through 1988, together with a restatement of the previous two forecasts for comparison. Table 2 gives the same three forecasts, but expressed in local currency terms.

Table 1

ESTIMATED EUROPEAN SEMICONDUCTOR CONSUMPTION--TOTAL SEMICONDUCTOR
(Millions of U.S. Dollars)

Date of Forecast	1984	1985	1986	1987	1988
October 1985	$4,805	$4,700	$5,454	$6,856	$8,523
February 1986	$4,805	$4,632	$4,923	$6,391	$7,939
August 1986	$4,805	$4,720	$5,417	$6,200	$7,898

Source: Dataquest
September 1986

Table 2

ESTIMATED EUROPEAN SEMICONDUCTOR CONSUMPTION--TOTAL SEMICONDUCTOR
(Millions of European Local Currency Units)

Date of Forecast	1984	1985	1986	1987	1988
October 1985	8,453	8,268	9,595	12,061	14,994
February 1986	8,453	8,493	9,026	11,718	14,556
August 1986	8,453	8,655	8,024	9,184	11,699
Exchange Rate	1.7592	1.8335	1.4813	1.4813	1.4813

Source: Dataquest
September 1986

MARKET OUTLOOK

Dataquest now expects European dollar consumption of semiconductors to increase by 14.8 percent in 1986, representing an actual decline in local currency terms of a negative 7.3 percent. We believe that the current softness in the European semiconductor market reflects a timing problem as opposed to a lack of faith in the overall semiconductor industry. A major reason for this softness in demand is that since the spring of 1986, end-user demand has not improved. As a result, the anticipated reversal in the OEM inventory liquidation process did not occur. To the contrary, since early 1986 most OEMs have embarked on a program to purge inventories even further, fueled by concerns about the health of the economy and their end markets, especially those in the United States. As a result, new bookings slowed substantially. This slowdown, coupled with the traditionally weak third-quarter vacation period, effectively ended any real hopes of a strong second half year.

Semiconductor consumption in Europe grew at a compound annual growth rate (CAGR) of 7.7 percent in U.S. dollars, or 18.8 percent in local currencies, from 1979 to 1985. Dataquest believes that the CAGR from 1986 to 1991 will be approximately 17 percent in constant dollars, although we do expect a slowdown in 1988-1989 as semiconductor sales are affected by the next downward trend of the industry cycle.

The forecasts contained in ESIS Volumes I and II are now outdated and are in the process of being republished. Hard-copy printouts of the detailed tables are available on request by clients who require earlier access. The data are also available electronically either in floppy disk format, via the DESTINY Datadisks, issue 05, or via the on-line service.

Jennifer Berg
Malcolm Penn

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EUROPEAN RESEARCH NEWSLETTER

ESIS Code: Vol. IV, Newsletters
1986-23

THE GALLIUM ARSENIDE MATERIAL INDUSTRY: A PLETHORA OF PLAYERS

SUMMARY

Gallium arsenide (GaAs), a III-V compound semiconductor material, is presently the most widely used substrate for device applications requiring high-speed, high-temperature operation and radiation hardness. A plethora of players has entered the gallium arsenide material market over the last few years in expectation of substantial development and rapid growth in the gallium arsenide device market. In a recent analysis, Dataquest identified 34 manufacturers of gallium arsenide and other compound semiconductor materials in the worldwide market with 19 companies in the United States (including two firms in Canada), 11 in Japan, and 4 in Europe. Manufacturing activities include production of polycrystalline material, single-crystal ingots, and wafers, and growth of epitaxial films.

Sumitomo Electric in Japan is acknowledged as the world market leader with an estimated share of approximately 50 percent. Dataquest believes that due to the number of players in this arena and the relative strength of Sumitomo Electric's position, GaAs material companies will become increasingly aggressive in their attempts to establish a significant presence in this market.

This newsletter contains an overview of the gallium arsenide and compound semiconductor material manufacturers in the free world. This information has been compiled from company literature and recent trade press announcements. We believe that the number and type of companies active in gallium arsenide and compound semiconductor materials are of significant importance to our clients. Dataquest is following both the gallium arsenide material and device markets through our Semiconductor Equipment and Materials Service and the upcoming Gallium Arsenide Industry Analysis, respectively.

144/146 New Bond Street / London W1Y 9FD United Kingdom / (01) 409-1427 / Telex 266195
1290 Ridder Park Drive / San Jose, CA 95131-2398 / (408) 971-9000 / Telex 171973

COMPOUND SEMICONDUCTOR MATERIALS

Gallium arsenide is just one of many substrates classified as a compound semiconductor material. These materials are identified by number designations, III-V and II-VI, which identify the number of outer shell electrons of the respective atoms that constitute the compound semiconductor material. Besides GaAs, other common III-V materials include gallium antimonide (GaSb), gallium phosphide (GaP), indium antimonide (InSb), indium arsenide (InAs), and indium phosphide (InP). Examples of II-VI substrates include cadmium telluride (CdTe), mercuric telluride (HgTe), and cadmium mercuric telluride (CdHgTe). Because commercial silicon technology is not presently capable of yielding production circuits operable above 10 GHz, GaAs is the substrate of choice for ultrahigh-speed ICs.

Starting Materials

Gallium does not occur in nature as a pure material. Economically recoverable deposits of gallium occur in bauxite and zinc ores, and gallium is typically refined as a by-product of aluminum or zinc recovery. It is believed that the earth's reserve of gallium is 110 million kilograms; the free world demand approximates 20,000 kilograms per year. Arsenic, an extremely toxic element, is found to a small extent as a pure material in nature, as well as in ores of antimony, silver, and in many sulfides. Arsenic has been designated as a carcinogen and its usage is carefully controlled by government health agencies.

Major suppliers of gallium in the free world include Alusuisse of Switzerland, purchased in 1985 by Alcan Aluminum (Montreal, Canada); Dowa Mining in Japan; Ingal, a joint venture between the Billiton subsidiary of Royal Dutch Shell of the Netherlands and aluminum producer VAW of West Germany; Musto Explorations (Canada), owners of the Apex mine in Utah, a major source of gallium and germanium in the world; Rhone-Poulenc of France; and Sumitomo Chemicals of Japan. Gallium is also produced in China, Hungary, and Czechoslovakia, but specific company activity in these countries is unknown. Furukawa Mining is believed to be Japan's largest supplier of high-purity arsenic, while Dowa Mining and Nippon Mining are major suppliers of high-purity indium, another important element present in compound semiconductor materials.

MATERIALS SUPPLIER OVERVIEW

Table 1 identifies manufacturers of polycrystalline material, single-crystal ingots, and wafers of gallium arsenide as well as other compound semiconductor materials. The information is not meant to represent an exhaustive analysis, but rather, has been formulated to give our clients an indication of the level of activity in this material segment on a worldwide basis. Information is based on company literature and recent announcements in the trade press, and has been organized alphabetically by company name.

Twenty-six of the 34 companies in Table 1 manufacture and supply the semiconductor industry with gallium arsenide wafers. Two companies (Hitachi Metals and Nippon Mining) are active in compound semiconductor materials but are not supplying gallium arsenide wafers to the industry at this time. Several GaAs wafer manufacturers also sell to companies that grow epitaxial layers of GaAs; these GaAs epitaxial wafers, in turn, are sold to semiconductor manufacturers. Six North American companies are participating in the epitaxial gallium arsenide market; these companies include U.S. companies Em-Core, Epitronics, Raytheon, Spire Corporation, and United Epitaxial Technologies, as well as Canadian start-up OMVPE Technologies. (Morgan Semiconductor is expected to start sampling its epi wafers by the end of 1986.)

The suppliers of compound semiconductor materials presented in Table 1 can be broadly classified as mining interests, cable manufacturers, silicon companies, chemical firms, and start-ups. For the cable manufacturers in particular, such as Furukawa Electric, Hitachi Cable, and Sumitomo Electric, the thrust into the compound semiconductor material market reflects a strategic transition from the more mature cable industry to fiber-optic technologies that rely on advanced optoelectronic materials and devices.

In addition to merchant materials suppliers, several vertically integrated semiconductor companies manufacture their own III-V substrates. Those semiconductor manufacturers that have captive production and consumption of GaAs include General Instruments, Harris, Hewlett-Packard, Hughes, M/A-Com, NEC, NTT, Rockwell, Siemens, Sony, Texas Instruments, Toshiba, and Westinghouse. Varian Associates, manufacturers of GaAs digital, microwave, and night vision devices, recently announced that it has ceased its captive production of GaAs substrate material because material of consistent quality is now available from merchant suppliers.

The fourth column in Table 1 includes the method of single-crystal growth for a given company's gallium arsenide, where known. The most common growth techniques are horizontal Bridgman (HB) and liquid-encapsulated Czochralski (LEC); both high-pressure and low-pressure LEC techniques have been developed. Horizontal Bridgman GaAs material is used in the fabrication of optoelectronic devices. However, silicon or silica doping can occur during horizontal Bridgman material growth, which renders the material useless for GaAs integrated circuits. Thus, LEC-grown GaAs material typically is used in the fabrication of digital and analog devices. Other methods of GaAs crystal growth that are used include vertical Bridgman, gradient freeze, Czochralski, liquid-encapsulated Kyropoulus (LEK), float-zone, horizontal- and vertical-zone melting, and MLEC (magnetic LEC).

GALLIUM ARSENIDE DEVICE MARKETS

The GaAs market initially developed in at least two independent areas. Since the mid-1960s, the demand for microwave communications and radar has driven the evolution of analog ICs (MMICs). Concurrently, the light-emitting properties of GaAs allowed the development of low-cost display devices (LEDs). In recent years, the emergence of fiber-optic communications heightened the need for GaAs lasers and photo detectors. Other recent applications include devices for electronic warfare (EW) and electronic countermeasures (ECM), Hall effect sensors, high-speed SRAMs and gate arrays, high-frequency phase-locked loops (PLLs), and linear and digital application-specific ICs (ASICs).

GaAs merchant market shipments in 1985 exceeded $1.3 billion. Optoelectronic devices represented $1.10 billion in merchant shipments, or essentially 80 percent of the GaAs merchant market sales. Analog IC shipments were approximately $80 million in 1985, while digital ICs represented only $26 million in merchant shipments. The remaining segment of the GaAs merchant market shipments is represented by other discrete devices including solid-state and power transistors.

Dataquest estimates that worldwide GaAs merchant device shipments will exceed $3.7 billion by 1990, which represents an overall CAGR of 22 percent. The optoelectronic device segment is expected to double between 1985 and 1990 to approximately $2.1 billion, with a CAGR of approximately 15 percent. In contrast to this moderate growth rate, Dataquest estimates that analog IC shipments will be in excess of $380 million in 1990 (37 percent CAGR), and digital IC shipments will approach $600 million (86 percent CAGR). Dataquest believes that the influx of new players in the gallium arsenide material market in the United States and Europe will be focusing on LEC material for IC devices, as Bridgman GaAs material (and optoelectronic devices) are mature markets in Japan.

DATAQUEST ANALYSIS

Dataquest has identified the level of worldwide industrial activity in GaAs in 1985. Thirty-four compound semiconductor materials manufacturers have been identified, 26 of which are supplying the semiconductor industry with GaAs wafers. Companies that produce GaAs devices include 28 merchant market suppliers of ICs, 26 merchant suppliers of GaAs discretes, and 21 captive-only houses manufacturing GaAs devices. Included in the count of 54 GaAs merchant device suppliers are 9 start-up companies that are expected to start shipping product in the 1986/1987 time frame.

It is important to maintain a perspective on gallium arsenide's role compared with silicon-based components in the semiconductor product families. GaAs and other III-V compound devices will displace silicon on a direct competitive basis <u>only</u> in applications where GaAs offers a distinct advantage over silicon-based devices, such as those requiring superior upper-frequency limits, better radiation hardness, or higher operating temperatures.

Table 2 indicates that the 1985 gallium arsenide IC market at $106 million still represented less than 1 percent of worldwide IC consumption, while the total GaAs merchant consumption of devices represented 5.5 percent of the worldwide semiconductor market. (Gallium arsenide devices include analog and digital ICs as well as discrete and optoelectronic devices.) In 1990, Dataquest estimates that gallium arsenide ICs will represent approximately 2 percent of worldwide IC consumption, while total GaAs merchant consumption of devices will represent 6.7 percent of the worldwide semiconductor market.

In contrast to the relative size of the device market segments, the number of companies currently producing wafers of silicon and gallium arsenide is essentially the same, which indicates that the gallium arsenide field is crowded. Sumitomo Electric in Japan is acknowledged as the world market leader in gallium arsenide and compound semiconductor materials, with an estimated market share on the order of 50 percent. The captive production and consumption of gallium arsenide by 13 semiconductor companies further reduces the size of the potential GaAs wafer market for merchant materials manufacturers. Dataquest believes that over the next few years, even as the gallium arsenide device market experiences growth, the gallium arsenide material companies will have to aggressively compete for sales, for share, and for survival.

Jim Beveridge
Peggy Marie Wood

Table 1

GaAs AND COMPOUND SEMICONDUCTOR MATERIALS SUPPLIERS WORLDWIDE

Company	Country	Products	Comments
Airtron	U.S.	GaAs wafers	Growth method: LEC Airtron--division of Litton Industries. 2", 2.5", 3" GaAs wafers available
Bertram Labs	U.S.	GaAs wafers	Growth method: HB 2" GaAs wafers available
Boliden Finemet AB	Sweden	GaAs wafers	Growth method: HPLEC 2 and 3" GaAs wafers available
Cominco Electronic Materials	Canada	GaAs, GaSb, InSb, InAs, CdTe, HgTe, and CdHgTe wafers	Growth methods: HPLEC, HB Completed expansion of LEC GaAs wafer production facility in Trail, British Columbia, in August 1985; capacity 250,000 square inches/year. 2", 3", 4" wafers available from Cominco
Commercial Crystal Labs, Inc.	U.S.	GaAs, GaP, InP wafers	Growth methods: LEC, HB 2" wafers available
Cryscon Technologies	U.S.	GaAs wafers	Growth method: LEC Subsidiary of Alcan Aluminum of Canada. Started shipping GaAs Q4/85. Cryscon supplies 2", 3" GaAs wafers produced by LEC and electrodynamic gradient freeze (EGF) technique. Annual capacity approximately 2 million square inches/year. Epitronics (other Alcan subsidiary) potential customer for Cryscon wafers
Crystal Specialties	U.S.	GaAs wafers, MOCVD epi reactors	CSI became subsidiary of Kollmorgen Co. in summer 1984. Wafer facility to be relocated to Colorado Springs, Colorado, from Ephraim, Utah, in Q3/86; reactor facility in Portland, Oregon

(Continued)

Table 1 (Continued)

GaAs AND COMPOUND SEMICONDUCTOR MATERIALS SUPPLIERS WORLDWIDE

Company	Country	Products	Comments
Dowa Mining	Japan	GaAs, InP wafers, poly InP, high purity In	Growth method: HB Research lab located in Akita
Em-Core	U.S.	GaAs epitaxial wafers, MOCVD epi reactors	Small start-up in New Jersey, started in late 1984
Epitronics	U.S.	GaAs epitaxial wafers	Subsidiary of Alcan Aluminum of Canada, like Cryscon Technologies
Furukawa Electric	Japan	GaAs, InP wafers, GaAs epitaxial wafers	Growth method: LEC Wafers produced at Tokyo lab
Galaris Corporation	U.S.	GaAs wafers, poly and single-crystal GaAs ingots	Growth method: HB Started in 1983 as research organization. Marketing of GaAs materials primarily focused toward R&D facilities
Gallium Arsenide Substrates	U.S.	GaAs wafers, poly and single-crystal GaAs ingots	Using gradient freeze process with less than 1000 dislocation defects/square centimeter. Company capitalized with $1 million in private funding
Hitachi Cable	Japan	GaAs, InP wafers, single-crystal GaAs ingots	Growth method: LEC Main production facility for III-V materials at Takasago plant in Ibaraki prefecture
Hitachi Metals	Japan	Single-crystal GaAs ingots	Growth method: LEC Working on single-crystal undoped GaAs

(Continued)

Table 1 (Continued)

GaAs AND COMPOUND SEMICONDUCTOR MATERIALS SUPPLIERS WORLDWIDE

Company	Country	Products	Comments
ICI Wafer Technology	U.K.	GaAs, InP wafers, poly and single-crystal GaAs and InP ingots	Growth method: LEC ICI announced in July 1985 plans to establish GaAs plant in U.S. (West Coast) in next 2 years to produce GaAs and other III-V compound wafers. ICI purchased Cambridge Instruments' III-V operations in January 1985. 2" and 3" GaAs, and 2" InP wafers available
Iwaki Handotai	Japan	GaAs wafers	Growth method: LEC 50-50 joint venture between Furukawa Mining and Shin-Etsu Handotai, established in 1982. Plant in Fukushima prefecture began producing 2" and 3" wafers in June 1983. Shin-Etsu Handotai started shipping 2" GaAs wafers to its U.S. subsidiary, SEH America, from Iwaki Handotai in June 1985. 3" wafers available in R&D quantities
M/A-Com Semiconductor Products	U.S.	GaAs wafers	Growth method: LEC Merchant sales as well as captive consumption of GaAs wafers. Microwave Associates, Ltd., is distributor for M/A-Com in the United Kingdom
MCP Limited	U.K.	GaAs wafers	Located in Wembley, Middlesex
Metal-specialties, Inc.	U.S.	GaAs, GaP, GaSb, InAs, InP, InSb wafers	Growth methods: LEC, HB

(Continued)

Table 1 (Continued)

GaAs AND COMPOUND SEMICONDUCTOR MATERIALS SUPPLIERS WORLDWIDE

Company	Country	Products	Comments
Mitsubishi Metal Corporation	Japan	GaAs wafers	Growth methods: LEC, HB Wafer plant located in Omiya, Saitama prefecture. Nissho Iwai Corp., distributor in the United Kingdom
Mitsubishi Monsanto Kasei (MMK)	Japan	GaAs, GaP wafers	Growth method: LEC Production system for 3" nondislocation GaAs wafers developed at Tsukuba plant. Plant capacity expected at 500 wafers per month. MMK using NTT's vertical magnetic CZ technology to produce the 3" wafers with only 10 defects per square centimeter. Monsanto Electronic Materials Co. (MEMC) to market MMK's GaAs wafers in the U.S.
Morgan Semiconductor	U.S.	GaAs wafers, GaAs epitaxial wafers	Growth method: LEC Started sampling low-pressure LEC 3" GaAs wafers in 1984; medium-pressure LEC 3" GaAs sampling due September 1986. Sampling of 2" and 3" GaAs epi wafers due by end of 1986
OMVPE Technologies	Canada	GaAs epitaxial wafers	Start-up located in St. Laurent, Quebec, Canada
Nippon Mining	Japan	InP wafers, poly and single-crystal InP, single-crystal GaAs and CdTe ingots	Growth method: LEC First Japanese company to grow low-dislocation density 3" InP crystal material. Nimic (Cupertino, CA) is a Nippon Mining subsidiary; purpose is to promote sales of GaAs, InP, CdTe, and other compound semiconductor materials in the U.S.

(Continued)

Table 1 (Continued)

GaAs AND COMPOUND SEMICONDUCTOR MATERIALS SUPPLIERS WORLDWIDE

Company	Country	Products	Comments
Raytheon	U.S.	GaAs epitaxial wafers	Growth methods: LEC, HB
Showa Denko	Japan	GaAs, InP wafers	Growth method: LEC First company in Japan to produce InP wafers by magnetic LEC. Sampled reduced-defect GaAs wafers in summer 1985
Siemens Company Inc., Opto Div.	U.S.	GaAs wafers	Growth method: HB Facility located in Cupertino, CA. 1.6 to 3" wafers available.
Spectrum Technology	U.S.	GaAs wafers	Growth method: LEC Spectrum founded in 1982, acquired in Q2/85 by Nerco Advanced Materials, Inc. (Portland, Oregon), a large mining interest in the Pacific Northwest
Spire Corporation	U.S.	GaAs epitaxial wafers and equipment	Located in Bedford, Massachusetts
Sumitomo Electric	Japan	GaAs, GaP, InP, InSb, InAs, GaSb wafers	Growth method: LEC, HB Largest III-V substrate supplier in the world; estimated GaAs worldwide market share of 50 percent. Has capacity for 3,000 3" GaAs wafers/month. GaAs material produced at wafer plant in Itami City (north of Osaka), Hyogo prefecture
Sumitomo Metal Mining	Japan	GaAs, GaP, and CdTe wafers	Growth method: LEC

(Continued)

Table 1 (Continued)

GaAs AND COMPOUND SEMICONDUCTOR MATERIALS SUPPLIERS WORLDWIDE

Company	Country	Products	Comments
United Epitaxial Technologies	U.S.	GaAs and AlGaAs epitaxial wafers	Start-up in Oregon; received approximately $5 million first round of venture funding. Company founded in mid-1984. Working with Crystal Specialties to develop MOCVD equipment
Wacker	West Germany	GaAs, GaP, InP wafers	Growth methods: LEC, HB

Source: Company Literature
Dataquest
August 1986

Table 2

WORLDWIDE CONSUMPTION OF SEMICONDUCTOR DEVICES
(Millions of Dollars)

	1985	Forecast 1990
Total Semiconductor	24,823	55,458
Total GaAs Devices*	1,371	3,720
Percent GaAs Devices	5.5%	6.7%
Total IC Devices	19,003	46,108
Total GaAs ICs	106	972
Percent GaAs ICs	0.6%	2.1%

*Includes analog and digital ICs, discretes, and optoelectronic devices.

Source: Dataquest
August 1986

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EUROPEAN SEMICONDUCTOR DIVISION

AUGUST MONTHLY REPORT

STOP PRESS

EUROPEAN SEMICONDUCTOR INDUSTRY SEMINARS--"IC OUTLOOK 1987"

- 15 September--Paris
- 16 September--Milan
- 17 September--Munich
- 18 September--Frankfurt
- 19 September--Stockholm
- 22 September--London
- 23 September--Edinburgh

The topics which will be covered include:

- Worldwide Technology and Business trends
- European Semiconductor Industry Update
- Semicustom Technology and Market Overview
- MOS Memory, Microprocessor, Microcontroller, and DSP Update
- IC Packaging Review

Meetings start at 8.30 am and finish at 4.40 pm

EARLY REGISTRATION IS ESSENTIAL TO AVOID DISAPPOINTMENT

For registration or further details contact your local Dataquest representative or office.

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144/146 New Bond Street / London W1Y 9FD England / (01) 409-1427 / Telex 266195

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STATE OF THE INDUSTRY

As mentioned in last month's report, we have now downrated our European semiconductor consumption forecast for the second half of 1986. This effectively postpones the anticipated recovery by at least two quarters.

The pace of recovery that began in the latter part of 1985 has proved unsustainable in the second quarter of 1986, especially in the wake of a simultaneous deterioration in the overall economic and end user performance. Our revised forecast reflects this adjustments.

A major reason for this softness in semiconductor demand stems from the fact that since the spring of 1986, end user demand just did not improve. As a result, the anticipated reversal in the OEM inventory liquidation process did not occur. To the contrary, since the April timeframe, fuelled by concerns about the health of the economy and their end markets, especially in the United States, most OEMs embarked on a program to pare inventories even further. As a result new bookings slowed substantially and this, coupled with the traditionally weak third quarter vacation period, effectively killed any real hopes of a strong second half year semiconductor performance.

The assumptions behind our previous forecast still hold true and we still believe that the current softness in the European semiconductor market is a timing issue as opposed to a lack of faith in the overall semiconductor industry fundamentals. Firmer pricing in the wake of the United States/Japan trade agreement and the return of OEM unit orders back to their current usage levels must inevitably work their way through the system. This could come without a substantial strengthening in the economy--all that is needed is for the industry to continue bumping along as at present together with a cessation of the OEM inventory liquidation. The opposite, however, is not true. A further worsening of the economic situation could easily push the recovery out still further.

Any significant positive momentum either in the cyclical outlook or in improved end user demand, especially in the U.S. computer market, could easily spark an explosion in the volume of semiconductor component bookings and subsequent billings. The key to this is end user vitality--that is the missing link today.

Table 1 below gives our revised quarterly forecast in U.S. dollars for 1985 through 1987. In interpreting these figures, the effect of the exchange rate variances must be taken into consideration. For example, in dollar terms, the 1986 performance indicates a positive 14.8 percent growth over 1985 whereas in local currency terms, this actually translates to a negative 7.3 percent growth--a very different picture indeed.

Table 1

ESTIMATED EUROPEAN SEMICONDUCTOR CONSUMPTION
(Millions of U.S. Dollars)

	1Q85	GR %	2Q85	GR %	3Q85	GR %	4Q85	GR %	1985
Total Semiconductor	1285	N/A	1175	-8.6	1136	-3.3	1124	-1.1	4720
Integrated Circuit	982	N/A	883	-10.1	851	-3.6	840	-1.3	3556
Discretes/Opto.	303	N/A	292	-3.6	285	-2.4	284	-0.4	1164
Weighted Average European Ex. Rate (Base 1980=100)	202.41		189.54		175.55		163.04		183.37

	1Q86	GR %	2Q86	GR %	3Q86	GR %	4Q86	GR %	1986	GR %
Total Semiconductor	1260	12.1	1380	9.5	1375	-0.4	1402	2.0	5417	14.8
Integrated Circuit	949	13.0	1044	10.0	1037	-0.7	1058	2.0	4088	15.0
Discretes/Opto.	311	9.5	336	8.0	338	0.6	344	1.8	1329	14.2
Weighted Average European Ex. Rate (Base 1980=100)	154.35		148.49		145.12		145.12		148.13	

Current Dollars	1Q87	GR %	2Q87	GR %	3Q87	GR %	4Q87	GR %	1987	GR %
Total Semiconductor	1445	3.1	1510	4.5	1570	4.0	1675	6.7	6200	14.5
Integrated Circuit	1097	3.7	1155	5.3	1207	4.5	1301	7.8	4760	16.4
Discretes/Opto.	348	1.2	355	2.0	363	2.3	374	3.0	1440	8.4
Weighted Average European Ex. Rate (Base 1980=100)	145.12		145.12		145.12		145.12		145.12	

OTHER INDUSTRY COMMENTS

GEC bid for Plessey rejected by Monopolies commission--early in August, the U.K. monopolies mergers commission report on the proposed GEC bid for Plessey was published. As had been widely expected, the report ruled that the proposed take-over would be against public interest and should not be allowed to proceed. Whilst supporting in principle the rationalisation of their overlapping interests in System X public digital switching, the main objection of the report was its impact on competition within the U.K., particularly in the market for defence electronics. GEC and Plessey are the U.K.'s two largest manufacturers of telecommunications equipment and defence electronic systems. Together they supply between 25 percent and 30 percent of the total U.K. output of electronic capital equipment and components, and larger proportions of some important segments of the telecommunications and defence electronics markets.

The report rejected arguments advanced by GEC and the Department of Trade and Industry that a larger company would be better able to compete in World markets. It accepted Plessey's assertion that it could continue to fund its R&D efforts and pointed to the potential loss of competitive R&D which would result in the merger.

In the telecommunications and electronics markets, the report concluded that there would be cost advantages if the two companies rationalised their System X public switching interests, though the merger would lead to reduced competition in the supply of PABX private exchanges and of transmission equipment.

The bid which first became public in December 1985 met with staunch resistence from Plessey. Culturally the companies are substantially different, and in the past, the companies have been staunch competitors.

New techniques promises breakthrough in GaAs production--a discovery which has emerged simultaneously from a U.S. university laboratory and Plessey research in the U.K. could make a dramatic impact on IC technology in the 1990s. The discovery is a way of marrying two semiconductor materials previously believed to be irreconcilably incompatible.

For more than 25 years, gallium arsenide has been threatening the dominance of silicon as the raw material for integrated circuits, but without ever making major inroads into silicon's markets. The development potential of silicon seemed inexhaustible, while the basic drawbacks of gallium arsenide refused to go away.

This new discovery allows the marrying of silicon and gallium arsenide in order to take advantage of the superior speed of the compound, coupled with the far greater efficiency in handling of silicon. The basic idea is to put a layer of gallium arsenide on a wafer of silicon, whereby the silicon simply is used as a compatible substrate that also acts as a heat sink for the poorly conducting gallium arsenide compound. Previous attempts have failed because of basic differencies in the crystal structures which strained and ruptured the film of gallium arsenide.

Plessey scientists at the Allen Clark Research Centre, Caswell, U.K. and simultaneusly a team at Illinois University, Urbana, U.S., have discovered that a super lattice structure can act as a mechanical sponge, soaking up stresses between the different crystals and suppressing their flaws.

The super lattice consists of several separate layers of semiconductor compound each a few atoms thick, deposited on a silicon wafer. Both teams use such compounds as gallium indium arsenide and gallium aluminium arsenide. A much thicker film of gallium arsenide is then deposited upon the super lattice sponge.

The U.S. scientists use molecular beam epitaxy to deposit their sponge and the gallium arsenide, however Plessey used a technique called Metal Organic Chemical Vapour Deposition (MOCVD), which is believed to be much more suitable for mass production.

Apart from the potential to make gallium arsenide on large silicon slices and the obvious improvements in manufacturability and handling of gallium arsenide semiconductor structures, one still more exciting prospect is the possibility of mixing gallium arsenide and silicon structures on the same wafer.

Computers save weight in fly-by-wire airliner--deliveries in France have begun of an advanced flight computer system for what is said to be the first commercial airliner in production that relies on a fly-by-wire system. In such a system, electronic signals replaces the mechanical components by which a pilot manipulates the aircrafts rudder, ailerons, and other control services.

The computer system is for the Airbus Industry A320, Europe's newest entry in the airliner market. The A320 is scheduled to make its first test flights in March 1987.

The computer system has been developed by a consortium of avionics manufacturers led by Sfena in Villa-Coublay. In its work for the A310 airbus, Sfena was one of the first to supply a fully digital flight computer. The system for the A320's computers rely on the Intel 80286 and 80287 processors.

Europe has taken a major lead in such systems. In the U.S., Boeing and Douglas whilst agreeing that fly-by-wire is the next step for commercial aviation, neither have plans to launch a plane with fly-by-wire systems as extensive as the A320 before 1990.

AUGUST INDUSTRY HIGHLIGHTS

Lex service expands in the U.S. with plans to acquire Richey/Impact Electronics, a privately owned U.S. electronics components distributor, for $13.5 million. Although Lex's own electronics components distribution division in the U.S. has faired badly during the current electronics sector slump, Richey/Impact, which specialises in the less volatile market of connectors, have remained relatively sheltered from the recession. The acquisition will be funded by the issue of 2.8 million new ordinary Lex shares with the balance paid in cash.

Daimler to build third car plant for DM1.8 billion in West Germany. The new plant in Southern West Germany will have a labour force of around 7,000 and is aimed at relieving Daimler's chronic lack of capacity in the car sector where demand has exceeded supply in all model ranges. In 1985, the company's car production rose by 13 percent to 541,000. This year's production is expected to rise again to more than 590,000.

Siemens, Thomson, and ICL in joint venture to develop computer aided design tools for very large scale integrated circuits. The three companies have launched a $34 million, four-year Advanced Integrated Circuit Design Aids (AIDA) project within the framework of ESPRIT. Siemens will act as project leader and will develop layout and testing tools, Thomson will be responsible for developing silicon compilers and user interfaces, and ICL will co-ordinate system specifications and data management tools for CAD equipment. •

Bundespost installs fibre optic ISDN test network in West Berlin to test various communication services on high speed terminals at up to 40 private and public subscribers. The system known as Berkom will cost around $45 million and is the forerunner of a planned 140-Mb/s broad-band integrated-services digital network.

Thomson and French laboratory in CCD development program aimed at strengthening Thomson's market position. By working with the Atomic Energy Commissariat's Laboratoire d'Electronique et de Technologie de l'Informatique (LETI) in Grenoble, Thomson intends to shrink its current 2.5 micron n-MOS technology to 1.5 micron within two years and to sub-micron line widths by 1990. LETI has financial experience in fine line lithography and is already cooperating with Thomson in the development of advanced MOS ICs.

Sanyo Electric, Japan, plans to transfer about 70 percent of its group production of semiconductors to Far East subsidiaries outside Japan over the next four years. The move follows an increasing production of electronic appliances elsewhere in Asia by Japanese-based companies as a result of the Yen's rise against the dollar.

Matsushita to build electronic typewriter plant in South Wales, its first office equipment plant outside Japan. The plant is slated to begin production in March 1987 with a target output of 20,000 typewriters and 50,000 printers. It will employ 100 people initially increasing to 300 in 1990. A major factor in the company's decision to locate in Wales was the success of its Panasonic colour television plant, established in Wales in 1974.

EEC acts on dumping of Japanese-made bearings announcing provisional anti-dumping duties on roller bearings made by five Japanese companies. The EEC action follows a complaint early last year by European producers including SKF of Sweden, the World's largest maker of roller bearings, that the Japanese were not adhering to price undertakings given in 1978.

U.K. telecommunications market set for further liberalisation with the issue in September by the Department of Trade and Industry of two new general licenses for value added network and branch systems. Among the main liberalisation moves in the license will be the liberalisation of all value added services except telex, and the requirement that companies will have to offer their services using open standards--a move designed to limit opportunities for tying the supplier's equipment to the provision of services.

Stromberg-Carlson, Plesseys U.S. based telecommunications equipment manufacturer, has been awarded a field trial of a digital exchange by Pacific Telesis, one of seven regional Bell Holding companies. It has also won an order for a light wave transmission system from Northwest Bell for its offices in Minneapolis. The field trial is a crucial stage in the elaborate evaluations processes before suppliers are allowed to sell equipment in bulk to the Bell operating companies.

Toshiba begins manufacturing VCRs in U.S. in October, following similar moves by Hitachi and Matsushita, aimed at lessening trade friction and avoiding potential future import surcharges. Toshiba's Tennessee plant now produces colour televisions and microwave ovens. Initially, production will be 5,000 units a month with most of the component parts coming from Japan. Production is scheduled to rise 20,000 units a month in 1987. The company currently exports 1.2 million VCRs to the U.S.

Intel to shed more than 1,300 employees overseas over the next few months. The redundancies reflect a continuing slump in U.S. IC sales and will effect employees in Barbados and Puerto Rico.

L'Air Liquide to pay $1.1 billion for U.S. gases group, Big Three industries. The deal marks a significant expansion by L'air Liquide into the U.S. market and one of the biggest foreign acquisitions for a non-oil company. Big Three had sales last year of $834 million and net profits of $56.8 million. The group intends to make a substantial rights issue on the Paris Bourse to help finance the deal. L'air Liquide had FFr1.1 billion of net profits last year on sales of FFr19.6 billion. It now ranks as the fourth largest industrial gas company in the U.S. after Union Carbide, Air Products, and Airco.

ICL's recovery program continues on track with a 64 percent jump in half year operating profits. The strategy was devised by Mr Peter Bonfield, ICL Chairman, and Dr Robb Wilmot his predecessor when they brought a company back from the brink of bankruptcy in 1982. At the heart of that strategy was a clear set of perceptions about what markets ICL should be in, and equally important, what markets ICL should not be participating in. The course on which ICL is embarking flows from clear decisions made by its top managers on several inter related issues including services, specialisation, joint ventures, and new markets. ICL, taken over by STC in 1984, now accounts for almost two thirds of the group's turnover.

CGE seeks FFr5 billion to finance merger with ITT and plans to raise the cash through bond issues. The French government approved at the end of July the merger of Alcatel, the CGE electronics subsidiary, and ITT's telecommunications interests. This merger will produce the World's second largest group in this sector after AT&T. CGE, originally thought to be one of the first nationalised companies to be privatised this Autumn, is expected to see its share flotation delayed at least by several months because of the need to digest the ITT deal. The group has cash resources of about FFr18 billion but does not want to dig too deeply into these reserves for the telecommunications venture.

Philips achieves 18 percent increase in second quarter profits to Fl208 million an increase of 18 percent. Overall Philips estimate that its 1986 sales volume will be between 6 and 7 percent above that of the previous year. The full extent of the profit growth is dependent on the pace of economic growth in the U.S. and a recovery in the semiconductor industry. Sales rose 6 percent in the first half year with significant growth registered in consumer electronics, in particular due to the burgeoning sales of video tape recorders and compact disc players.

U.S. acquisition gives ICI a lead in paint making whereby ICI has become the World's biggest paint manufacturer following its purchase of a Glidden, U.S., from Hanson Trust for $580 million. Glidden was previously the sixth biggest paint company in the World by volume, with sales last year of 283 million litres. ICI, previously third in the World league table, will now be more than half as large again as the previous World leader, Pitsburg Paint and Glass (PPG) of the U.S. whose output stands at 450 million litres.

Rolls-Royce wins engine order for 16 British Airways jumbo jets valued at £600 million in face of stiff competition from General Electric and Pratt and Whitney of the U.S. The engines will go into 16 Boeing 747-400 long range aircraft scheduled to be delivered between the Spring of 1989 and the end of 1990.

Toshiba buys toner powder plant in the U.S. from 3M. The move is seen as part of a plan by Toshiba to boost its position in the U.S. copier market. The plant, located in South Dacota, was purchased for an undisclosed sum and Toshiba has agreed to invest $7.6 million in it over the next four years.

Volvo and GM to link truck operations in the U.S. whereby under the merger, Volvo will have majority ownership and operational control. The venture will be called the Volvo GM Heavy Truck Corporation. The proposed deal marks a significant boost for Volvo, already the World's third largest heavy truck manufacturer behind Daimler Benz of West Germany and Renault/Mac.

U.S. suffers $8.8 billion deficit on electronics in 1985 with exports of $35.6 billion outpaced by imports of $44.4 billion. Of this $17.6 billion was with Japan. Japan's $20.7 billion of electronics exports to the U.S. was a record. Other major exports to the U.S. include Taiwan, $3.3 billion, Canada, $2.6 billion, Mexico, $2.5 billion, South Korea, $2.5 billion, Singapore, $2.3 billion, West Germany, $1.7 billion, Hong Kong, $1.6 billion, Malaysia, $1.4 billion, and the U.K., $1.0 billion.

NEC to raise printer prices in the U.K. by approximately 10 percent, in a move against the market's general trend of falling prices. After the price rises, NEC printers, aimed at the business personal computer market, will cost from £549 to £1,275.

Decision imminent on suppliers for French telecom network, a new computerised business communications network, as part of the gradual deregulation of the country's telecommunication system. IBM, Paribas Investment Bank, and Sema Metra, one of France's leading software companies, have already established a joint venture to offer value added communications services aimed mainly at large enterprises wishing to set up their own telecommunications networks. The competitive Olivetti-Suez-Telesystems grouping, announced earlier this summer, has attracted some controversy over Telesystems' involvement. Telesystems is a subsidiary of DGT, the country's telecommunication regulatory authority. Bull, the French state computer group, has also entered the field in association with GE of the U.S. as a third contender to start value added services.

Siemens and BASF in computer talks aimed at combining their computer hardward and peripherals businesses. BASF said it will spin off its present activities, with annual sales of DM600 million in 1985, into a new company shortly. BASF also produces and markets computer discs and tape cassettes where it currently ranks as one of Europe's market leaders with annual sales of around DM1.2 billion. BASF market's an IBM compatible computer mainframe produced by Hitachi as well as some Hitachi laser printers. Siemens current agreement to sell mainframes manufactured by Fujitsu of Japan expired in 1989.

EEC acts over Japan's European photocopier business with the announcement of anti-dumping duties of up to 15.8 percent following one of the biggest investigations conducted by the Brussel's commission. All the major Japanese plain paper photocopier producers will be affected by the provisional duties, imposed for a four month period. The commission said that its investigation show that Japanese manufacturers, which have 85 percent of the EEC market, were placing machines in Europe at substantially below their normal value in Japan, causing serious damage to manufacturers within the community. The announcement met with stiff resistance from the Japanese manufacturers who immediately challenged the methods used by the EEC during its investigation.

Gould puts defence business up for sale in a move that will reduce the company's size by almost one third. The group, which has been undergoing a major restructuring, said it planned to divest its defence system business with reported pre-tax earnings of $37.3 million on sales of $400.3 million in 1985. The group plans to concentrate on its commercial businesses. Gould, whose share price jumped $1.25 to $21.25 on the news, has began discussions with several unidentified companies.

Strong Yen blamed for stagnation in Japan leading to declining volume in the end-value of exports, a slow down in manufacturing investment, and an increase unemployment. The Japanese economic planning board are predicting that economic growth in 1986 may be less than 2 percent, compared with 4.5 percent in 1985. Japan's GNP dropped 0.5 percent in the first quarter of 1986.

CGE seek control of Lynch Communications Systems, the Nevada based telephone equipment manufacturer in which Alcatel already has a 46.7 percent stake. Lynch is among the smaller U.S. telephone equipment producers with sales of $42,3 million in the first half of 1986, down from 62.2 million a year earlier. Alcatel has seen its stake as a long term investment and has gradually boosted its holding from 41 percent in early 1985 to 44 percent by January 1986.

Japanese railway posts record loss of Y18,484 billion in fiscal 1985, nearly Y200 billion up on the previous year. This brings the Japanese National Railway (JNR) company's cumulative losses to Y14,121 billion and its long-term debt to Y23,561 billion. The government plans to privatise the loss making railroad next year. It is estimated that between 60,000 and 80,000 workers must be cut from the current 300,000 strong workforce if JNR is run effeciently.

Israel to cooperate in Eureka, the pan-European research program, through joint ventures with French companies. France is Israels fourth largest export market, ranked behind the U.S., Great Britain, and West Germany. As part of the agreement, the two countries Ministries of Industry's also agreed to make efforts to double bi-lateral trade and increase industrial cooperation between the two countries.

Sharp fall in profits at Kyocera, the World's largest manufacturer of IC ceramic packages. Net earnings for the first quarter ending June 30 were down 27.9 percent to Y4.7 billion on sales 13.0 percent lower at Y64.4 billion. Sales and earnings continue to be pressurised by the Yen's sharp appreciation against the dollar.

Ericsson plans 4,800 job cuts following a drop of 28 percent in profits for the first 6 months of 1986. The planned work cuts will take effect in the public telecommunications and informations systems group by the end of 1988. Ericsson's profitability has been under severe pressure since 1984 and it has already cut some 4,000 jobs in its heavily loss making information systems business area in 1985. New telecommunications orders booked in the first half-year however increased by about 16 percent and in addition, Ericsson has made a series of vital breakthroughs in the U.S. telecommunications market. Volume deliveries of its AXE digital public switching system to the U.S. should begin in 1988. The cost of developing its AXE system for the U.S. and U.K. markets however has put a heavy burden on the group's already stretched finances.

GM to set up joint venture in Japan with NHK Spring of Yoko Hama to manufacture car suspension springs made of fibre glass reinforced plastic. The joint venture company, NHK Inland, will begin operations in October and output from the plant will be sold to vehicle manufacturers in Japan and other Asian and Pacific countries.

Rising Yen lifts Japans jobless rate to 2.9 percent, according to government figures announced at the end of August. The figures showed another record trade surplus with exports surpassing imports by $867 billion and 11 percent on Junes surplus. Ministry of Finance Officials said that Japanese exporters are absorbing about half the Yen's appreciation against the dollar in the form of lower profit margins on their U.S. exports. The Yen has appreciated by 51 percent against the dollar in the past year, but Japanese exporters increased their export prices by only 24.6 percent on average. This squeeze on exporters margins is starting to push up Japans unemployment rate.

EUROPEAN SEMICONDUCTOR DIVISION ACTIVITY REPORT

The major activity in August concentrated on updating the detailed European semiconductor consumption forecasts in the light of our recent industry analysis. We have completed all of the European, regional and country analyses by technology, and end use (ESIS Volume I, (all tables), and sections 2 and 3 in ESIS Volume II); updates on sections 8, 9, and 10, ASIC, Memory and Microprocessor, will be completed early in September.

NB in this current revision, we will be expanding the breath of the data analysis to include a regional analysis of the ASIC estimates.

For those clients who wish for advanced copies, the relevant Destiny Datadisks (issue 4) are now available--please send your order to Jennifer Berg at our London office.

A further activity which was launched in prototype form during August was the Dataquest Monday Report. This service is only avalable on-line and is geared to provide up-to-date tactical information on the Worldwide semiconductor market. The service is a joint development program of the European, Japanese, and U.S. Semiconductor Divisons and is defined to include:

- Price and lead time (by region)
- Historical prices (by region)
- Price analysis
- Market intelligence

Each of these sections will be updated every two weeks, except for the market intelligence secion which will be updated weekly.

For more information on this, please contact Jim Beveridge, European Project Manager--Monday Report, at our London office.

And finally, as previously mentioned, we are now actively recruiting an additional Senior Industry Analyst to join our U.K. staff filling the gap created by Adrian Tarr's departure from the group earlier this year.

THOUGHT FOR THE MONTH

In Japan, more than in any other country in the World, the information society is being built. In a joint effort between government ministries, local authorities, and private companies, Japan is entering a new era of growth--one that promises to be substantially different from previous social phases.

In its post war history, Japan has singled out specific economic and social goals and has subsequently directed financial and human resources to their achievement. In the 1960s it was steel, ship building, and chemicals that help to build an internationally competitive economy. In the 1970s, the car and electronics industries were the vehicles used to make Japan a nation on a par with the U.S. and Europe, (and with dramatic effect). Now in the 1980s and 1990s, priority is being given to the information society defined by MITI as "a unique humanistic information oriented society supported by vital economic activities while fulfilling its duties as an important member of international society".

New growth industries have been defined as office automation, telecommunications, VLSI, and the production of new materials. Actual trends in Japan are the growing internationalisation of business, with increasing pressure to open Japan's home markets to foreign companies; a strenthening of the private sector by intensified competition and facilities cooperation; acceleration of a creative technological process; and stimulation of the regions by the development of information techology and telecommunications. Within this context and with the integration of technologies and the growth of international business being the main driving forces, many Japanese corporations are currently redefining their business strategies.

Technology progress is accelerating rapidly in Japan, not only wanting to rid itself of its "copy cat" image but also to gain competitive advantage. A substantial activity in advanced basic research already exists including such areas of life sciences, artificial intelligence, components, super computing, new materials, and bio-technology. In addition, several large scale telecommunications projects are underway in Japan aimed at giving Japan advanced communication technology, in particular in the area of visual communications, for example, teleconferencing, sketch phones, electronic white boards, and facsimile equipment. Stimulating factors behind its high innovative potential are the "gadget mindedness" of the Japanese, the intense competition in the home market, and the availability of a large test market in Japan.

So where does all this place Europe? Theoretically Europe too is well positioned to pursue a similar path. There are many parallels. For example, especially in the area of international/intercompany collaborations and shared/joint development programmes, and especially in the critical area of the promotion of standards.

Furthermore, the reawakened European initiative (following Europe's dramatic international decline in the 1970s) has been steadily gathering momentum since the early part of the 1980s and is beginning to position Europe at a strategic advantage.

Is Europe culturally and psychologically able to take up the initiative from this strategic positioning?

There are two distinct camps here--the believers and the non-believers, both within Europe and elsewhere. In general, the former camp has the smaller following at present, especially outside Europe. But personally, I believe there is mounting evidence to believe increasingly in the former view.

The nationalistic and company parochialism of the past is now increasingly in the minority and that will be the key catalyst ingredient in Europes future well-being. Given its vast market potential, its increasing strength in the key new technologies, its traditional strength in basic research, and its new breed of European entrepreneurial managers, Europe in the 1990s ought once again to be capable of holding its head up amongst the rest of the World's advanced industrial civilisations.

Malcolm G Penn

FUTURE EVENTS DIARY

SEMICONDUCTOR CONFERENCES

- SEPT 10-12, European Printer Industry Conference
  Le Beau-Rivage Palace, Lausanne, Switzerland
  "Printer Markets--the Spotlight Shifts to Europe"

- SEPT 15-23, European Semiconductor Division Industry Seminars
  (Frankfurt, Edinburgh, London, Milan, Munich, Paris, Stockholm)
  "IC Outlook 1987"

- OCT 8-10, European Telecommunications Industry Conference
  Hilton International, Vienna, Austria
  "Strategy for the 1990s"

- OCT 20-22, Semiconductor Industry Conference
  Hotel Intercontinental, San Diego, California, USA
  "Recovery: Managing the New Industry Structure"

Plus in 1987

- FEB 5-7, Semiconductor User Information Conference
  Tampa, Florida, U.S.A.

- JUNE 3-5, European Semiconductor Industry Conference
  Madrid, Spain

SPECIAL REPORTS

- Korean Semiconductor Industry Report--available now
- IC Update '85--available now
- 1985 News Digest--available now
- GaAs Market Update--available third quarter 1986
- DSP Market Update--third quarter 1986
- Taiwan Semiconductor Industry Report--available third quarter 1986
- Hong Kong Semiconductor Industry Report--available third quarter 1986
- China Semiconductor Industry Report--available fourth quarter 1986
- IC Start ups--available fourth quarter 1986

NEWSLETTER SUBSCRIPTIONS

- IC ASIA
- IC JAPAN
- European Monthly Report

ON-LINE SERVICES

- ITT Dialcom Worldwide Electronic Mail (74:DQE002)
- Semiconductor Group Database History, Forecast & Market Share Data, Europe, Far East, Worldwide
- SIA Database, Bluebook, Flash Report, Forecast

For further information on the above items or any other aspect of DATAQUEST services please contact your local DATAQUEST office.

Dataquest

a company of The Dun & Bradstreet Corporation

1290 Ridder Park Drive
San Jose, California 95131
(408) 971-9000
Telex: 171973
Fax: (408) 971-9003

Sales/Service offices:

UNITED KINGDOM
DATAQUEST UK Limited
144/146 New Bond Street
London W1Y 9FD
United Kingdom
(01) 409-1427
Telex: 266195
Fax: (01) 491-2790

GERMANY
DATAQUEST GmbH
Rosenkavalierplatz 17
D-8000 Munich 81
West Germany
(089) 91-1064
Telex: 5218070
Fax: (089) 91-2189

FRANCE
DATAQUEST SARL
41, rue Ybry
92522 Neuilly-sur-Seine Cedex
France
(1)47.58.12.40
Telex: 630842
Fax: (01)46.40.11.23

JAPAN
DATAQUEST Japan, Ltd.
Taiyo Ginza Building
7-14-16 Ginza, Chuo-ku
Tokyo 104, Japan
(03) 546-3191
Telex: J32768
Fax: (03) 546-3198

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EUROPEAN SEMICONDUCTOR DIVISION

JULY MONTHLY REPORT

STOP PRESS

WORLD SEMICONDUCTOR TRADE STATISTICS (WSTS) DATA NOW AVAILABLE. Effective immediately, DATAQUEST will provide and market on-line access to the semiconductor trade data generated by the WSTS program, including:

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STATE OF THE INDUSTRY

As mentioned in last month's report, the previously expected upswing in semiconductor demand in the second half of 1986 is now postponed, at least until the first half of 1987. The outlook for the rest of 1986 now looks slow and sluggish as the continuing uncertainty in the worldwide economic and business environment favors a 'wait-and-see' scenario. Electronic equipment build schedules are being maintained but, in

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144/146 New Bond Street / London W1Y 9FD England / (01) 409-1427 / Telex 266195

1290 Ridder Park Drive / San Jose, CA 95131 / (408) 971-9000 / Telex 171973

general, these are still being filled by short-term order placements on the semiconductor vendors who are still well placed to respond to such demands in a timely fashion.

Overall, the semiconductor industry is still bumping along in an overcapacity situation--and electronics end-markets are stagnant.

Amongst the large U.S. computer manufacturers, and this sector alone accounts for around 40 percent of the total U.S. consumption, only Digital stands out. This is primarily due to its strength and breadth of new product announcements, which offer ever increasing price/performance capability, as well as new hardware/software solutions to pull the whole computing environment together--the elusive inter-connectivity issue. For example DECNET DOS allows users to fully mix IBM PCs and other systems in a VAX environment totally transparently.

We believe that this summer softness in both semiconductor bookings and billings will now continue throughout the seasonally poor summer months. Though this is not particularly good news, it should be remembered that even at today's sluggish run rates, the levels are substantially up from this time last year, despite the overall poorer economic background.

Whilst not wishing to promote a 'mannana' syndrome, it should always be remembered that industry leaders always are at their most pessimistic whilst at the trough of the recession with no (apparent) respite in sight. The capacity cuts already put in place and the continuing low level of new capital investment ultimately means the recovery will take place, and is likely to be just as fast and furious as in previous cycles.

One of the biggest unknowns in the present economic scenario is the effect of disinflation and the apparent changing effect it is having on business and consumer spending habits, especially when coupled with the general overall business uncertainties. Deflation tends to generate expectations of further deflation with the result that people do not rush out to buy. Instead, people and businesses tend to keep their cash in the bank or the financial markets rather than buy or make products that may well cost less tomorrow.

Furthermore, from a business point of view, there is the added concern of why invest in new plant and equipment, or hire more staff, when you're not sure if anyone will actually buy the extra output. This coupled with the tax uncertainties in the U.S. fiscal reform proposals is not causing the electronics industry to initiate a rebounding performance. And until the U.S. electronics industry does so rebound, the worldwide semiconductor industry will remain flat and dull.

As a result, we are now downsizing our 1986 European semiconductor market estimates from a positive 6 percent growth (in local currencies) to a negative 1.2 percent. The dollar growth rate will still show a positive growth of 9.6 percent due to the marked appreciation of the European local currrencies versus the U.S. dollar, see table below:

Estimated European Semiconductor Consumption
(Millions of Dollars)

	1985	1986	1987
Total Semiconductor	$4,720	$5,111	$6,391
Integrated Circuit	3,556	3,856	5,008
Discrete	1,164	1,255	1,383
Exch. Rate (1978 = 100)	168.9	142.6	142.6

Source: Dataquest
August 1986

See also June Monthly Report, ESIS Exchange Rate Quarterly Newsletter, and section 4 of this issue--European Semiconductor Division Activity Report.

OTHER INDUSTRY COMMENTS

BUSM applies advanced technology to regain lost market share--five years ago, British United Shoes Machinery (BUSM), a Leicester based supplier of machine tools to the shoe sector, was in decline. Today it is once more a leading force using new technology to pioneer systems that are fast becoming industry standards.

Shoe manufacturing is traditionally labor intensive. The pattern is row upon row of manually controlled machines, with each machine geared to a specific task; cutting, stretching, pleating and stitching leather, shaping soles, and fixing the uppers to the soles with glue and nails. BUSM reflected this approach.

By the 1960 's the machines produced had reached a level of sophistication, based largely on mechanical engineering. It offered little flexibility.

In the meanwhile, Taiwan, South Korea, and Brazil amongst others were fast taking over the mass market for shoes and their cheap labor meant that they could operate machinery at costs far below that available in the west. Inevitably their home markets declined. BUSM realised that only a complete rethink would suffice if it was to keep pace with this revolution.

The idea was that an entire shoe production unit could be put together in a limited space with the efficiency of operation being centered on single unit. BUSM's new system is computer controlled with information and tasks performed being passed on automatically to the manufacturing, marketing, accounts, wages, and despatch departments. Production can be related quickly to market demands.

The system--known as flexible manufacturing (FMS)--has meant that set up times for most procedures have virtually been eliminated. Bar coding of all paper work means the terminal operators have a minimum of keying to perform. The rapid flow of information achieved enables the central computers to establish operational priorities, smooth out production bugs, and cut clerical costs. In terms of manpower, the effect has been considerable. There were 2,900 employees in 1975 when things really started to go wrong for the company--today there are 1,450.

At the beginning of the 1980's 85,000 different parts were stored in BUSM's warehouses--today the figure stands at 55,000.

Much of the electronic expertise employed at BUSM has been developed by the company itself using CAD/CAM equipment installed in 1984 at a cost of more than £1 million.

Last year the turnaround was almost complete. Machinery sales were up to £20.2 million--from a low point of £60 million in 1981--and exports had surged ahead to £17.5.

JULY INDUSTRY HIGHLIGHTS

Amstrad ready for attack on IBM compatible PC market with the launch expected in September of its PC 1512 machine. Four models are expected; selling for £399, £449, £549, and £649, depending on specification. The machines will operate MS DOS 3.2 operating system as well as Digital Research's GEM software which provides screen icons and call down menus similar to the Apple MacIntosh. The computers will come complete with mouse, video monitor, and serial and parallel ports, though unlike the Amstrad processors, a printer will not be included in the basic models.

GEC in joint venture to develop Euro fighter radar in conjunction with Hughes Aircraft Co. of the U.S. and AEG of West Germany. The Euro fighter (formerly the EFA) is near the end of its project development phase with a formal go ahead for full development expected this year. More than 800 Euro fighters are expected to be built worth an estimated £20 billion for research, design, development, production, and initial in-service report. The radar will be based on the Hughes APG-65 already in service with the U.S. Air Force. Work will be shared between GEC Avionics, Hughes, AEG, and radar companies in Italy and Spain.

Burroughs and Plessey in Office Automation venture. In a bid to secure a significant part of the U.K. market in advanced office automation systems, the U.S. company has established a series of co-operative marketing arrangements in Europe. These are designed to allow two partners to work together to win a complete sales deal. The arrangement signed at the beginning of July between Burroughs and Plessey follows an earlier contract whereby Burroughs took over support and servicing arrangements for Plessey workstation sites, while Plessey added Burroughs workstations to its product range. The new agreement aims to link Burroughs's expertise in mainframe computing and Plessey's skills in telecommunications to provide integrated office networks where voice telephone and data can be combined into one system.

Olivetti, the Italian Office Automation Group, announced plans to invest L20 million in a new and automated factory for the design and manufacture of floppy disks. The factory, to be built in the Val d'Aosta region of northwestern Italy will supply Olivetti plants which produce personal computers and other office products.

Ferranti in Spanish chip venture talks with Piher Semiconductors, a Barcelona based company, aimed at transferring technology for the manufacture of ASICs. The proposed joint venture is likely to involve the Local Authorities in Barcelona, the Industry Ministry in Madrid, Serrano Semiconductores, and Ferranti.

GE cancels $250 million joint venture with Sharp to build a semiconductor plant in the U.S. Under the original plan announced in 1984, RCA, which is now part of GE, and Sharp were scheduled to build the highly automated CMOS semiconductor factory in Washington State. The two companies formed a joint venture, RCA/Sharp Microelectronics, in which RCA held 51 percent ownership. Preliminary construction, which began in the autumn of 1985, has been on hold in recent months.

Nixdorf forecasts good year for profits following buoyant sales and orders for the first six months of 1986. Turnover for the half year rose by 18 percent to DM1.8 billion while order intake at the end of June stood at DM4.5 billion, a gain of 15 percent. The present level of orders will enable Nixdorf to sustain its performance over the rest of the year. Nixdorf confirmed that the Group had recently won a $100 million order to supply point-of-sale terminal computers to the U.S. retailing chain, Montgomery Ward.

Mitel is seeking U.S. partners to distribute its large SX 2000 digital switch in the U.S. market. It may also enhance its product lines with other companies' products including those of British Telecom. The large digital switch, which has not been selling as well as it could, was seriously delayed in getting into production and the heavy development costs brought Mitel near to bankruptcy before it was acquired by British Telecom.

Europe's Eureka research program gets $2 billion boost following the announcement of 62 new projects at the beginning of July. This brings the total number of projects agreed on so far to 72, with a total value of $2.36 billion dollars. Of these, seven are in computer technology, four in software, five in artificial intelligence, three in telecommunications, 11 in industrial control and robotics, nine in semiconductors, 20 in non-electronics, and 13 in other electronic areas. Eureka, first proposed by the French Government a year ago, is intended to improve the competitiveness of Europe's high technology industries by encouraging joint development of commercial products and services.

Nokia boosts electronics side in an effort to boost its diversification program. Nokia's origins lie in forest products which it first started manufacturing in 1865. In 1986, paper related and chemical products still accounted for well over half the company's annual sales. Nokia's origins in electronics started in the late 1950's as an off-shoot of the company's cable and cable machinery interests. Since then the electronics group has grown extremely fast due, in part, to several substantial acquisitions, to become the biggest single factor accounting for 41 percent of total sales during the first four months of 1986.

Bull shows first half rise in profits to Ffr144 million from Ffr39 million last year. The return to profitability follows a major restructuring that has taken place in recent years, and it is one of the main reasons why the French Conservative Government decided to reconfirm Mr. Jacques Stern as Chairman of the Computer Group. In a separate move, Bull announced plans to acquire a 40 percent stake in the Spanish information technology company, Telesinero.

Siemens forecasts earnings of DM1.5 billion for 1986, despite a likely fall in sales of 10 percent. Currency changes and a sharp fluctuation in the building of power station businesses is currently depressing sales and orders this year. Spending on research development in 1986 is estimated to total DM5.5 billion (more than 11 percent of sales) following DM4.8 billion in 1984-85. This includes an estimated DM 600 million to be spent on the mega-project, the advanced memory program being developed in conjunction with Philips. In a separate announcement Philips and Siemens announced their intent to cooperate in the use of a new technological standard for integrated circuits for digital transmission networks in the teleommunications industry.

Inmos provision scars Thorn-EMI's performance, with a £45 million allowance for extraordinary items, following substantial write-downs on its plant in Colorado Springs in the United States. In a related move, Inmos announced 500 redundancies at this facility. Despite this, Thorn-EMI announced a higher than expected pre-tax profits of £104.7 million compared to £108.3 million for 1985-86.

Rise in Yen leads to lay-offs in Japan at the Hattori-Seiko Group, known for its Seiko watches and Epson computer printers. The Company announced that 6,000 workers in its watch making factories would go on reduced time working from next month until the end of the year. This is as a result of export difficulties. In a related move, Aiwa, the consumer electronics group, is looking for 700 volunteers from its 3,150 work force, to take early retirement. The company, which is 52 percent owned by Sony, said it would also be closing one of its three Japanese factories and would consolidate manufacture of mini-computers and headphone stereo sets at its plant in Singapore.

Siemens and GTE scale down telephone exchange venture from a full scale amalgamation of their public telephone exchange equipment operations in the U.S. Instead a less ambitious joint venture is planned which will effectively allow Siemens to absorb GTE's U.S. and international transmission systems business along with its public switching and business switching operations in Italy, Belgium, and Taiwan. Siemens will hold 80 percent of the new company which will embrace a global 11,000 GTE employees in the transmission and business systems operations. The revised deal means Siemens will have to continue trying to sell the EWSD digital switch system on its own in the U.S. market presently dominated by AT&T and Northern Telecom.

Proposed ITT/CGE merger receives approval from French Government which will create the world's second largest telecommunications group after AT&T. ITT has been asked to increase it participation in the new French controlled telecommunications venture to 37 percent, instead of the 30 percent planned when the deal was first announced at the beginning of July. Under the revised deal, ITT is expected to receive about $1.5 billion in cash and CGE has agreed to take on at least $800 million of ITT debt. The joint venture leaves 63 percent owned by a European holding company which, in turn, will be controlled by CGE. The French group is seeking for other European partners to buy stakes in the new holding company. The joint venture will group ITT's worldwide telecommunications activities, valued at about $2.8 billion together with those of CGE's Alcatel telecommunications subsidiary, worth about $1.4 billion dollars.

Oki Electric slips into the red following a consolidated net loss of Y97 million in the year to March 1986, a reversal from net profits of Y9.1 billion in the preceding year. For the current year to March 1987, Oki projects a recovery to consolidated pre-tax profits of Y4 billion with net profits Y2 billion on sales of Y420 billion.

Sony plans to double overseas output over the next three years from about $1.8 billion to about $3.6 billion. The strategy may lead to new plants being built abroad and to job losses in Japan. Sony along with other Japanese exporters, is shifting production overseas in order to shelter from the effects of the high yen. The output will be equally divided between the U.S., Europe, and Asia in order to minimize currency risk, trade friction, and political risks. The resultant reduction in exports from Japan may cause Sony to lay-off some of its temporary workers who make up about 20 percent of the company's labor force.

Japan delays the launch of its Digital Audio Tape (DAT) program which was originally scheduled for Autumn this year. DAT is aimed at providing compact disc sound quality on a recordable, erasable compact cassette. The main reasons for the delay are believed to be nervousness that it will impact the rapidly growing market for compact discs, and the fear of copyright law suits regarding the use of DAT to record compact discs.

West German Cartel Office approves sales of Triumph-Adler to Olivetti. The deal, if concluded, will give the the Italian office automation group a significant share of the West German electronic typewriter market and mark a further consolidation of Europe's office automation industry. Triumph-Adler controls the single biggest share of the German market with about 30 percent, followed closely by Olympia. Olivetti and IBM each follow with about 10 percent share. The agreement covers the worldwide operations of Triumph-Adler which also produces mini and personal computers.

Ericsson wins third agreement to supply an advanced digital telephone exchange in the highly competitive U.S. market. Nynex, whose operating subsidiary New York Telephone and New England Telephone serve 13 percent of the U.S. population, has signed a letter of intent with Ericsson's U.S. subsidiary for an AXE switch that will be tested in the Manhattan network. If the tests are successful, the deal could result in sales for Ericsson by 1988. Ericsson is presently neck-and-neck with Siemens in the race to become the third equipment supplier to the Bell Companies, after AT&T and Northern Telecom of Canada.

EEC electronics groups seek U.S. and Japanese concessions to make it easier for European companies to sell in their markets. The demands were made in a joint statement by senior executives of Bull of France, ICL of Britain, Nixdorf and Siemens of West Germany, Olivetti of Italy, and Philips of the Netherlands. The six link their demands to EEC plans to create an open international market by 1992 and say that the EEC should seek reciprocal measures from the U.S. and Japan.

MBB, the West German aerospace group, has been awarded the country's first SDI research contract by the U.S. Defense Department. The deal covers the development of an infra-red measuring system for use in space. The value of the contract, initially worth DM 8.8 million, could increase to DM85 million if MBB can produce a satisfactory prototype. In a separate announcement, Mr. Roland Mecklinger was nominated as Deputy Chairman and Head of its Defense Equipment Division. The 48-year old Mr. Mecklinger comes from Standard Elektrik Lorenz, the ITT majority owned electronics company, where he was in charge of the key telecommunications division.

Canon agrees West German deal to ease trade friction over Japanese copier exports to Europe. Under the deal, Canon has bought a 26 percent stake in CPF Deutcheland a West German office equipment sales group. The main consequence of the deal is that CPF will distribute copiers made by Canon in France and West Germany and stop importing copiers from Japan.

Continuing losses at leading semiconductor groups hit share prices with record lows being recorded. Both Intel and AMD announced second quarter operating losses in July. The bad news was only partially compensated by Motorola's announcement of an increase in sales in its semiconductor sector of 12 percent in the second quarter.

Italcable buys 20 percent of Voice Mail International (VMI) a California based company which manufactures and markets recorded voice communication services and systems. Italcable, which is contolled by IRI-STET holding group, is said to be paying $4 million as an initial investment in VMI. The investment will strengthen Italcable's presence in the U.S. and allow to gain access to developing technologies in the value added market.

STC in joint venture to operate micro-chip plant with LSI Logic. The agreement which was finalized in July, solves the British company's problem of what to do with its new VLSI plant at Foot's Cray in Kent. Under the deal, LSI will lease from STC the plant on which STC has spent about $25 million. In return, STC will take a minority shareholding of about 10 percent in LSI's U.K. subsidiary which will operate the joint venture.

Mercury and ICL form a joint venture which will represent another big step in Mercury's challenge to British Telecom. The project, offering specialist data communication services to businesses, is also a further sign of ICL's determination to concentrate more on computer services to complement its hardware production. In addition to the link with Mercury, ICL is to collaborate with GEISCO, the information services subsidiary of GE of the U.S., in the growing market of the international electronic interchange of business information using the telephone network.

Italtel more than doubles profits for the first half year to Lr37.7 billion. The profit for the same six month period of last year was Lr16.5 billion. Last year Italtel lifted profits by 60 percent to Lr42.1 billion on a total turnover of Lr1228 billion. Under the leadership of Mrs. Marissa Bellisario, the Company has undergone a major restructuring. The total work force being reduced by 10,000 since 1980 to 18,840, and the heavy losses of the early 1980's have been transformed into profits.

West Germany Bundespost reaches deregulation milestone on modems, with the Government agreeing to allow manufacturers to sell modems directly to the public. Until recently, the only way to connect a computer in West Germany to another one there or abroad has been to lease a normally bulky Siemens or SEL modem from the Bundespost, the country's telecommunications monopoly. As a result of this restrictive practice, there are only an estimated 59,000 modems in West Germany compared with around 115,000 in France, and nearly 300,000 in the U.K.

EUROPEAN SEMICONDUCTOR DIVISION ACTIVITY REPORT

The major activity during July was the finalization of the 1985 market share estimates (superseding the provisional estimates published in January 1986) and the revised market estimates for the European semiconductor consumption estimates. This requires a virtual 100 percent update of the European Semiconductor database. This work is still in progress and will be completed during August. The information will be initially made available electronically, either by datadisk or via the on-line service with hard copy versions of the reports following on at a later date.

Work on the "IC Outlook '87" seminars continues and the final program brochure is enclosed with this issue of the European Monthy Report. Mark your diary now. The first meeting commences Monday, 15 September in Paris and this year the Seminars are being staged in seven major European cities.

The topics which will be covered include:

- Worldwide Technology and Business trends
- European Semiconductor Industry update
- ASIC and LOGIC Technology and Market overview

- MOS Memory, Microprocessor, Microcontroller, and Digital Signal Processor update

- IC Packaging review

Meetings start at 8.30 a.m. finish at 4.30 p.m.

NOT TO BE MISSED

<u>THOUGHT FOR THE MONTH</u>

In the closing minutes of the extended July 30 deadline, the U.S. and Japan clinched a deal which theoretically brings the world price of IC's under U.S. Government control The agreement promises foreign semiconductor companies greater access to the Japanese semiconductor market and calls for a price monitoring system designed to prevent Japanese semiconductor manufacturers from dumping.

The five-year agreement, which has been heralded by the U.S. as "a precedent to prevent future unfair trading practices in high technology", leaves many issues unanswered and, hardly before the ink had dried, came under intense critcism and wide spread scepticism.

One can hardly pick a more emotional topic to discuss in this month's Thought for the Month, and whilst I do not intend to present a formal opinion on the subject, in view of both the signficiance of the action and the incredibly high level of inquiry, discussion, and concern we have received recently, I will attempt to condense the issues and concerns, together with some analysis and further food for thought.

First the settlement details:

- Japan agrees not to sell specific IC's at below "fair value" price

- U.S. agrees to suspend anti-dumping changes against Japanese IC manufacturers

- Both governments agree to take steps to monitor prices and to avoid dumping in third countries

- Japan agrees to make efforts to increase IC imports from foreign semiconductor companies

- Japan agrees to promote relationships between Japanese IC users and foreign IC manufacturers.

And some of the issues. As with other trade restraints against Japan, this is a political solution to an industrial problem. The main question remains whether such a bilateral deal is in the best interests of customers worldwide, not least in Europe where European end equipment companies have, since 1980, enjoyed the benefit of falling IC prices. Certainly there has been a strong reaction from the EEC with regards to the legality of such a bilateral agreement on a third party.

Doubtless the proposed agreement on IC prices can be defendable as a perfectly respectable agreement between one government and another, even consistent with GATT, i.e. to prevent dumping before it occurs and to consult quickly if there is evidence that it is starting to occur. The unilateral extension of such an understanding beyond the normal jurisdiction grounds is not so defendable, especially as, for example, the European governments' and/or the EEC were not part of the negotiations.

The industrial problem is familiar enough. The U.S. invented the IC and for many years was the pace-setter in production and development. Silicon Valley epitomized the silicon culture--new products--new markets -- new aplications. The U.S. semiconductor industry has remained largely independent yet routinely trapped by cyclical problems of overcapacity, plummeting prices, and increasingly expensive development costs.

The U.S. problems were further exacerbated by the "start-up phenomenon" which incidentally was the very engine that drove the explosive growth of the industry since the very beginning. However, there is a darkside to this as well. Whilst it indisputably pushes hard at the boundaries of innovation and technology, it does have a serious negative consequence. The defections leave the parent company virtually depleted of key staff thereby severely detracting from the progressive advancement in the more traditional areas of expertise.

On the other hand, Japan was happy to acquire the technology and apply their production skills in vertically integrated companies. In this way, they were able to seize the mass market as they become established to fund further developments. Furthermore, in Japan, traditional loyalty to the company is still predominant and quite the opposite to the entrepreneurial U.S. semiconductor environment.

What of the concerns? The biggest single concern must be whether such an agreement will be beneficial in the test of time. For certain, it has fired a massive warning shot to the world that predatory pricing tactics no longer play a meaningful role in the new era of world trade. That is absolutely a beneficial action. But as with all such political agreement, there are some real potential pitfalls, for example:

- By negotiating a floor price it will initially give the Japanese companies extra revenue with which to improve their competitive position in the next generation of products

- It could delay the inevitible and necessary structural adjustment amongst the U.S. producers.

- Setting up a global price and production cost monitoring system effectively creates a cartel agreement between two countres, especially critical since these two nations collectively supply around 88 percent of the total worldwide semiconductor consumption.

- Higher component prices in the U.S. will tend to drive production elsewhere to lower cost areas--it is not much use creating a "cure" at the component level that ultimately prices the end user to be non-cost competitive at the system level, eg. against his Japanese counterpart.

- How long before a grey market actively flourishes and what effect is this likely to have on the officially franchised channels of distribution.

- How long before the rapid advances of technology make any attempt to regulate the industry by bureaucratic controls completely impractical.

- The very pervasiveness of the semiconductor industry is substantially due to the ever decreasing cost per function--through higher levels of integration, yes, but also through falling unit selling prices.

- How long before the OEM's become creative in finding legal solutions to avoid the increased component costs, no matter how sympathetic they may be to the principles of the issue.

- And what about Korea?

Korea too enjoys the advantages of low labour and capital costs, and can draw on an extremely industrious and disciplined workforce. Having recently invested more than $1 billion in plant and equipment, Samsung, Hyundai, and others are now ready to aggressively move to market with advanced IC designs, many of which were licensed from U.S. semiconductor companies.

And they too enjoy the benefit of an essentially captive domestic markets and the strength, stability, and staying power that comes with being part of a multi-billion dollar conglomerate. Unlike the Japanese, their exports stand to benefit from the decline of the dollar since the Won, unlike the Yen, moves in concert with the U.S. dollar. They have also proved their industrial strength and reactiveness for example in construction, steel, shipbilding, shoes, and consumer electronics.

As with all such agreements, there are the elements of irony and inconsistency. Irony in that one could postulate what might have happened had the European semiconductor industry/EEC had taken similar action against the U.S. semiconductor industry in the early 1970's when they were forced to retire from the then leading edge commodity IC mass markets (DTL and TTL) under essentially similar circumstances.

And in the harsh analysis of the agreement, it is difficult to understand how such an agreement can be compatible with the repeated pleas for free market access. Of course, a harsh analysis is not appropriate - the issues are far too complex and involved.

For better or for worse the agreement is a reality, and its very existence will change the industry in the years to come. Hopefully it will not slow down pervasion, but it must inevitably bring a new era of business management--price fixing and the entrepreneurialism that has so typified the semiconductor industry since the very beginnings don't naturally go hand-in-hand.

Malcolm E. Penn

FUTURE EVENTS DIARY

SEMICONDUCTOR CONFERENCES

- SEPT 10-12, European Printer Industry Conference
  Le Beau-Rivage Palace, Lausanne, Switzerland
  "Printer Markets--the Spotlight Shifts to Europe"

- SEPT 15-23, European Semiconductor Division Industry Seminars
  (Frankfurt, Edinburgh, London, Milan, Munich, Paris, Stockholm)
  "IC Outlook 1987"

- OCT 8-10, European Telecommunications Industry Conference
  Hilton International, Vienna, Austria
  "Strategy for the 1990s"

- OCT 20-22, Semiconductor Industry Conference
  Hotel Intercontinental, San Diego, California, USA
  "Recovery: Managing the New Industry Structure"

Plus in 1987

- FEB 5-7, Semiconductor User Information Conference
  Tampa, Florida, U.S.A.

- JUNE 3-5, European Semiconductor Industry Conference
  Madrid, Spain

SPECIAL REPORTS

- Korean Semiconductor Industry Report--available now
- IC Update '85--available now
- 1985 News Digest--available now
- GaAs Market Update--available third quarter 1986
- DSP Market Update--third quarter 1986
- Taiwan Semiconductor Industry Report--available third quarter 1986
- Hong Kong Semiconductor Industry Report--available third quarter 1986
- China Semiconductor Industry Report--available fourth quarter 1986
- IC Start ups--available fourth quarter 1986

NEWSLETTER SUBSCRIPTIONS

- IC ASIA
- IC JAPAN
- European Monthly Report

ON-LINE SERVICES

- ITT Dialcom Worldwide Electronic Mail (74:DQE002)
- Semiconductor Group Database History, Forecast & Market Share Data, Europe, Far East, Worldwide
- SIA Database, Bluebook, Flash Report, Forecast

For further information on the above items or any other aspect of DATAQUEST services please contact your local DATAQUEST office.

Dataquest

a company of The Dun & Bradstreet Corporation

1290 Ridder Park Drive
San Jose, California 95131
(408) 971-9000
Telex: 171973
Fax: (408) 971-9003

Sales/Service offices:

UNITED KINGDOM
DATAQUEST UK Limited
144/146 New Bond Street
London W1Y 9FD
United Kingdom
(01) 409-1427
Telex: 266195
Fax: (01) 491-2790

GERMANY
DATAQUEST GmbH
Rosenkavalierplatz 17
D-8000 Munich 81
West Germany
(089) 91-1064
Telex: 5218070
Fax: (089) 91-2189

FRANCE
DATAQUEST SARL
41, rue Ybry
92522 Neuilly-sur-Seine Cedex
France
(1)47.58.12.40
Telex: 630842
Fax: (01)46.40.11.23

JAPAN
DATAQUEST Japan, Ltd.
Taiyo Ginza Building
7-14-16 Ginza, Chuo-ku
Tokyo 104, Japan
(03) 546-3191
Telex: J32768
Fax: (03) 546-3198

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Datagram

July 1986

A DATAQUEST FOCUS CONFERENCE

WHERE ARE SEMICONDUCTORS GOING?

An Application Market Perspective

September 8, 1986
Santa Clara Marriott Hotel
Santa Clara, California

The health of the electronics equipment industry continues to impact the demand for semiconductors. At this Focus Conference, Dataquest experts and industry executives will discuss key electronics market projections, issues, and trends and how they will impact the market for semiconductors. Major markets that will be addressed include:

- Personal computers
- Business computers
- Technical workstations and minisupercomputers
- ISDN
- Peripherals
- Smart cards

This Focus Conference is sponsored by Dataquest's Semiconductor Application Markets service (SAM). Fees will be $175 for SAM clients and $235 for nonclients.

A conference brochure with more details will be forthcoming.

SAM 86-1

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EUROPEAN MONTHLY REPORT

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EUROPEAN SEMICONDUCTOR DIVISION

JUNE MONTHLY REPORT

STOP PRESS

WORLD SEMICONDUCTOR TRADE STATISTICS (WSTS) DATA NOW AVAILABLE. Effective immediately, DATAQUEST will provide and market on-line access to the semiconductor trade data generated by the WSTS program, including:

- o Monthly "flash" report featuring the book-to-bill ratio
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- o Semi-annual WSTS forecasts

DATAQUEST will also market hard copy versions of the same reports. This service is available to anyone, whether an existing DATAQUEST subscriber or not. For further information please contact either your local DATAQUEST office or Jennifer Berg, Product Manager, at our London, U.K. office.

STATE OF THE INDUSTRY

Without doubt, the continuing lackluster performance in the industry now means a more protracted recovery process than our original September 1985 predictions indicated. Right now we see the following indicators:

- o Slow and sluggish second quarter overall, but
- o Very mixed company by company results
- o High degree of uncertainty and confusion
- o A setback--yes; stall--not yet

IN THIS ISSUE

144/146 New Bond Street / London W1Y 9FD England / (01) 409-1427 / Telex 266195

1290 Ridder Park Drive / San Jose, CA 95131 / (408) 971-9000 / Telex 171973

The slowdown in bookings trend now means overall a more sluggish third quarter than our original estimates. Even though the first half year billings look like coming in almost exactly as we predicted last September, the now almost certainty of a lower second-half year billings performance is causing us to markdown our year-on-year local currency growth rate from the originally predicted level of 6 percent growth to a slight decline of up to 2 percent (present worse case scenario), or zero growth (best case scenario). Because of the substantial weakening of the U.S. dollar versus the European currencies, our dollar forecasts will still show a positive growth.

As we previously predicted, individual performance on a product by product, company by company basis is widely diverse. For example:

Company A, a predominantly commodity broad-range supplier--"May was slow and June showed no improvement. Book-to-bill in June was less than one and July's looking weak".

Company B, a predominantly proprietary IC supplier--"June was very good for us. We had a positive book-to-bill with telecoms, EDP, and automotive all strong. What's more, buyers are placing long-term orders, 10-20 weeks out. July's looking strong also".

Company C, a predominantly MOS commodity IC supplier--"June was strong but admittedly from a fairly weak base line. Book-to-bill is above unity and July is looking good".

So what is happening out there? I'm not sure we know the full answer but we sat down last week and tried to list out the key differences from the same point in time at the previous recovery cycle. Though not exhaustive, we came up with the following issues:

- o Strong focus on inventory control (OEM and device manufacturers)
- o Just-in-time (JIT) impact on inventory needs (up to 75 percent typically)
- o Productivity issues of moving from 4-inch to 5-, or 6-inch wafers
- o Yield improvements (and consistency) associated with increased wafer fab-automation
- o Reduced manufacturing cycle times (OEM and device manufacturers)
- o Push to stabilize manufacturing cycle times
- o Priority to strengthen long-term vendor/customer relationships
- o Improving visibility of real usage (impact of JIT and ship-to-stock)

Added to this, there is an unanimous reluctance both with the OEMs and semiconductor device manufacturers to trigger off and fuel another boom-bust cycle. Device manufacturers are attempting to manage their order entry and backlogs better with an overall desire to stabilize prices and billings over the long term rather than go for a short term profit.

Factors that contribute to the present overall business uncertainty are:

- o Increased protectionism (copyright, dumping, and market access issues)
- o U.S. air strike on Libya
- o Chernobyl disaster
- o Increasing uncompetitiveness of many of the U.S. electronics companies since 1980 (strong dollar and work ethic issues)
- o Overall business uncertainty in the computer industry

None of these factors support an aggressive growth scenario, rather a "sit tight and wait it out" strategy.

And then there is the increased international competitiveness within the semiconductor companies with many new players (Korea, Taiwan, start-ups etc.) and a renewed vigour from many established players, especially from Europe.

Even in the fastest growing areas such as ASIC, CMOS, and high-performance memories, in many cases the growth rate in the supplier base is exceeding that of the total available market. All that makes for an extremely volatile market in the short term with a tendency for oversupply in the commodity sectors (and commodity nowadays includes many ASIC families) but with excellent strength in the proprietory or high-performance device segments.

Our medium-term (1987 and beyond) scenario has not changed. We continue to believe that 1987 will be a year of strong growth and profitability for the semiconductor industry--but we also believe that the mix of players, their relative position, strength, and even long-term viability have changed dramatically. And not to be overlooked, right now Japan has it problems too.

OTHER INDUSTRY COMMENTS

CEG/ITT merger heralds long-awaited European telecommunications industry shake-out--the proposed merger of ITT's 14 European telecoms companies with France's state-controlled CGE telecoms subsidiary, Alcatel, promises a standard European digital switch, especially with both GEC and Plessey rumoured to be interested in taking a stake in the pan-European venture. The move is seen as potentially extremely beneficial to the European telecommunications industry.

The move follows reports that U.S. financial circles are seriously concerned about ITT's performance which, after failing to bring its System 12 switching system to the U.S. market, is now experiencing serious difficulties in Europe. Under the scheme, it it believed that ITT would retain a 30 percent stake in the merged groups.

For ITT, the sale of its telephone equipment business, with a turnover last year of $4.6 billion would mean a huge benefit of around $2 billion in cash and debt reduction. It would also radically transform the company.

ITT is known to want a quick decision on the proposal, highlighting chairman Rand Araskog's determination to divest the business, even though many practical difficulties exist.

ITT is not alone in its troubles in the telecommunications market. The pace of change in telecommunications, driven both by the advent of digital technology, market demands, and the trend of deregulation, has sent many competitors seeking alliances and/or consolidations to help cover costs and secure export markets.

Typically it now costs around $1 billion to develop a digital switch with several hundreds of millions more needed annually to update and add new features. Nowhere has the burden of these costs been greater than in Europe where, protected by national monopolies, some $7 billion has already been spent on more than half-a-dozen different systems--over twice that of the U.S. yet for around the same equivalent marketsize. A shake-out is inevitable--the proposed ITT/CGE merger is but the first step down the road.

JUNE INDUSTRY HIGHLIGHTS

Bull sees its smart cards as a world winner and plans to manufacture its memory chip smart cards in the U.S. at a new facility in Dallas early next year. The move is part of its efforts to become a dominant supplier of IC cards in the U.S. market. Bull, together with Casio, is already competing in a major test programme by MasterCard, the credit card organisation.

Telefonica raises net profit 20 percent and revenues 12.6 percent to Pta39.2 billion and Pta429.2 billion respectively. The Spanish telecommunications company is 47 percent controlled by the State. Telefonica gained stock market listings in London, Paris, Frankfurt, and Tokyo in 1985 and is presently studying the posibility of a listing on the New York stock exchange.

Hoechst sees continuing progress and forecast a significant increase in 1986 earnings based on its year-to-date performance. Much of the improvement stems from cheaper energy prices and the falling dollar, which has slashed the cost of imported raw materials.

British Telecom (BT) poised to enter personal computer market this autumn with an IBM-compatible machine made by Zenith in the U.S. BT is also talking with troubled U.K. computer manufacturer, Apricot Computers, with the view to marketing its new IBM-compatible Xen computer launched this month. The move is part of BT's desire to diversify, particularly into the office equipment market. The computers will be sold under the British company's Merlin brand name.

Irish entrepreneur spots market gap to build world leading aircraft brokerage and leasing business. Confirmation of this achievement by the 11 year old company, GPA, was the placement of one of the largest ever orders for civil aircraft towards the end of the month. The order for 51 Boeing 737-300s, 30 Boeing 737-400s, and 15 McDonnell Douglas MD-83s with options on 10 more MD-80's was valued at $2.75 billion. It will almost double GPA's portfolio of jet aircraft to 187 over the next five years. GPA was launched in 1975 with just one airliner and capital of $50,000.

Philips plans joint venture in Taiwan with the Taiwan Fluorescent Lamp Company for the manufacture of energy efficient lamps for the Taiwanese market. The venture will be 51 percent owned by Philips, which will provide management expertise, and 49 percent owned by Taiwan Fluorescent Lamp Company, which will contribute local manufacturing expertise. In addition, Philips is planning to take a 12 percent stake in Taiwan Fluorescent, Taiwan's leading producer of lighting equipment. Philips is the world's largest maker of light bulbs and lighting equipment.

Britain unveils world's first optical computer at Heriot Watt University, Edinburgh. The technology, though still in its infancy, threatens to make electronic computers redundant. Optical computers can potentially process data 1000 times faster than the fastest electronic equivalents. The demonstration was the culmination of a 1.2 million Ecu (£750,000) European research program into optical bistability known as Ejob.

West German Government pledges DM500 million to Eureka to help finance projects covered by the European high technology cooperation. The number of such projects is expected to jump substantially following the third 18-nation ministerial conference of Eureka which begins in London in the first week of July.

European groups consider joint IC research and development cooperation to develop the advanced technologies needed to design and make VLSI devices for the 1990s. The new initiative, known as Joint European Silicon Submicron or Joint European Facilities, envisages the creation of a common research institute which would work closely with participating European companies and national research laboratories. Philips, Siemens, and Thomson are spearheading the new initiative.

IRI lists reasons for backing Alfa deal with Ford regarded by IRI, Italy's state holding company which owns Alfa, "as a most advantageous proposal". A conflict arose when Fiat, Italy's biggest private sector group, spelled out its own plans for Alfa. IRI prefers the deal with Ford because it would (a) keep Alfa together as a corporate unit, (b) ensure the maximum utilization of production capacity at Alfa, and (c) it would not be expected until July 21. Fiat saw its own car merger talks with Ford breakdown last Autumn.

France approves Italian control of Valeo, the leading vehicle components maker in France. The compromise agreement reached in mid-June resolved what was seen as the first key test of industrial policy for France's centre-right Government. Under the agreement, CIR, Mr DeBenedetti's holding company, has undertaken to keep its shareholding to below 30 percent until the end of 1990 and to keep its participation to less than the total of the four French institutional investors over this period. As such, the Government has prevented Valeo from falling completely into foreign hands, though Mr De Benedetti will assume day-to-day management control.

Bell company, Nynex, plans joint venture with Cable and Wireless to build two private translatlantic telecommunications cables costing about $600 million. The move follows an earlier announcement by British Telecom, U.K., CGT, France, and AT&T International, U.S., to bring forward their plans for a transatlantic fibre-optic telephone cable (TAT-9) by two years. This move was aimed at deterring Cable & Wireless and its current U.S. partner Tel-Optic. Under the new deal Nynex will buy Tel-Optic's rights for £10 million. The private cable is expected to lead to much lower international telephone charges--one of the most profitable businesses for telecommunications operators.

IRI expects sharp cut in losses in 1986 from Lr1,593 billion in 1985 to Lr600 billion. In all, IRI maintains holdings of some 500 industrial companies. Commenting on IRI's policy of privatising a number of subsidiaries, Professor Romano Prodi, chairman, declared privatisation to be a strategic choice which must be continued in the future. IRI raised Lr2,600 billion in 1985 through the sale of shares in its subsidiaries.

Footscray wafer fabrication plant sale nears completion with LSI Logic poised to take control within a month. LSI Logic Europe and STC have already signed a letter of intent for the purchase of the new wafer fabrication building, which will require around a further $20 million to equip. Plans to instell wafer production machinery are not estimated to start before 1987/88 depending on market conditions though the plant is likely to be used first for assembly, then test, and then metalization before that time frame.

GE completes acquisition of RCA and will disclose combined financial results for the first full quarter with the period ending September 30, 1986. Under the terms of the merger, GE acquired RCA for $6.4 billion in cash. The U.S. Justice Department completed its review May 21 and as a result, GE will sell by November 1986 its Vidicon tube business as well as five NBC radio stations within 18 months. Currently, the precise effect that this merger will have on the two company's semiconductor operations remains unknown.

Apricot pulls out of mainstream personal computer market and is launching its first IBM-compatible models. One of the U.K.'s fastest-growing companies, the rapid fall in price of personal computers following the arrival of cheap IBM-compatible "clones" from the Far East has convinced Apricot it cannot make profits from its existing mainstream area. It plans instead to confine itself to selling sophisticated personal computer systems based on the Xen machine launched last October. It has also now made the Xen computer fully IBM compatible.

SGS strongly rumoured to be bidding for Zilog, whilst both parties remain tight-lipped on the reports. Exxon, Zilog's parent, is believed to have received several offers for the acquisition of Zilog over recent weeks, but with SGS emerging as the strongest contender. SGS has a long-standing business relationship with Zilog as the alternative source for the U.S. company's microprocessor products. Exxon acquired Zilog in

1981, but the semiconductor company has failed to live up to expectations. For SGS, the purchase of Zilog's components group would give it a long-sought after boost to its U.S. presence putting it on a more even footing with Philips (Signetics) and Thomson (Mostek).

Siemens buys Hyundai's U.S. wafer fabrication plant into which it will move its Power Semiconductor Division. The move is scheduled to take place in mid-July and the technology transfer of the division's SIPMOS power MOSFET wafer fabricaion and assembly line will take approximately six months. Production will be maintained at the existing Broomfield, Colorado location until the move is complete. The move is part of Siemen's attempt to enlarge its U.S.-based semiconductor operations. In addition, Siemens is strongly rumoured to be eyeing the Sperry IC plant made redundant following last month's takeover by Burroughs. This facility is capable of MOS and bipolar wafer processing at VHSIS level line widths and includes the E-beam mask shop, a complete test capability, and a built-in guarantee of $100 million in Sperry semiconductor purchases.

Dumping duties and rising yen hits Japan and opens U.S. window for Korean memory suppliers, in particular Samsung and Hyundai. Simultaneously, U.S. companies, in particular AMD, Intel, and TI, are aggressively going after Japanese market share, aided by the weak dollar and strong yen. Japanese suppliers, whilst obviously smarting under the short term difficulties, claim that the limited nature of the Korean memory lines will present no permanent threat to their broad-based product offerings. Déja vu?

Ericsson wins Norwegian order valued at Skr90 million to supply four digital main exchanges during 1986. The exchanges with more than 50,000 lines of local and transit lines will be located in Oslo, Bergen, and Stavanger. The contract has an option for a further 20,000 lines in 1987. The Norwegian PTT said it has ordered the AXE equipment partly because of shipment delays with the previously awarded System 12 ITT contract for 700,000 lines and partly to cope with the rapid increase in telephone traffic.

Better outlook for GI, the U.S. electronic, semiconductor, and cable television equipment group, as first quarter results, ending June 1, show a net profit of $5.13 million. This compares to a loss of $6.3 million in the same period last year. The figures include an aftertax gain of $3.3 million from the sale of 470,000 shares in Symbolics. The group also reported a strengthening in the semiconductor division's results.

Philips in joint venture with Gold Peak Industries, Hong Kong, to produce and market car audio equipment for the Far East. Production is set to begin at the end of this year in China in co-operation with a local organization. Output has yet to be determined and the investment in China is expected to reach US$2.5 million within two years. The potential partner in China will provide 30 percent. The joint venture, Car Audio Electronics, will be 51 percent owned by Philips and 49 percent by Gold Peak and will have its headquarters in Hong Kong. Gold Peak is Hong Kong's leading manufacturer of car audio systems.

Voest-Alpione and Oki scrap microchip plant joint venture plans following Voest-Alpine's heavy 1985 losses. The preliminary agreement signed last May called for a $285 million investment but almost immediately ran into several difficulties.

IBM to make new memory system solely in U.K. at Havant to be used with the company's System/38 medium scale computer range. The new system, the 9335, is a magnetic disk drive capable of storing up to 3.4 billion bytes of data. Improvements in IBM's magnetic memory technology now allow more than 25 million bits of data to be packed into each square inch of disk space.

Philip/DuPont joint venture, PDO, in Italian deal with STET to produce and develop compact audio and data disks at a plant near Rome. Producton will start in 1988 and is set to reach 15 million CD-audio and CD-ROM discs by 1989. STET will own 51 percent of the new joint venture, PDO 39 percent, and Philip's Italian subsidiary the remaining 10 percent.

Big advance in earnings at Swiss Watchmaker, SMH, with 1985 net earnings of SFr60.4 million up from SFr26.5 million in the previous year. Simultaneously, turnover increased 13.6 percent to SFr1.8 billion. The two principal factors contributing to the group's success were the success of the Swatch, the low cost plastic watch of which 8.3 million were sold last year, and a strong performance from ETA, the group's watch movement and component subsidiary.

U.K. microchip company, Plasma Technology, wins Chinese order for 19 machines used to etch and deposit thin layers of chemicals in the IC production process. The total value of the order is £1 billion. The order follows the relaxation of Cocom's rules to vet exports on sales of advanced electronic equipment to China.

Breakthrough for Ericsson in battle for U.S. market following the receipt of a letter of intent from Mountain Bell, one of the seven regional Bell operating companies, to supply one of its AXE digital telephone exchanges for field trials.

Philips signs joint venture with Taiwanese government and four local private companies to set up a $208 million joint VLSI plant in Taiwan. Philips will invest about $57 million for a 27.5 percent stake in the venture and the Taiwanese government will hold 48.3 percent. The balance will be split between the four local companies. The joint venture, Taiwan Semiconductor Manufacturing, will produce 10,000 VLSI ICs per month by 1987, increasing fourfold to 40,000 per month by 1990. At least half of the production is targeted for export.

Recovery at Thomson tops expectations with the group reporting net profits of FFr583 million in 1985 compared with a loss of FFr3.5 million in 1984. The profits exceeded estimates of between FFr400-500 million made in February by chairman Alain Gomez.

Olivetti and Seiko join forces in LCD joint venture to manufacture liquid crystal screens. The new venture, Tecnis, calls for a $250 million investment at a plant in Aosta valley near the Italian group's headquarters at Ivrea. Construction of the plant will begin later this year for production in 1987. The screens will be targeted at the European computer and automotive markets.

EEC and EFTA agree on simplified customs systems to be introduced in Europe from January 1, 1988. The agreement with EFTA is the first step towards computerizing customs formalities throughout Western Europe and marks a new milestone in efforts to create a homogeneous European economic environment.

France leads Europe in attracting Japanese industrial investments in terms of the number of plants planned or in operation. As of May 1986, 40 Japanese factories are already running, or soon to be running in France, compared with 37 in Britain, 31 in West Germany, and 23 in Spain. Britain still leads Europe in terms of employment created or preserved by Japanese companies. A total of 12,400 people work in Japanese installations in Britain, compared with 11,600 in Spain, 10,000 in France and 9,100 in West Germany.

EUROPEAN SEMICONDUCTOR DIVISION ACTIVITY REPORT

The major event in June was the 5th annual European semiconductor industry conference held at the Excelsior Hotel, Venice, Italy, June 4-6. The event attracted a record number of attendees. A separate newsletter reviewing the highlights of the conference is currently being published.

The conference theme--"Applying Technology for Profit"--was chosen to feature thought provoking presentations by the people and companies that are shaping the future of semiconductors in Europe.

Copies of the proceedings are available at a cost of $350 from Lyn Cooke at our London, U.K. office.

The program for July concentrates on updating the European market estimates database, both the final 1985 company market share data and the revised market forecasts for 1986 and beyond. The results of these updates will become available from the end of July.

In addition to this we will be researching material for the forthcoming Dataquest IC Outlook 1987 Seminars (see Future Events Diary of this report for list of venues).

The topics which will be covered include:

- Worldwide Technology and Business trends
- European Semiconductor Industry update
- Semicustom Technology and Market overview
- MOS Memory, Microprocessor, Microcontroller, and Digital Signal Processor update
- IC Packaging review

Meetings start at 8.30a.m. finish at 4.40p.m.

NOT TO BE MISSED

Finally, June saw the addition of Byron Harding to our U.K.-based European semiconductor research staff. Byron joins us as a Research Associate to assume responsibility for the extensive computerised database that we have now developed. We are currently recruiting a further senior industry professional to bring the group back up to full strength.

ESD THOUGHT FOR THE MONTH

At the recent Dataquest Copying and Duplicating Industry European Conference held in Vienna at the end of June, Mr Takeshi Mitarai, President, Canon Europa N.V., presented the key note address. The theme of this address was "The Canon Copier Business in Europe", during which Mr Mitari described some of Canon's manufacturing experiences in Europe. Below is an extract of some of the key points made in his address.

> " Recruiting local employees for the factory, especially at the basic production level, has not produced significant problems. There are slight differences between working habits in Japan and those in Europe, but nothing drastic. Where we do have real problems, ones that we seem to share with our native manufacturers in Europe, is in recruiting talented and trained factory supervisors and managers.
>
> There seems to be real shortage of trained production staff at the technical and supervisory level here in Europe. Of course, employee mobility here is greater than in Japan, but that has not proved a significant problem for us.
>
> In the early phase, there is a significant difference between productivity in Japan and productivity in Europe. But we see a very rapid closing of the gap as staff and production lines settle down.
>
> Our biggest problem in Europe is procuring quality parts locally. This is a particular problem in relation to electronic parts. I will single out the three problems my managers have when it comes to procurement.
>
> First, the European electronics manufacturers are poor marketers. Quality literature and specifications that are up to date and accurate are often not available.
>
> Secondly, quality is a real problem. Samples work but we often find a market deterioration in the quality and reliability of the production output we receive.
>
> Thirdly, speed and reliability of delivery. Japanese companies have learned to reduce working capital demands by limiting inventories of production parts and by very rapid turnover of stock from production into despatch. This places a significant obligation on the supplier".

In this regard, that is the total procurement problem in relation to elecronic parts, reliability in quality and delivery is all. This is the key differentiator which will play a crucial role in the ultimate determinator for market success and profitability. And if one is to be successful in international export markets, it is a lesson that needs to be learnt quickly and vigorously, whether an electronic OEM or semiconductor device manufacturer.

Protectionism may (artificially) provide some relief from the export onslaught in the short term, but in the end it is the ultimate consumer who is being cheated. For example, a recent study in the U.K. showed that the restraint shown by the Japanese manufacturers over VCR exports to Europe is costing the consumer around £170 per machine, and so far has done little to create new jobs. In addition, protectionism tends to nurture the inefficient manufacturers. This tends to result in a lack of urgency to take the necessary steps to improve research, product development, manufacturing efficiency and marketing.

And thirdly, there is the real danger that those overseas producers who have the lead in certain technologies will abandon the protected countries which in turn will lose across to that technology. And once continuity and competitiveness in technology is compounded by loss of access to the leading edge developments, it will be extremely difficult to catch up.

One thing is for sure. The iron laws of economics will eventually catch up and the jobs protectionism was supposed to have saved will be lost anyway, but at an exceptionally high cost.

We are moving into a period of fairly good long term outlook for the world economic scenario as a whole, but simultaneously are moving in two directions at once with the increased trend to protectionism as a major uncertainty.

Ultimately we need freer world trade today, not less, but if we get too discouraged by the short term results, we will get more protectionism. That in turn will dampen the world economic growth rates in the medium term. If, however, we can find ways to improve world trade, the longer term outlook will undoubtedly be even stronger.

Malcolm G Penn

FUTURE EVENTS DIARY

SEMICONDUCTOR CONFERENCES

- SEPT 10-12, European Printer Industry Conference
  Le Beau-Rivage Palace, Lausanne, Switzerland
  "Printer Markets--the Spotlight Shifts to Europe"

- SEPT 15-23, European Semiconductor Division Industry Seminars
  (Frankfurt, Edinburgh, London, Milan, Munich, Paris, Stockholm)
  "IC Outlook 1987"

- OCT 8-10, European Telecommunications Industry Conference
  Hilton International, Vienna, Austria
  "Strategy for the 1990s"

- OCT 20-22, Semiconductor Industry Conference
  Hotel Intercontinental, San Diego, California, USA
  "Recovery: Managing the New Industry Structure"

Plus in 1987

- FEB 5-7, Semiconductor User Information Conference
  Tampa, Florida, U.S.A.

- JUNE 3-5, European Semiconductor Industry Conference
  Madrid, Spain

SPECIAL REPORTS

- Korean Semiconductor Industry Report--available now
- IC Update '85--available now
- 1985 News Digest--available now
- GaAs Market Update--available third quarter 1986
- DSP Market Update--third quarter 1986
- Taiwan Semiconductor Industry Report--available third quarter 1986
- Hong Kong Semiconductor Industry Report--available third quarter 1986
- China Semiconductor Industry Report--available fourth quarter 1986
- IC Start ups--available fourth quarter 1986

NEWSLETTER SUBSCRIPTIONS

- IC ASIA
- IC JAPAN
- European Monthly Report

ON-LINE SERVICES

- ITT Dialcom Worldwide Electronic Mail (74:DQE002)
- Semiconductor Group Database History, Forecast & Market Share Data, Europe, Far East, Worldwide
- SIA Database, Bluebook, Flash Report, Forecast

For further information on the above items or any other aspect of DATAQUEST services please contact your local DATAQUEST office.

Dataquest

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1290 Ridder Park Drive
San Jose, California 95131
(408) 971-9000
Telex: 171973
Fax: (408) 971-9003

Sales/Service offices:

UNITED KINGDOM
DATAQUEST UK Limited
144/146 New Bond Street
London W1Y 9FD
United Kingdom
(01) 409-1427
Telex: 266195
Fax: (01) 491-2790

GERMANY
DATAQUEST GmbH
Rosenkavalierplatz 17
D-8000 Munich 81
West Germany
(089) 91-1064
Telex: 5218070
Fax: (089) 91-2189

FRANCE
DATAQUEST SARL
41, rue Ybry
92522 Neuilly-sur-Seine Cedex
France
(1)47.58.12.40
Telex: 630842
Fax: (01)46.40.11.23

JAPAN
DATAQUEST Japan, Ltd.
Taiyo Ginza Building
7-14-16 Ginza, Chuo-ku
Tokyo 104, Japan
(03) 546-3191
Telex: J32768
Fax: (03) 546-3198

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EUROPEAN RESEARCH NEWSLETTER

ESIS Code: Vol. IV, Newsletters
1986-22

THE SMART IC CARD--MARKET OVERVIEW

INTRODUCTION

By 1990 the total number of magnetic credit cards in circulation worldwide will top 1 billion. The credit card has become an accepted part of everyday life. Popular though it is, this card is not without its limitations. Small memory capacity, a limited lifetime, and a susceptibility to fraud are factors limiting the true market potential for growth and acting as a driving force in bringing about the next generation of credit cards--the IC card.

IC CARD

The IC card, "smart card," or intelligent data carrier, as it is sometimes called, is a credit card with an integrated circuit imbedded in it. Metal contacts on the surface of the card allow the integrated circuit to be accessed by interfaced circuitry and the information held on the card to be updated. The International Standards Organization (ISO) has begun the process of creating standards for the IC card that will be used in financial transactions. Discussed below are the areas in which critical parameters are being specified.

Mechanical Stability

The IC card must be able to withstand the harsh environmental stresses to which a standard credit card is subjected. Some of the most rigorous torsional requirements experienced by the card take place during wintertime when the cards are pressed into service for clearing frosty windshields. The North American user subjects the credit cards to much greater wear and tear than his European or Asian counterpart. European and Asian males tend to carry their credit cards in their jacket pockets or in purses whereas North American males regularly sit upon theirs. All these factors have been taken into account in arriving at the current specification.

144/146 New Bond Street / London W1Y 9FD United Kingdom / (01) 409-1427 / Telex 266195
1290 Ridder Park Drive / San Jose, CA 95131-2398 / (408) 971-9000 / Telex 171973

Security

The device has to be secure, meaning that its contents should not be able to be read or modified by unauthorized persons. As part of the evaluation of the prospective vendors for their CP8 card, the French company CII Honeywell Bull used the services of the National Security Organization to determine how the cards could be accessed or tampered with. Tests included a scanning electron-microscope evaluation and microprobing of the die surface. Only one IC card out of the four under review passed all the security tests.

Electronic Protocols

Important for the acceptance of the card within the global financial community is the standardization of the electronic signals and exchange protocols used in reading and writing information to the card. At the time of writing, this specification is still being worked on by the major card manufacturers and financial institutions represented on the ISO.

Contact Location

ISO has agreed to adopt the CP8 French standard as the international smart card standard. This decision was reached in two stages. In May 1985, the United States withdrew its objections to the existence of two standards for the position of the chip on the card. The French chip is placed at the top of the card while other manufacturers have a chip at the bottom. ISO then accepted the French standard for the exchange of information. The technology, invented by the French inventor Roland Moreno, was adopted by Bull and thus has given Bull a substantial lead over other smart card manufacturers. Mr. Moreno has been in contact with a number of Japanese electronics groups, which could lead to the licensing of the French smart card technology in Japan.

THE MAGNETIC MARKET

North America is the premier credit card marketplace. Within this geographic area, Visa and MasterCard together have achieved 40 percent penetration of the marketplace while the upscale American Express Card has 15 percent. Further market development is limited by the increasing number of expensive on-line authorizations and the growth of fraud. Visa and MasterCard reported a combined fraud, abuse, and authorization cost of $902 million as of 1984, and estimate an additional cost of $21.5 billion by 1990. These factors, combined with the high potential for innovative intelligent new products afforded by a smart IC card, are generating the hotbed of activity surrounding IC card trials. The magnetic card is fighting back in the guise of the latest magnetic striped card under trial with Visa. This card uses magnetic stripes to increase memory capacity and the complexity of user validation, thereby increasing both the lifetime and the security quotient of the card.

TYPES OF IC CARDS

The IC card can be divided into two distinct types: a simple version containing only memory and a more complex form consisting of the processor core with an interface to memory.

Memory Card

EPROM, EEPROM, and fusible link-based technologies are under development, where 16K bits of memory correspond to 2,000 letters. The current cash card has a capacity of 0.6K bits of memory, or 75 letters. The increased availability of larger EPROMs and EEPROMs is an important factor in the growth of this sector, with 128K-bit and 256K-bit memories currently under development. Applications include usage as a robust storage medium for data that would normally be held on a magnetic tape or in a floppy disk format. In an industrial production environment it will be ideal as a batch tracking medium, processing information being modified and updated as production lots move from station to station.

Processor Card

Built-in processing power in the form of a CPU core interfacing with memory on a chip or as part of a two-chip set increases the flexibility and hence the number of applications available to the user. For example,

- The handling of multiple bank accounts
- The ability to deal with transactions in a variety of currencies
- Its use as a personal directory/memorandum
- The use of a single card for many transactions (e.g., financial, educational, and social)

In addition, the more intelligent the card the higher the levels of security that can be implemented. Worldwide credit card fraud is presently estimated at more than $500 million per year.

Outlined below is a résumé of the market situation by country. A list of IC card activity by region is detailed in Table 1.

France

In March 1985, France announced its intention to establish a sophisticated nationwide cashless retailing method involving an initial investment of FFr220 million. This scheme is based on the IC card and incorporates a two-stage introduction schedule. The first stage is the introduction of 3 million cards in four regions of France, namely

Brittany, Calais, Lyons, and the Riviera. The second stage of investment is scheduled to spread into 12 million smart cards around the whole country by the end of 1988. The total cost for both stages will be around FFr1 billion. Concerted action has been planned by the Post Office and Savings Banks in France for IC cards. DGT, the French telecommunications authority, is to place an order for 1 million cards for coinless pay phones with 15,000 such booths in use by early 1987.

Though Bull of France and Olivetti of Italy have agreed to form a joint venture for the development and production of automatic teller machines (ATMs) the agreement would result in an ATM operation large enough to be competitive worldwide. TRT Telecommunications and Informatique, the French electronics company owned by Philips, have been awarded a FFr130 million contract to provide IC cards for the French banking payments network. The order was signed with the Carte Bancaire organization which will supply 4.2 million cards over the next three years. The Carte Bancaire organization also has a contract with Bull for 12.4 million cards to be shipped by 1988.

Italy

A trial system in Bormio, North Italy, has been using 5,000 IC cards and 35 terminals. This is being operated as a joint venture between Credito Valtellinese and Intelmatique, a subsidiary of the French PTT.

Japan

Although not as fast as their European counterparts at introducing IC card trials, Japanese manufacturers have nevertheless been moving quickly to strengthen their position in the domestic market. The test results are being used to lobby U.S. companies with a view to making inroads into the important North American marketplace. There have been a number of trials running during 1985 and 1986. One of the most notable is between the Sumitomo Bank and Kyowa Bank in Haikarigaoka Park Town, Mitaka City. This was a financial system, with the card being utilized for banking, home shopping, and cable television (CATV) charge accounts. In Tokyo, The Women's University of Medicine has developed a health control card system called Sante. It uses an electronic module that accepts input data on the patient's health history.

The manufacturing and assembly process for IC cards has to be controlled within very fine limits. IC card manufacture lends itself well to the assembly, production and electronic techniques developed by the watch and calculator manufacturers. Dataquest believes that, given the opportunity, Japan has the technological infrastructure to capitalize quickly on the global market opportunity presented by the IC card.

United Kingdom

Thorn EMI has plans to supply smart cards for an identification system developed to help solve soccer hooliganism. Sperry would supply the computer terminals. British Telecom is looking to increase the use of prepaid phone cards for its pay phones, and an IC card is one system under consideration. Another use for smart cards is demonstrated by Paytel, a cable TV company, which makes pay-per-view television equipment operated by debit cards.

United States

MasterCard started two IC card tests, one in Washington, D.C., using Bull cards and one in Florida using Casio cards. For each of these two tests MasterCard has made 50,000 cards available. MasterCard's version uses an intelligent terminal to debit the balance held in the card. This requires dual ownership, i.e., acceptance by the terminal and knowledge by the person holding the card of the authorization code, before the transaction will be completed. Bull, anticipating a favorable outcome of its trials against Casio, is pressing ahead to begin production of smart cards in the fall at a new facility in Dallas, Texas.

MasterCard's major rival, Visa, has recently unveiled plans for a super IC card incorporating a touch-sensitive keyboard and display which it expects to test in about 18 months. This card will eliminate the need for special terminals. The card carries account balances that are created as the card is loaded with deposits by punching in a code provided by the bank. After each purchase, the balance on the Visa card is debited by the amount used. If the cardholder tries to make a purchase for more than the amount the card contains, he or she will not receive an authorization code.

West Germany

A banking committee has been formed, headed by the Deutsche Sparekassen and the Giroverband, to implement an IC card scheme. The banks believe this will complement the Eurocheque guarantee cards currently held by 50 percent of their banking customers.

Jennifer Berg
Jim Beveridge

Table 1

IC CARD ACTIVITY BY GEOGRAPHIC REGION

Location	Company	Activity
Australia		
Canberra	Commonwealth Bank	Bank trial with Steria (France)
Canberra	The National Bank	Bank trial with Steria (France)
Perth	ANZ	Bank trial with Steria (France)
Sydney	NSW State Bank	Bank trial with Steria (France)
Canada		
Toronto	Royal Bank of Canada	Use of Bull IC card as an access security device to financial network
France		
Aix-en-Provence	Thomson	IC manufacture for Bull
Grenoble	Crouzet	IC card electronic cash registers
Paris	Carte Bancaire	Installing IC card payment network
Paris	Credit Agricole	MasterCard trial
Paris	Credit Mutuel	MasterCard trial
Paris	DGT (French PTT)	15,000 telephone paybooths by the end of 1986
Paris	Schlumberger	IC card manufacturer
Paris	Steria	Card designer
Trappes	Bull	IC card manufacturer

(Continued)

Table 1 (Continued)

IC CARD ACTIVITY BY GEOGRAPHIC REGION

Location	Company	Activity
Holland		
Eindhoven	Philips	IC supplier to Bull
Italy		
Bormio	Credito Valtellinese	Trial system, 5K cards
Milan	Olivetti	Automatic teller machine producer
Japan		
Akijimi City	Mitsui Bank	Firm banking system
Kamei	Seibu Credit	Health record and management service
Minatoku, Tokyo	NEC	IC supplier to Casio
Mitaka City	Sumitomo Bank	Home shopping services
Tokyo	Casio	IC card producer
Tokyo	Dai Nippon Printing	Leading printing company in IC trials
Tokyo	Kyodo Printing	Developing IC card
Tokyo	Mitsubishi Plastics	IC memory card producer for education market
Tokyo	Postal Savings Bureau	International Giro Card
Tokyo	Seibu Credit	Gold card trial, 30K people
Tokyo	Toyo Trust Bank	Private financial management and forecast service

(Continued)

Table 1 (Continued)

IC CARD ACTIVITY BY GEOGRAPHIC REGION

Location	Company	Activity
Switzerland		
Zurich	GRETAG	Security card manufacturer
United Kingdom		
Glasgow	Motorola	IC supplier to Bull
London	Thorn EMI	Soccer supporter ID
London	Paytel	Per-per-view TV
United States		
Boston	Tandem Computers	System security product development with Voest-Alpine
Colorado Springs (Colorado)	Intelligent Card International	IC card manufacturer
Dallas	Micro Card Technology	Distributor of Bull cards for MasterCard trial (Bull subsidiary)
Florida	Citicorp	MasterCard trial, user
Florida	Microcard	Distributor of Casio card for MasterCard trial
Maryland	Maryland Bank	MasterCard trial, user
New York	MasterCard	Card trial organizer
New York	Paymatek	U.S. IC card division of Schlumberger
Palo Alto (California)	Indentix	Security card manufacturer (fingerprints)

(Continued)

Table 1 (Continued)

IC CARD ACTIVITY BY GEOGRAPHIC REGION

Location	Company	Activity
United States (Continued)		
San Mateo (California)	Visa	Super smart card proposal
Texas	Multimil, Richardson	IC card test kit with RS-232 interface
Virginia	Bank of Virgina	MasterCard trial, user
Washington, D.C.	Dept. of HEW	Plan to issue National Health Insurance subscriber IC cards
West Germany		
Frankfurt	Giroveband	Eurocheque trial
Munich	Deutsche Sparekassen	Eurocheque trial

Source: Dataquest
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EUROPEAN RESEARCH NEWSLETTER

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VENICE WORKSHOP WINNERS:

RESOLVING SEMICONDUCTOR TRADE CONFLICT AND DISTRIBUTION IN THE VLSI ERA

INTRODUCTION

"Resolving Semiconductor Trade Conflict" and "Distribution in the VLSI Era" were the topics of the semiconductor trade issues workshop held during the Dataquest European Semiconductor Industry Conference in Venice from June 4 to June 6, 1986. This newsletter summarizes the findings of the workshops.

RESOLVING SEMICONDUCTOR TRADE CONFLICT

Over the past decade, Japanese companies have made steady gains in worldwide semiconductor market share. These gains have been mainly at the expense of U.S. semiconductor manufacturers, which have seen their market share decrease in the MOS memory category from 74 percent in 1979 to 39 percent in 1985.

In the past year, several U.S. companies have taken legal action against Japanese companies, claiming that they have gained this market share by unfairly dumping their products in the U.S. market. As the discussion of trade issues between the U.S. and Japanese governments and industries progresses, it has become apparent that the resolution of these issues may have far-reaching consequences for the global marketplace.

Participants in the semiconductor trade issues workshop examined the issues surrounding trade conflicts among Europe, Japan, and the United States, discussed their current status, and explored ways of resolving the situation.

144/146 New Bond Street / London W1Y 9FD United Kingdom / (01) 409-1427 / Telex 266195
1290 Ridder Park Drive / San Jose, CA 95131-2398 / (408) 971-9000 / Telex 171973

Dataquest began the discussion by summarizing the background of the product dumping suits, including the market history, the legal procedure for dumping decisions, suits in progress, preliminary judgments, the possible impact of decisions, and alternative courses of action.

The group then broke up into teams to exchange ideas and summarize conclusions about one of the following questions:

- Considering the dumping penalties and the negotiations taking place, what is the likely impact on European-based manufacturers and suppliers?

- What characteristics of the Japanese manufacturers' modus operandi have contributed to their success in market penetration? Which features should other manufacturers incorporate in order to improve their operational efficiency?

- If dumping penalties are imposed, what will be the likely long-term impact on the U.S. semiconductor manufacturers and users? Outside of legal actions, what steps can be taken by U.S. companies to compete more effectively in the global marketplace?

A spokesperson appointed by each of the teams presented the team's findings to the entire workshop. The workshop participants then voted for the winning presentation, which is summarized below.

Worldwide Trade Issues

The winning trade issues group discussed a general overview of the topic, the impact of the current situation on users, and the possible courses of action open to U.S. vendors in order to increase their global competitiveness.

The general overview consisted of the following observations:

- Americans started dumping in Europe before the Japanese (standard logic in the 1970s).

- Japanese manufacturers did no more than respond to market conditions.

- Japanese manufacturers steadily gained market share because of their quality and ability to deliver.

- It is uncertain where the proposed Japanese/American agreement leaves the European vendors.

- South Korea should not be ignored in the trade discussions.

- Semiconductor memory prices change over time and with demand (history has proven that it is a cyclical business).

Impact on U.S. Users

The group emphasized two positive impacts on U.S. users. The first impact is strategic sourcing. Given the current situation, it seems likely that users will make more of an effort to develop strategic sources for their components. Extra care should be taken in the selection of vendors since a number of users were taken by surprise when companies dropped unprofitable product lines. A second positive impact is that there are likely to be more Japanese sources in the United States (i.e., wafer fabrication plants) in order to overcome the restrictions on imports from Japan into the United States. Obvious disadvantages for U.S. users would be higher prices in the U.S. marketplace and more offshore system assembly, which would affect domestic employment.

Impact on U.S. Vendors

The main positive impact for U.S. vendors will be time--legal action has been taken that will buy time for U.S. manufacturers, allowing them to expand their product portfolios and bring costs down to be on par with the Japanese. If the U.S. and Japanese governments can agree to a solution whereby the dumping duties are waived, then there is the potential for U.S. vendors to gain up to 20 percent of the Japanese market. Amid a lot of uncertainty, the most probable effect will be a short-term gain in profitability and an increase in local employment. The negative aspects include some potential losses. The group felt that the concept of the United States as a free trading nation had been somewhat damaged by these events; consequently, the potential for U.S. vendors to increase their presence in Europe and other markets has been diminished.

Ways for U.S. Manufacturers to Increase their Global Competitiveness

U.S. companies must focus on the innovation of new products and processes. This has been the area where U.S. manufacturers have traditionally excelled and where they can have the most effect on their own future. Increasing automated manufacturing capability is a must if the United States is to continue to compete globally. It was emphasized that more and more manufacturers from the Pacific Basin are improving their processing and manufacturing capability with the aim of outmanufacturing U.S. and Japanese companies. Buying silicon from lower-cost sources, such as Korea, might help ultimately to bring the overall cost down.

These points were very well received by the audience and captured several of the ideas brought up by other groups during the discussions.

DISTRIBUTION IN THE VLSI ERA

The move within the marketplace toward more complex components and customized integrated circuits heralds a change in the role of the semiconductor component distributor. The commodity logic market, which today attracts a large portion of the distributors' turnover, is being steadily eroded by a range of new semicustom products. Participants in this workshop examined the distributor's role in marketing semicustom and VLSI products to the mass marketplace.

Dataquest first presented a review of the changing distribution marketplace with an emphasis on the move from standard logic to semicustom circuits and the increasing pervasiveness of VLSI products.

As in the trade issues workshop, the group then broke into teams to exchange ideas and summarize conclusions about one of the following questions:

- Taking the distributors' perspective, what effect will the changing marketplace have on their customer bases with respect to semicustom/MPU/MCU utilization? What structural modifications should be implemented in order to cope with the new environment? What time scales apply to these changes?

- From the manufacturers' perspective, how does distribution fit into the marketing of semicustom/VLSI products? What support can the manufacturer offer the distributor?

- From the users' perspective, what service is expected from component suppliers in terms of technical support, security of supply with respect to second sources, and fast semicustom turnaround time? How far can distributors go in meeting these needs?

The winning presentation considered the distribution challenge from the manufacturers' perspective.

<u>Distributors' Performance</u>

The group's view was that European distributors were not supporting VLSI opportunity in the small to medium-size customer base. They complained that the interface between the majority of distributors and company purchasing and design managers took the form of "supermarket shopping," i.e., there was little or no design-in activity. An additional concern was the fact that many major distributors were tending to invest in additional "supermarkets" rather than specialist distributors geared to help customers design-in VLSI circuits.

The specialist "high technology" distributors that are in existence are limited by human and financial resources, which in turn limit their customer base. Because of these limitations, the distributors must increase revenue by promoting equipment sales, which once again diverts their focus from the critical VLSI design area.

Impact on the Customer Base

The poor performance by the distribution network also affected the customer base. A lack of educational activity by distributors meant that the small to medium-size customer was ill-informed as to the latest products and circuits available. This, in turn, led to less innovation, curtailed expansion, and slowed overall market development.

Impact on the Distributors

At the distributors' level, poor performance meant the potential loss of business opportunities and a shrinking of the major distributors' customer base. To some extent this was compensated for by semiconductor manufacturers and consultants increasing field application engineering support resources and picking up the design-in work. The end result was distributors' diminishing ability to determine their own destiny in terms of growth.

DATAQUEST CONCLUSIONS

The overall impression of the workshop participants was that distributors were becoming fat and complacent. Although making better profits than most semiconductor companies, they were not adapting to change quickly. But will the current situation result in the return of the in-house distributor? The workshop proposed the following action plan for distributors to consider:

- Visit and support design groups in a broad customer base
- Develop technical capability
  - Hire field application engineers (FAEs)
  - Move toward a technical sales force
  - Develop technically oriented distributors that have access to the customer base of the parent "supermarket"
  - Move away from distributing products and toward distributing designs

Jim Beveridge
Susan Scibetta

Dataquest
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EUROPEAN RESEARCH NEWSLETTER

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1986-20

HIGHLIGHTS OF DATAQUEST'S EUROPEAN SEMICONDUCTOR INDUSTRY CONFERENCE--APPLYING TECHNOLOGY FOR PROFIT

SUMMARY

DATAQUEST's fifth annual European Semiconductor Industry Service conference was held in Venice at the CIGA Hotel Excelsior, at the beginning of June. The event attracted a record number of attendees.

The conference theme, "Applying Technology for Profit," was chosen to reflect the thought-provoking presentations made by the people and companies that are shaping the future of semiconductors in Europe. The program consisted of formal presentations, workshops, and informal discussions related to the following topics:

- The latest VLSI component and manufacturing equipment developments and their impact on application markets
- Understanding the users' complex performance requirements
- The issues involved in creating an international environment for alliances in Europe
- The latest developments in GaAs and ASIC technologies
- Industry leaders' current opinions of the status of the market environment

SPEAKER HIGHLIGHTS

- A. Zylbersztejn, Bull--"The User's Perspective"

  "The all-pervasiveness of CMOS, allowing systems on-chip, means that the distinction between system design and chip design is disappearing. The result must be closer cooperation between semiconductor suppliers and their systems-house customers, especially where the latter have no in-house semiconductor capability.

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1290 Ridder Park Drive / San Jose, CA 95131-2398 / (408) 971-9000 / Telex 171973

"Examples are Olivetti/VTI, Nixdorf/Ferranti, and ICL/Fujitsu. They should aim for 'pseudo-vertical-integration,' or relationships as close as those between a systems house and its captive semiconductor division. However, it is rare in Europe for these agreements to be made between two European companies; moreover, European semiconductor process technology can lag a year or more behind what is available in the United States. Europe has to act to solve this problem (and with the Mega-project and ES2, it is trying to) or it could be cut off from the latest technology by future U.S. embargos."

- G. Oswald, Siemens--"European Leadership in Telecommunications VLSI"

  "Europe has the design tools, the silicon technology, and the systems know-how to take and keep world leadership in telecommunications ICs. However, it needs a willingness to commit to very long-term pay-back cycles. That is most suited to large vertically integrated companies. Siemens has 200 design engineers working on telecom IC projects that do not anticipate break-even for five years. Siemens is the only company in the world currently sampling CCITT-standard ISDN chips.

  "Quality of management and unified, standardized markets are more important to Europe's taking telecommunications IC leadership than direct labor costs and the fact that we work fewer hours than the Americans and Japanese."

- E. Knapp, Nixdorf--"What Does an Equipment Manufacturer Need from Europe to Support His Needs?"

  "A standard European design tool environment is vital. That includes standard tool interfaces and common data bases. Prototyping must be made faster to match PCB-prototyping times, and prototyping technology must be two years ahead of mass-production technology because this is the average delay from system design to production. Tooling investment must be nonrecurring and reasonable.

  "A major problem is the lack of leading microelectronics process technology in Europe. It is hoped that this will become available in Europe before the end of the decade. A suitable IC vehicle by which Europeans might regain world IC market share is DRAM controllers where multiple organizations and a standardized, cascadable memory element could be an accepted approach."

- J. Hubbard, Texas Instruments--"Worldwide Electronics Competitiveness--A Mandated User/Supplier Partnership"

  "Systems houses have to be world-class. They need either a world-class in-house semiconductor capability, or a strong long-term partnership with a world-class semiconductor manufacturer. Now, that partnership has to be of the 'pseudo-vertical-integration' model.

"Customer data show that the difference in unit cost between a best-case supplier and a worst-case supplier varies from fourteen times for LSTTL to six times for HCMOS. One of the barriers to success is achieving management comprehension of the total quality culture that is needed to achieve global competitiveness."

- J-P. Liebaut, Mietec--"Bringing ASICs to the Mass Market"

  "The Program for Microelectronics in Flanders has addressed the problem of how a small company can provide VLSI design experience to a newly graduated engineer. The solution is called INVOMEC, a network of leased lines between universities and industrial colleges allowing interactive circuit design. The purpose is to shortcut the route by which a freshly graduated engineer becomes able to take responsibility for new designs.

  "INVOMEC is one of three arms of the Flanders Program. The others are IMEC, the country's Technology Research Centre, and MIETEC, the industrial arm for ASIC manufacturing and sales."

- K. Kimbara, Hitachi--"A Path to the Future--Future VLSI and Applications"

  "Business relationships are becoming more important as the trend toward noncommodity ICs grows. The result is types of IC products not seen before--User-Friendly ICs (UFICs)--occupying the ground left free by standard products on the one hand (MOS memory, microprocessors, microcomputers, standard logic, and standard linear), and by ASICs on the other hand (gate array, standard cell, custom, and programmable logic).

  "Within the UFIC area are peripheral ICs, consumer linear, telecom ICs, and products like ZTAT--Hitachi's reprogrammable microprocessors with on-chip EPROM and EEPROM. Sales values for these defined areas by 1990 would be $9 billion for UFICs and $7.4 billion for ASICs.

  "New applications are: in consumer products--compact disk, digital TV, pocket TV, IC card, and electronic camera; in office automation--laser beam printers, PC plus integral phone, and portable PCs; in computers--workstations, high-definition displays and optical disks; in telecom--ISDN, cellular radio, and integrated voice/data terminals; and in industrial--factory automation."

- J. Wallace, Ford Microelectronics--"GaAs, from Laboratory to Production"

  "Yield is the key constraint on the progress of gallium arsenide. While the United States has focused on military R&D, Japan has concentrated on reproducibility and manufacturability. Cooperative ventures between systems manufacturers and gallium arsenide IC houses, as between Gigabit and Cray, are a good vehicle for promoting gallium arsenide in an application-specific world. Gallium arsenide is not a replacement technology but an alternative for high-speed memories or to alleviate logic bottlenecks."

- B. Lambourghini, Olivetti--"Strategy for Alliance--Creating an International Environment in Europe"

  "Driving forces for European manufacturers are: the evolution of DP products from elite products to commodity products; the growing need for customization; the need for economies of scale in manufacturing and to support the critical mass for R&D investments; new competitors; and deregulation. A way of handling these forces is by alliances.

  "There are five useful types of alliances: first, strategic, where there is long-term involvement which is complementary in terms of products and long-term common goals; second, merger and acquisition policies, which depend on government antitrust attitudes; third, VC alliances, such as when Olivetti invested in 30 U.S. and 10 European high-tech small companies; fourth, joint ventures, which are useful for specific product areas like the Olivetti/Bull agreement on automated banking terminals; fifth, corporate alliances, which solve temporary problems and achieve economies of scale."

- R. Blair, LSI Logic--"ASIC Technology--A Permanent Change"

  "Buying customized ICs used to be expensive; multiple iterations were usually required, there were no standards and no alternate sources, integration levels were low, it needed a physicist to get an ASIC to work, and they were made with out-of-date processing technology.

  "Now, 90 percent of the designs are delivered right the first time, alternate sources are available, they are made on RAM processes, no IC design knowledge is needed to get chips to work, systems designers can design ICs, and 10,000-gate devices are in production."

- G. Childs, British Telecom--"ASICs for Telecommunications"

  "The diverse requirements of telecommunications ICs will require 'mixed silicon technology' and more sophisticated design tools. Silicon technology, with moves to wafer scale integration and submicron geometries, is advancing faster than the best design tools.

  "BT has developed ASTRA, a full-custom rapid chip design system; HITEST, a move to automate the processes of a human test programmer; and STACE, a tool which analyses data by scanning for patterns--for example, to scan two simulation runs which produce different outputs.

"The sustainable voltage swings and linearity of 1 micron and submicron CMOS technology are likely to be very poor for analog applications. For these, CMOS circuits using bipolar drivers appear an attractive option."

- Y. Poupon, IBM (France)--"European Component Supply for IBM Data Processing Manufacturing"

  "Competitiveness in semiconductor manufacturing depends on volumes, plant size, sister plants, investment in information systems, mechanization, processes, and clean rooms. The value of sister plants was that comparison of results helped to push up yields, quality, and cost/performance.

  "IBM's manufacturing plants were monitored from chip level, to subassembly level, to box level by the company's Electronic Design System (EDS). The system controlled the E-beam mask-making machine, which was also used for chip differentiation (currently 15 different chips were being made per wafer). EDS also monitored the production lines and 70 percent of the staff had their own terminals. Continuous Flow Manufacture (CFM) had produced a 60 percent reduction in turnaround between Q4, 1984 and Q4, 1985."

- C. Krijgsman, Philips Elcoma Division--"Technology and Profits"

  "The number of IC designers needs to explode to keep up with the market demand. Uniqueness is necessary for profits and to achieve uniqueness, design is key. The proliferation of designs could mean the standardization of design rules and even of processes. There is no reason why a semiconductor company shouldn't put part of its design budget into independent design houses, and no reason why wafer fabs should not be owned by more than one company.

  "The key competences required are: for application-specific chips--customer interface, CAD capability, design ability, applications support, and systems know-how; for general-purpose chips--excellence in process technology. The result is that general-purpose chips will be made by the large producers with their own foundries, while small companies will make special-feature or special-function chips."

- Pasquale Pistorio, SGS Group--"Take the Intitiative, or Take the Remainder"

  "Niche market strategies will allow individual European companies to survive but this won't allow Europe to survive as a strategically independent industrial microsystem. No major macrosystem can survive in electronics if it does not have controlled access to a microelectronics industry that has a broad-based and valid product range. For the microelectronics industry to have that, it must fully embrace manufacturing science.

"SGS' capital investment has averaged 33.3 percent of sales over the last five years. These investments were directed at larger wafers, finer lithography, automated production, information systems which control product life, quality levels aimed at 50 ppm, and programs which will establish Just-in-Time and Ship-to-Store as normal within two years."

WORKSHOPS

In addition to the main conference proceedings, two workshop sessions were offered.

- Workshop 1: Semiconductor User Requirements
  - Motivating vendors to improve performance
  - Practical steps for improved inventory management
- Workshop 2: Semiconductor Industry Issues
  - Resolving worldwide trade conflict
  - Distribution in the VLSI era

At the end of each workshop, the participating group presented its proposals to the other workshop attendees. The team with the best proposal in each area received an award.

DATAQUEST will publish a separate newsletter summarizing the results of these workshops at a later date.

Workshop 1

Introduction

Participants in this workshop formed work groups whose task was to propose programs in one of two areas:

- Motivating vendors to improve performance
- Practical steps for improved inventory management

Background

Strategic partnerships between electronic equipment manufacturers and their materials suppliers have become a necessary requirement for remaining competitive in the challenging international electronics industry. Supplier quality and delivery performance have become more important than price for achieving lower overall manufacturing costs. Continuous improvement in manufacturing performance requires new relationships between customers and their suppliers.

Attendees of this workshop should approach their tasks from the perspective of developing strategic partnerships to achieve the assigned tasks.

<u>The Workshop Format</u>

Each work group was given one hour to discuss and organize its proposal. At the end of the hour, the proposals were presented to the work shop attendees in five-minute presentations. The proposals followed this outline:

- Objectives of the proposal
- Obstacles to achieving objectives
- Steps to accomplishing objectives

<u>Workshop 2</u>

<u>Introduction</u>

This workshop focused on two key industry topics: world trade issues and distribution in the VLSI era.

<u>Resolving Worldwide Trade Conflict</u> - Over the past decade, Japanese companies have made steady gains in worldwide semiconductor market share. This gain has been mainly at the expense of the U.S. semiconductor manufacturers, which have seen their market shares decrease in the MOS memory category from 74 percent in 1979 to 39 percent in 1985.

During the past year, several U.S. companies have taken legal action against Japanese companies, claiming that the Japanese companies have gained this market share unfairly by dumping their products in the U.S. market.

As the discussions of trade issues between the U.S. and Japanese governments and industries have progressed, it has become apparent that the resolution of these issues may have far-reaching consequences for the global marketplace.

Participants in the workshop examined the issues surrounding trade conflicts between Europe, Japan, and the United States, discussed the current status, and explored ways of resolving the situation.

DATAQUEST first summarized the background of the product dumping suits, including these key points:

- Market history
- Procedure for dumping decisions
- Suits in progress

- Preliminary judgments

- Possible impact on decisions

- Alternative courses of action

The group then broke into teams to exchange ideas, and summarize conclusions about one of these three questions:

- Considering the dumping penalties and the negotiations taking place, what is the likely impact on European-based manufacturers and suppliers?

- What characteristics of the Japanese manufacturers' modus operandi have contributed to their success in market penetration? Which features should other manufacturers incorporate in order to improve their operational efficiency?

- If dumping penalties are imposed, what will be the likely long-term impact on the U.S. semiconductor manufacturers and users? Outside of legal action, what steps can be taken by U.S. companies to compete more effectively in the global marketplace?

<u>Distribution in the VLSI Era</u> - The move within the marketplace toward more complex components and customized integrated circuits heralds a change in the role of the semiconductor component distributor. The commodity logic market, which today attracts a large portion of the distributors' turnover, is being steadily eroded by a range of new semicustom products.

Participants in this workshop examined the distributor's role in marketing semicustom and VLSI products to the mass marketplace.

DATAQUEST first presented a review of the changing distribution marketplace, as follows:

- The size of the European distribution marketplace

- Growth of VLSI products

- Semicustom versus standard logic

- Fast turnaround ASIC marketplace

The group then broke into teams to exchange ideas, and summarize conclusions about one of the following three questions:

- Taking the distributors' perspective, what effect will the changing marketplace have on their customer bases with respect to semicustom/MPU/MCU utilization? What structural modifications should be implemented in order to cope with the new environment? What time scales apply to these changes?

- From the manufacturers' perspective, how does distribution fit into the marketing of semicustom/VLSI products? What support can the manufacturer offer the distributor?

- From the users' perspective, what service is expected from component suppliers in terms of technical support, security of supply with respect to second sources, and fast semicustom turnaround time? How far can distributors go in meeting these needs?

1987 CONFERENCE

The next DATAQUEST European Semiconductor Industry Conference is planned for Madrid, Spain, in June 1987. Once again, we expect a large attendance; therefore, we are asking participants to make their reservations early to assure their places at the conference.

Jennifer Berg

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EUROPEAN RESEARCH NEWSLETTER

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LONG-TERM PROCUREMENT IMPLICATIONS OF SEMICONDUCTOR PRICE DUMPING

SUMMARY

The current situation involving the dissemination of information about the dumping rulings and the administration of those rulings is at best confusing and at worst very costly. This newsletter will:

- Review the current situation
- Evaluate the Japanese Ministry of International Trade and Industry (MITI) proposal
- Examine the reasons the Federal Trade Commission (FTC) concurs with the Japanese manufacturers that claim that no dumping has occurred
- Analyze the effects of both the short- and long-range price trends and recommend strategies for success

INDUSTRY STATUS

Figure 1 illustrates the current situation. The ITC ruled on May 27 that the U.S. IC industry had been "injured" by price dumping of Japanese 64K DRAMs. The 256K DRAM and EPROM rulings have not gotten that far in the proceedings and are awaiting the U.S. Department of Commerce's announcement of the final dumping penalty percentages by company. The final penalty percentage decision for the 256K DRAMs and EPROMs was delayed so that the Japanese manufacturers involved could gather more accurate cost data.

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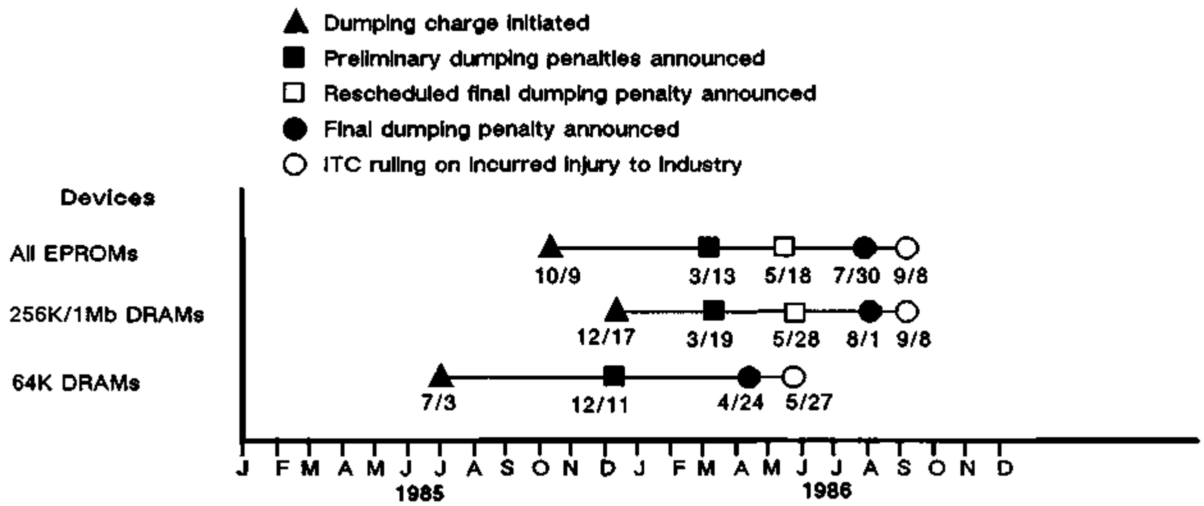
Figure 1

SEMICONDUCTOR PRICE DUMPING PROCEEDING SCHEDULE



Source: DATAQUEST
June 1986

As stated in our SUIS Research Newsletter 1986-8, "Semiconductor Dumping and Prices: Who Pays the Bill," the effects of the dumping charges have accelerated the then ongoing price stabilization caused by inventory replenishment and increased demand. The question at that time was whether the imposed penalties were applied before or after prices had risen above continually declining costs. It appears that the crossover point has been reached and that 64K DRAM, and to some extent 256K DRAM and EPROM, prices will peak by the third quarter of this year. Price declines will then follow gradual cost reductions. The pricing of 1Mb DRAMs has not been appreciably affected by the dumping penalties due to limited shipments. Furthermore, because of the soft systems market, we do not expect new designs implementing the 1Mb DRAM to be pushed into the market any sooner than necessary. As a result, shipments of these parts will not force cost-related price cuts faster than the normal experience curve. Using a 4:1 trade-off point, we estimate that by the fourth quarter of 1987, 1Mb parts will reach bit price parity with the 256K device.

Table 1 shows the 1985 prices for the major semiconductor devices and the expected price trends for the rest of 1986.

Table 1

MAJOR SEMICONDUCTOR PRICES AFFECTED BY DUMPING RULINGS

	1985				1986			
Device	Q1	Q2	Q3	Q4	Q1	Q2	Q3*	Q4*
64K DRAM	$ 1.75	$ 1.10	$ 0.80	$ 0.85	$ 1.10	$ 1.15	$ 1.20	$ 1.15
256K DRAM	$ 9.75	$ 4.75	$ 2.75	$ 2.10	$ 2.25	$ 2.50	$ 2.60	$ 2.45
1Mb DRAM	N/A	N/A	$160.00	$125.00	$50.00	$34.00	$24.00	$18.50
128K EPROM	$ 6.57	$ 4.14	$ 3.11	$ 2.61	$ 2.90	$ 2.90	$ 2.90	$ 2.85
256K EPROM	$21.55	$12.14	$ 5.67	$ 4.70	$ 4.35	$ 4.75	$ 4.20	$ 3.85

*Estimated prices
N/A = Not Available

Source: DATAQUEST
June 1986

MITI Proposal

If implemented, the MITI proposal to monitor semiconductor production and prices has many long-range implications for the electronics industry (see the SUIS Research Bulletin 1986-15, "MITI Offers Proposal to Avoid Dumping Penalties"). Though the proposal will eliminate dumping penalties and all the headaches that go along with them, the resulting MITI-imposed market controls will transfer marketing decisions from individual industry competitors to the state and will moderate the Japanese memory industry.

Both sides of the bargaining table are exerting enormous political pressure to force acceptance of this proposal or a variant thereof. The Japanese desire improved U.S.-Japanese business relations, and the United States wants greater access to the Japanese electronics market. An agreement like this would, with one stroke, eliminate the administrative burden of dumping penalty enforcement and possibly allow price reduction to resume in the near term. In return, U.S. companies would receive a guarantee of greater access to Japanese markets over the long term.

The wild card in this arrangement is whether competing U.S. and Korean memory manufacturers will follow MITI's pricing structure or if they will undercut the set floor prices to regain market share. Near-term pricing will likely stabilize if the proposal is made official policy. Longer-term pricing under the proposal will remain market-driven, with the MITI-orchestrated price structure acting as a single megavendor that can influence memory price trends although not necessarily all contract prices. The exclusion of ASICs in the proposal implies that this may be the next major target for the Japanese manufacturers.

FTC Determination

The FTC has stated that after looking at the cost data criteria, it found that dumping had not occurred for the 64K DRAM device. The key to this statement is the criteria used in determining what constitutes price dumping. The FTC claimed that using "constructed costs" in determining dumping violations would "not assure benefits of fair price competition for U.S. consumers." Although the constructed-cost method of determining price dumping is required by law, the FTC remarked that the U.S. Department of Commerce should determine dumping by comparing the retail selling price of 64K DRAMs in the home Japanese market versus the U.S. prices for the same device over the entire life of the device.

Micron Technology's financial reports provide a good example of how dumping based on costs can be misleading (see Table 2). Although product-related revenue and shipments dropped, fully loaded product expenses rose, resulting in higher costs per unit as more overhead had to be spread over fewer shipments. To compound the problem, the average selling price dropped by a factor of three. In effect, semiconductor companies sometimes have to sell below cost in order to ride out the cyclical swings of the market.

Table 2

TYPICAL OVERHEAD VERSUS VOLUME DILEMMA
(Micron Technology, 1984-1985 ($M))

	1984		1985	
	FY	Q4	FY	Q4
Revenue	$84.00	$31.20	$69.80	$ 5.00
Cost of Sales	$48.10	$15.50	$77.00	$12.70
Profit/(Loss)	$35.90	$15.70	($ 7.20)	($ 7.70)
Units Sold				
64K DRAM	$33.50	$19.20	$59.70	$ 2.80
256K DRAM	-	-	$ 0.40	$ 1.50
ASP	$ 2.50	$ 1.62	$ 1.16	$ 1.16
Cost Per Unit	$ 1.43	$ 1.00	$ 1.28	$ 3.39
Profit/(Loss) Per Unit	$ 1.07	$ 0.62	($ 0.12)	($ 2.23)

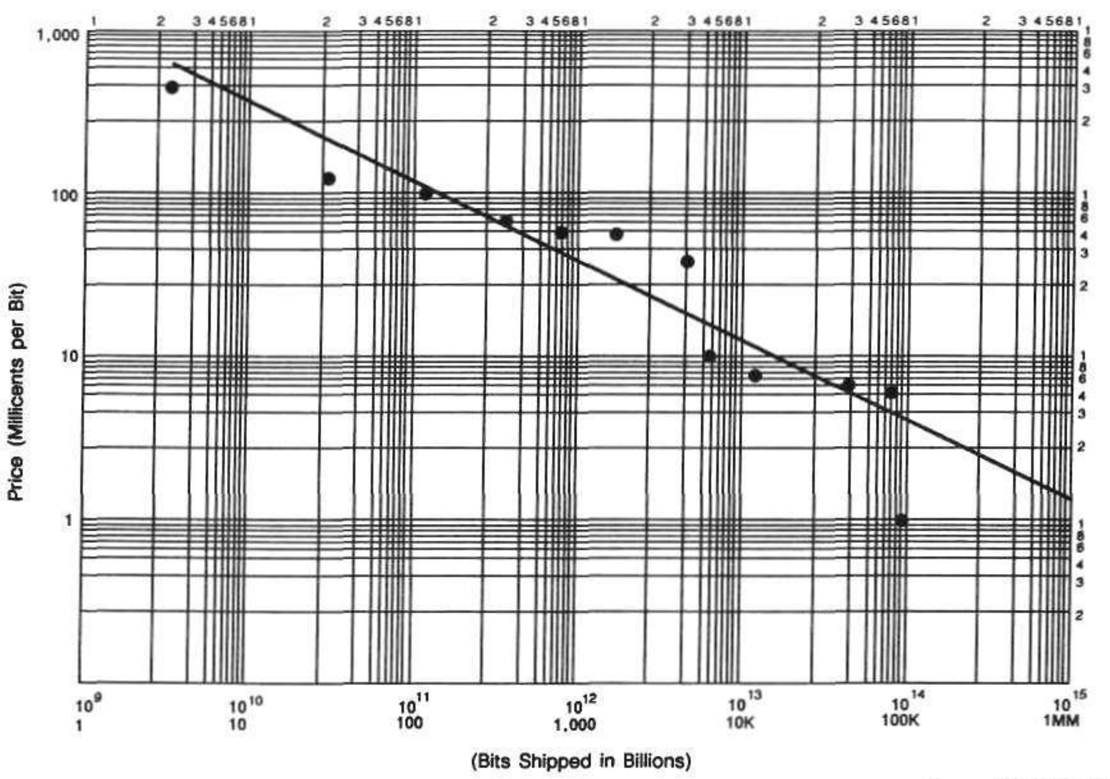
Source: Micron Technology
DATAQUEST
June 1986

The FTC issue echoed the arguments of the Japanese companies involved and was dismissed as inadmissible under current antidumping law. The implication for foreign semiconductor manufacturers is that the current laws provide little recourse to disprove dumping using the traditional comparative price argument. As it now stands, semiconductor users can expect near-term price increases for the affected devices until the dumping penalty time frame expires. Any price reductions in the interim will have to be well documented with cost-reduction justifications.

Near-term price stability or selective hikes will result regardless of whether dumping penalties remain or an agreement is reached through diplomatic channels. Long-term prices and their impact on manufacturing costs are expected to follow the normal bit price experience curve for semiconductors once the price dumping furor subsides (see Figure 2). Market share opportunities at the expense of Japanese manufacturers and overall cost reductions will force the continued trend toward long-term price decreases. The current strength of the yen against the dollar makes the United States an attractive site for investment in the very industries that are seeking dumping protection. Joint ventures between Japanese and U.S. companies are increasing both in response to the strength of the yen and as a means of improving business relations between the two countries.

Figure 2

DRAM EXPERIENCE CURVE



Source: DATAQUEST
June 1986

As worldwide quality standards improve due to acquired and created productivity gains, the short-term cost advantages of offshore manufacturing may prove to be long-term liabilities as automation and increased emphasis on high quality become the standard. The proliferation of technology transfers and joint ventures between Japan and the United States is advantageous for both parties. The U.S. companies gain manufacturing efficiencies and process enhancements while the Japanese companies attain licenses to state-of-the-art designs for future products. Since material and equipment costs are relatively equivalent, the cost differential of the variables involved with offshore manufacture versus U.S. manufacture center around labor, logistics, and facility costs. Long-term automation gains and the resulting lower labor costs coupled with quality improvements may overshadow the short-term savings resulting from overseas labor and facilities.

DATAQUEST ANALYSIS

The current semiconductor pricing situation raises questions that will affect many companies' long-term plans. One of the major questions many companies are dealing with is whether to move manufacturing facilities offshore. Some of the key factors influencing these decisions are cheap labor, lower capital costs, lower material costs, and proximity to suppliers. Balanced against offshore plant construction are domestic productivity gains made with automation, potential political volatility of the offshore country, required logistical support, and proximity to customers. Long-term overall semiconductor bit price reductions will continue to keep the semiconductor price per function down, thus negating the need for offshore plants due to semiconductor price trends.

Regardless of final dumping penalty percentages or agreements reached diplomatically, all Japanese products (including semiconductors) will continue to cost more due to the yen exchange rate. Prices for non-Japanese parts (U.S., Korean, European, etc.) will be less, unless a company attempts to skim some extra profit in relation to Japanese pricing. The semiconductor market will prevent any extended skimming as opportunities to gain market share overcome temporary price supports. As their quality comes up to par with the U.S. and Japanese manufacturers, the Korean semiconductor manufacturers are more than willing to gain market share at the expense of their competitors.

As the international financial markets settle upon consistent exchange rates, the near-term speculative exchange differentials will become less of a factor in determining whether to move facilities offshore. Interesting questions arise in light of the current phenomenon of Japanese companies coming to manufacture in the United States and U.S. companies going offshore. If Japanese companies can manufacture in the United States and make a profit, why cannot U.S. companies do the same? And, assuming many U.S. companies do go offshore to save costs, to whom will the U.S.-based Japanese companies sell?

Recommendations

In order to maximize profits, near-term strategies for using offshore turnkey assemblers and subcontractors while automating onshore facilities will provide a strong foundation for long-term growth. This approach minimizes exposure to fixed offshore plant expenses yet offers the advantages of labor savings. Logistical support for offshore manufacturing is critical and must be thoroughly understood before embarking into the international traffic channels.

Price dumping should be viewed as a temporary blip in an otherwise consistent reduction of semiconductor costs per function. As market forces regain control, competition will force prices downward in line with reduced costs. Procurement specialists should consider the following when negotiating prices:

- If dealing with a Japanese vendor, compare the exchange rate used for the last contract with the current exchange rate to determine the net price differential for the current contract.

- Prices in general will trend downward by the third quarter of this year as available capacity is filled and dumping adjustments become absorbed into pricing schedules.

- Before deciding to move facilities offshore, a thorough check of a company's traffic department is necessary (i.e., if there are logistical problems in dealing with domestic suppliers, the Pacific Ocean will only compound the problem).

- Continue to encourage close vendor-buyer relations that include price and delivery guarantees in order to ensure consistent pricing.

By understanding the current pricing phenomenon as a temporary anomaly and not a long-term trend, the decision to move manufacturing offshore also appears as a short-term fix. Long-term growth and industrial strength require the determination to invest where the markets are, not necessarily where the short-term costs are lowest.

Jim Beveridge
Mark Giudici

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RESEARCH BULLETIN

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1986-18

MITI OFFERS PROPOSAL TO AVOID DUMPING PENALTIES

SUMMARY

Japan's Ministry of International Trade and Industry (MITI) has proposed a semiconductor monitoring system in an effort to avoid the implementation of dumping penalties on Japanese DRAMs and EPROMs. The MITI proposal was published in a prominent Japanese industrial journal, Nihon Keizai, as a "trial balloon" to elicit an official U.S. response. MITI has used this procedure in the past to test public and industry reaction to policies that were later made official. The new proposal includes the following:

- A demand-supply guidepost system to curb overproduction and stabilize prices
- A lowest-export-price system (price floor) to prevent below-cost sales (dumping)
- A uniform minimum price system to prevent circuitous exports to the United States or elsewhere through third countries (Europe and Asia)

Under the new system, similar to MITI's control of Japanese iron and steel production, a select committee will announce a quarterly semiconductor demand-supply outlook. If production plans exceed consumption forecasts, MITI will request Japanese vendors to reduce their production plans. Both the Japanese and U.S. governments will negotiate fully loaded production costs to determine price curves.

DATAQUEST ANALYSIS

The main reason for MITI's proposal can be seen in Table 1. In addition to the dumping penalties, the current dollar/yen exchange rate compounds export difficulties and will continue to be a problem regardless of any decision about dumping penalties. For this reason, MITI believes that dumping penalties are adding insult to injury.

Table 1

COMPOUND EFFECT OF DUMPING PENALTIES AND EXCHANGE RATE

Japanese Device	Penalty Status	Average Penalty %	Current $/Yen Difference	Total Penalty
64K DRAM	Final	20.75%	30.80%	51.55%
256K DRAM	Preliminary	40.00%	30.80%	70.80%
All EPROMs	Preliminary	63.10%	30.80%	93.90%

Source: DATAQUEST
May 1986

MITI's new proposal is a reaction to strong pressure from Japanese semiconductor manufacturers that want to eliminate dumping penalties and improve U.S.-Japanese trade relations. It is also an effort by MITI to reassert its influence over the Japanese semiconductor industry. The key points of this proposal are:

- The end of a free market in commodity semiconductors
- A short-term rise in prices for Japanese commodity semiconductors and a more stable long-term price-reduction schedule
- The elimination of dumping charges and penalties
- Governmental negotiation of fully loaded production costs

It is important to note that South Korean semiconductors and Japanese ASICs are not included in this proposal. The ASIC marketplace is expected to become the next price battlefield soon. In response to that expectation, many ASIC companies are now absorbing their nonrecurring expenses to remain competitive.

The proposal would allow both governments to walk away from the issue without giving up any concessions or losing face. Any effects on prices will be attributed to a nonpolitical area--the dollar/yen exchange rate. Although the proposal is not policy yet, it will be interesting to see whether U.S. or Korean manufacturers will choose to follow the MITI pricing guidelines or to gain market share by setting prices below the agreed-upon rate.

It is the semiconductor user who will likely pay the bill for the market tampering done by the U.S. and Japanese governments. In return for relatively higher prices, they promise stability in the historically volatile commodity semiconductor market.

Jim Beveridge
Mark Giudici

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EUROPEAN RESEARCH NEWSLETTER

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EUROPEAN FAST STATIC RAM PRICING SURVEY (CMOS)

DATAQUEST estimates that in 1985 the worldwide fast static RAM market was US$360 million. Of this total, Europe's share was almost 14 percent or US$50 million. The fast static RAM marketplace has been attracting an increasing number of manufacturers because of its steady growth and relative stability. This newsletter reports on the status of the market pricing. Inputs for 1K and 10K quantities for the week beginning 1 March 1986 were received from seven manufacturers. The results of our survey are shown in Table 1.

PRICING TODAY

At the 16K static RAM 10K level, the results indicated:

- The more than 60 percent premium for the 45ns part versus the 55ns part clearly demonstrates the added value attributed to the lower-yielding variants.

- Surprisingly, a much smaller premium was asked for when comparing 36ns and 25ns parts with 45ns parts. In the case of the 16Kx1, the price of the 35ns part averaged 12.5 percent above the 25ns, and in the 4Kx4, the 35ns commanded a 3 percent premium over the 45ns part.

- The 2Kx8 and 4Kx4 organizations were priced at 28 percent and 17 percent, respectively, above the 16Kx1 (using the 45ns part as a reference).

- A wide pricing spread between high and low bids was apparent especially at the high speeds. The highest bid received for the standard 16Kx1 (55ns) was 33 percent higher than the lowest. In the case of the 4Kx4 (25ns), the top bid was more than three times the lowest bid.

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The 64K analysis was limited because only a few inputs were received for 16x4 configurations and 64x1 devices faster than 45ns.

- The 64Kx1 (55ns) was a factor of 3.88 times more expensive than the 16Kx1 (55ns). Despite this, DATAQUEST believes that the pressure for users to obtain a lower cost per bit by upgrading is not nearly as intense as in the DRAM marketplace, where a factor of better than five times has to be achieved before users will upgrade to the higher-density device.

- Although a low number of bids was received for 64K parts, almost all the manufacturers will be releasing new 64K parts throughout 1986. The Japanese manufacturers are being especially prolific, e.g., Fujitsu intends to introduce seven parts and Toshiba, five.

PRICING TRENDS

Manufacturers report that a number of factors are influencing pricing, as follows:

- The 1985 backlash--The more popular parts--notably the 16x1--were overinventoried in 1985 and the price fell correspondingly. The prices are now stabilizing as demand comes into alignment with supply.

- More participants--The marketplace is becoming more and more crowded as the established producers--AMD, Fujitsu, Hitachi, Inmos, Intel, Mitsubishi, NEC, and Toshiba--are joined by new start-ups or new programs in established producers. Among the new companies are Alliance Semiconductor, Cypress, IDT, Lattice Semiconductor, Mosel (a Taiwanese company), Triad (a new start-up out of Inmos Corporation), Visic, Vitelic, VLSI Technology, and via licensing arrangements NMB Semiconductor, Seiko, Sharp, and Sony. This increased participation will probably accelerate the price erosion in the marketplace.

- Demand for more complex, faster parts--Manufacturers operating at the leading edge of the technology are managing to improve their total kit price by offsetting price reductions in the more mature parts against the premiums obtained for products such as very high-speed devices (25ns), special feature parts, dual port RAMs, or RAMs with separate I/Os.

DATAQUEST ANALYSIS

The overriding impression we received from our survey was that the fast static RAM marketplace is much more stable than its DRAM counterpart. Cost/performance improvement is being obtained through improvements in system architecture and design rather than by the addition of bulk memory. The market is also more niche oriented; i.e., product differentiation, ingenuity in design, and market identification play important roles in outpointing the competition. Consequently, many manufacturers are finding it a marketplace where margins can be made and sustained.

Jim Beveridge

Table 1

16K/64K FAST STATIC RAM (CMOS) PRICING
(In U.S. Dollars)

	2Kx8		16Kx1		16Kx1		16Kx1		4Kx4	
	45ns		55ns		45ns		35ns		55ns	
	1K	10K	1K	10K	1K	10K	1K	10K	1K	10K
High	10.21	8.99	4.59	3.79	6.58	6.29	13.14	7.35	5.75	4.39
Low	5.99	4.98	3.15	2.86	3.29	3.00	5.72	4.29	3.43	3.07
Median	8.11	6.99	4.11	3.34	6.44	5.46	8.65	6.15	4.81	3.94

	4Kx4		4Kx4		4Kx4		64Kx1		64Kx1	
	45ns		45ns		25ns		55ns		45ns	
	1K	10K	1K	10K	1K	10K	1K	10K	1K	10K
High	12.25	11.02	9.30	7.35	15.96	12.14	22.98	17.46	28.08	21.35
Low	3.50	3.15	3.72	3.58	3.93	3.72	11.44	10.01	12.87	11.44
Median	7.36	6.38	7.51	6.56	8.54	6.95	16.23	12.97	20.19	17.45

Source: DATAQUEST
April 1986

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EUROPEAN RESEARCH NEWSLETTER

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SEMICON EUROPA 1986--CAUTIOUS OPTIMISM

OVERVIEW

Semicon Europa 1986 was held at the Zuspa Convention Center in Zurich, Switzerland, from March 4 to 6. This was the twelfth time that this show, organized by the Semiconductor Equipment and Materials Institute (SEMI), had been held in Zurich.

This show, which was the first of the year in the SEMI Calendar of Events for 1986, will be followed by other shows as shown in Table 1.

Table 1

SEMICON SHOW LOCATIONS FOR 1986

Show	Location	1986 Dates
SEMICON West	San Mateo, California	May 19-22
SEMICON Osaka	Osaka, Japan	July 1-3
SEMICON East	Boston, Massachusetts	September 16-18
SEMICON Southwest	Dallas, Texas	October 14-16
SEMICON Japan	Tokyo, Japan	December TBA Technical Sessions 10-11

Source: SEMI

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SHOW REVIEW

In addition to the exhibition, which allowed the equipment and materials industry that supplies European semiconductor manufacturers to demonstrate the latest technological advances, the event was supported by technical sessions under the broad title "Advanced Wafer Technology." The sessions covered wafer ecology, facility automation, and VLSI patterning. Papers of high technological content were presented by leading scientists and process engineers from Europe, Japan, and the United States.

The first session, dealing with wafer ecology, included five papers covering contamination and defect control during materials and wafer handling, together with clean room design and equipment.

The second session concentrated on facility automation and included developments in the field of factory automation, automated fabrication steps, and third-generation test systems. Aspects of an integrated front-end line were also discussed. Session three dealt with VLSI patterning and included papers on optical processing, E-Beam direct write processing, X-ray lithography processing, and plasma processing, with emphasis on the software equipment and processing aspects.

To accommodate the increased number of exhibitors, up from some 350 companies in 1985 to some 400 this year, the show filled five halls, compared with three last year. European companies were well represented in their display of the very latest in processing equipment and materials.

Table 2 lists the major European-owned companies that exhibited broken down into the principal product areas of:

- Chemicals
  - Silicon suppliers
  - Other chemicals
- Wafer process equipment
- Maskmaking
- Assembly

Table 2

EUROPEAN-OWNED SEMICONDUCTOR EQUIPMENT AND MATERIALS COMPANIES EXHIBITING AT SEMICON/EUROPA 1986

Company	Location	Comments
Chemicals		
Silicon Suppliers		
Dynamit Nobel Silicon	Italy	Silicon Wafers
ICI Wafer Technology	United Kingdom	III-V Semiconductor Materials
Rhone Siltec	France	Silicon Wafers/Ingots
Topsil	Denmark	Float Zone Silicon NTD and HPS
Wacker-Chemitronic	West Germany	Hyper Pure Silicon Slices, Solar Grade Multicrystalline Silicon Slices
Other Chemicals		
BOC	United Kingdom	Process and Specialty Gases
Heraeus	West Germany	High Purity Materials, Aluminum Nitride Substrates
Hoechst Chemicals	West Germany	Photoresists and Related
Johnson Matthey	United Kingdom	Precious Metals for Sputtering
L'Air Liquide	France	Process and Specialty Gases, Gas Equipment
Merck	West Germany	Photoresists, High-purity Chemicals
Messer Griescheim	West Germany	Specialty Gases and Associated Equipment
Micro-Image Technology	United Kingdom	High-purity Chemicals, Clean Room Accessories
M.I.T.-Halbleiterchemie	West Germany	UV, E-B, X-Ray Photoresists, and High-purity Chemicals

(Continued)

Table 2 (Continued)

EUROPEAN-OWNED SEMICONDUCTOR EQUIPMENT AND MATERIALS COMPANIES EXHIBITING AT SEMICON/EUROPA 1986

Company	Location	Comments
Wafer Process Equipment		
Riedel-de-Haan	West Germany	High-purity Chemicals
Soprelec	France	See Micro-Image Technology
A.E.T.	France	Rapid Anneal, Dry Etch/Strip
ASM Europe	Holland	Epitaxial Reactors, Diffusion Furnaces, Driers, Purifiers, 4-Point Probe, Steppers
Balzers	Liechtenstein	Sputtering, Evaporation, Plasma Etch, Thin-film Products
BOC	England	Wet Etch Equipment, Vacuum Coaters
Cambridge Instruments	England	EB Lithograph, MOC VD
Centrotherm	West Germany	Diffusion Systems, Clean Room Technology, Quartz Tube Etching Systems
CIT Alcatel	France	Dry Etch, Vacuum Deposition
Convac	West Germany	Wafer Photolithography, Photomask Equipment, Robotic Systems
Electrotech	United Kingdom	Sputtering, PECVD, Dry Etch
ISA Riba	France	MBE, Surface Epitaxy
Kummer	Switzerland	Plasma Etch/Plasma Deposition, Ion Sources, Process Furnaces
Nordiko	United Kingdom	Reactive Ion Etch/Plasma Deposition, Sputtering
Philips	Holland	E-Beam Lithography

(Continued)

Table 2 (Continued)

EUROPEAN-OWNED SEMICONDUCTOR EQUIPMENT AND MATERIALS COMPANIES EXHIBITING AT SEMICON/EUROPA 1986

Company	Location	Comments
Phoenix Semiconductor Equipment	United Kingdom	Wet Etching/Stripping
Plasma Technology	United Kingdom	(See Krummer)
SAPI Equipments	France	Wet Benches, Cleaning Stations
Semy Engineering	France	LPCVD, PECVD, Diffusion Furnace
Suss, Karl	West Germany	Contact/Proximity Aligners
Vickers Instruments	United Kingdom	E-Beam System for Inspection and Measurement
Wellman Furnaces	United Kingdom	LPCVD Gas Systems, Furnace Loading
Wilde & Leitz	Switzerland	Stereomicroscopes, Wafer Inspection Systems
Maskmaking		
Compugraphics	Scotland	
IC Masks	United Kingdom	
Nanomask	France	E-B photomasks
Assembly		
Alphasem	Switzerland	Wafer Loaders, Die/Wire Bonder
ASM Europe	Holland	Die/Wire Bonder, Dicing, Molding Presses
Cryophysics	Switzerland	Laser Coding
ESEC	Switzerland	High-speed Die Bonders and Dicing Saws

(Continued)

Table 2 (Continued)

EUROPEAN-OWNED SEMICONDUCTOR EQUIPMENT AND MATERIALS COMPANIES EXHIBITING AT SEMICON/EUROPA 1986

Company	Location	Comments
Farco	Switzerland	TAB, Flat-pack Bonding Machines
Slee Semiconductor-Technik	West Germany	Encapsulation
Suss, Karl	West Germany	Wafer Dicer, Prober

Source: DATAQUEST
March 1986

This table shows a good representation of European-owned companies in all the leading areas of equipment and materials supply. Some of them are highlighted below.

Chemicals

In the area of chemicals, European companies are well in the forefront. Wacker-Chemitronic is the leading supplier of silicon wafer substrates in Europe and accounts for more than 40 percent of worldwide demand for polycrystalline silicon. Exports account for about 80 percent. European suppliers of other chemicals, including gases, included Merck displaying chemicals with particle class specification for the manufacture of ICs, positive and negative photoresists, and other process chemicals. Hoechst showed its AZ positive photoresists, and its associated companies, Messer Grieshiem and Riedel-de Haen, showed gases and low-particle chemicals, respectively. Micro-Image Technology, a leading supplier in the United Kingdom, was showing high-purity chemicals and clean room accessories, together with its affiliated companies, Soprelec (France) and M.I.T.-Halbleiterchemie (West Germany). In addition to Messer Griesheim, process and special gases and related equipment were represented by BOC and L'Air Liquide.

Wafer Process Equipment

Wafer process equipment is well represented by European-owned companies. AET is now recognized as a European leader in the field of thermal management applied to semiconductor manufacture. The company exhibited its large range of rapid annealing systems, including one system working under vacuum using specialty gases that is specifically designed for III-V compounds. CIT Alcatel demonstrated the latest advances in vacuum deposition equipment, Convac wafer photolithography, and maskmaking equipment. Electrotech exhibited its new PLASMAFAB M4 multichamber, fully automated, single-wafer etching system, which is available in plasma, reactive ion, and triode configuration. Nordiko displayed the new NS-2050 Multielectrode Sputtering System, which features continuous or indexed rotation between targets, R.R. Etch, Bias, heating to 500°C, and temperature control. Plasma Technology showed its new RIE 8000 reactive ion etch system. Karl Suss Manufacturers showed mask aligning, probing, and scribing equipment. It also displayed its new SUSS RA 120 GaAs Scriber for III-V compound materials and a new 6-inch contact/ proximity lithography tool for mix-and-match applications, designated SUSS MA 150 Production Mask Aligner. Vickers Instruments introduced its new fully automated C.D. measurement system, QUAESTER CD07A. This system features cassette-to-cassette handling of wafers up to 6 inches in diameter and is easily upgradable for the next generation of 8-inch wafers.

Maskmaking

In the area of maskmaking, Nanomask showed electron beam photomasks and its CAD tool service.

Assembly

In assembly, there were a number of European-owned companies. Cryophysics displayed laser coding of components and its CRYO-TOOR-8 Cryopump Retrofit kit. ESEC featured its new Die Bonding System Model 2005, which offers a fully automated die attacher for automated factory environments with host communication based on SECS I & II protocol. The company also showed its High-performance Dicing Saw Model 8003 and its High-speed Auto Die Bonding System for power devices--Model 2004 A-PLF.

DATAQUEST SUMMARY

It is apparent that European-owned companies are at the forefront of leading-edge technology and that they are well aware of the challenge to meet the local needs of European semiconductor manufacturers. It is likely, therefore, that local competition in Europe will make the going far more difficult for American and Japanese companies trying to improve their market penetration.

Europe has weathered the recent recession in the electronics industry comparatively well, and there are now optimistic signs of recovery. DATAQUEST estimates growth in 1986 at about 6.3 percent over 1985. Indeed, DATAQUEST estimates that the semiconductor market in Europe will reach US$9,809 million by 1990; thus, the opportunities for European equipment and material suppliers abound.

Finally, a word must be said on the latest in-topic, namely, application-specific integrated circuits (ASICs), in which what previously was on the PCB has been integrated onto the silicon. As a result, densities will increase further and more VLSI computer-aided design tools will be required. Manufacturing facilities will have to adapt in order to facilitate fast turnarounds of small runs on a range of specially designed ICs. The development of this market, which holds great potential over the next 5 to 10 years but is so very different from the present memory technology requirements, will mean even closer liaison between equipment and materials suppliers and semiconductor manufacturers. To this end, the emergence of more European suppliers of equipment and materials oriented to the needs of the local semiconductor manufacturers' requirements is judged as a good omen for Europe, as it prepares for the impact that ASICs will have in the market.

Jim Beveridge

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LOGIC DEFINITION BROADENS

The synergism of application-specific integrated circuits (ASICs) and the demands of certain end markets is creating a whole new breed of products and business opportunities. These are logic products aimed at very specific applications and are based on a sharp departure from the traditional role of standard products.

Recently, we have observed the growth of a family of catalog products aimed at unique applications, such as telecommunications and digital signal processing (DSP). This newsletter broadens the definition for products that are standard catalog parts but which are aimed at a unique application.

ASICs MERGE WITH CATALOG PRODUCTS

The forces that created the ASIC market have spread into the catalog product portion of the semiconductor business. Some of today's products are both catalog products and application-specific products. The basic trend is still in force; as VLSI chip complexities increase, the applications become narrower. However, they do not become so narrow that a single chip can only be used by a single user.

For example, suppose that nuts and bolts are analogs of flip-flops and gates. Like flip-flops and gates, they are used almost universally in all mechanical devices. However, when many nuts and bolts are combined to build a product of higher complexity, that product becomes less generally applicable. If it is a bridge, it may be unique to the particular river crossing for which it was designed. If it is a car, it may appeal to a class of users, say racing drivers, but not to all users.

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THE DESIGN DILEMMA

The design dilemma results from the fact that chip complexity is increasing as competitive pressures increase. As suppliers attempt to differentiate their products, there is a continual search for unique niches where they can have a dominant position. Meanwhile, design costs escalate because of complexity and the number of units over which the design costs can be amortized decreases, leading to increased design cost per unit. This has led many standard product manufacturers to seek larger and larger markets for their chips even though the application windows are narrowing.

The advent of ASICs has led to the creation of a design technology aimed directly at solving this problem. Forces in the ASIC market demand that design costs be kept low. Often design costs are even reduced at some penalty of higher manufacturing cost. The most conspicuous example of this is the gate array, which may require twice the chip area of a handcrafted chip performing the same logic function. Extensive development of new CAD tools has also helped reduce design costs.

Traditionally, designers of catalog items have been "micron fiddlers," devoted to saving every last square micron of chip area and to designing and redesigning to achieve optimum chip performance. This design strategy may be appropriate for memory products and for some other types of products, but it is probably inappropriate for some unique applications.

Ironically enough, the silicon real estate in standard products is often wasted in spite of the best efforts of the "micron fiddlers." This comes about because many chips are used in applications that do not make use of all the circuitry on the chip. One of the outputs of a flip-flop may not be used, an internal feedback loop of a counter may be disabled, or a microcontroller may not use all its internal memory or have all inputs or outputs connected. This situation is so prevalent in the microcontroller market that some manufacturers routinely strip off the unused circuitry for customers with high-volume applications.

One solution to the design dilemma is to apply ASIC design technology to end-market applications resulting in catalog applications logic. This solution is illustrated in Figure 1. Some companies are already doing this; in fact, one major manufacturer is even using gate arrays to design some of its microperipherals.

THE LOGIC FAMILY TREE

Figure 2 shows the proposed expansion of logic segments to include application-specific logic products (ASLPs). This new term covers standard or catalog products that have a limited use in certain end markets. Note that the term ASIC has been expanded to include all cell-based products, thus encompassing standard cells and compiled-cell products.

Table 1 gives some examples of the types of products found in the ASLP segment. We believe that this segmentation allows for a finer cut of our existing categories and offers an opportunity for further divisions in the future. If an ASLP grows rapidly, a separate category will be established.

DATAQUEST ANALYSIS

Which type of company will be best equipped to address this emerging market for ASLP? Will the traditional catalog product vendor or the ASIC vendor be more successful?

Standard product firms have the advantages of being more likely to have serious product planning disciplines and being more accustomed to engaging their customers in applications dialogs. However, their engineers are likely to be "micron fiddlers," a disadvantage that leads to high design costs and a tendency to miss market windows because of long design times.

ASIC companies have the advantages of being familiar with the design tools and employing engineers that are not "micron fiddlers." While some ASIC companies leave all the applications work to their customers and do not have a well-developed product planning discipline, they are in touch with thousands of systems engineers who are all developing new applications. These ideas represent a greater diversity than can be encompassed by a single product planning group within a single company.

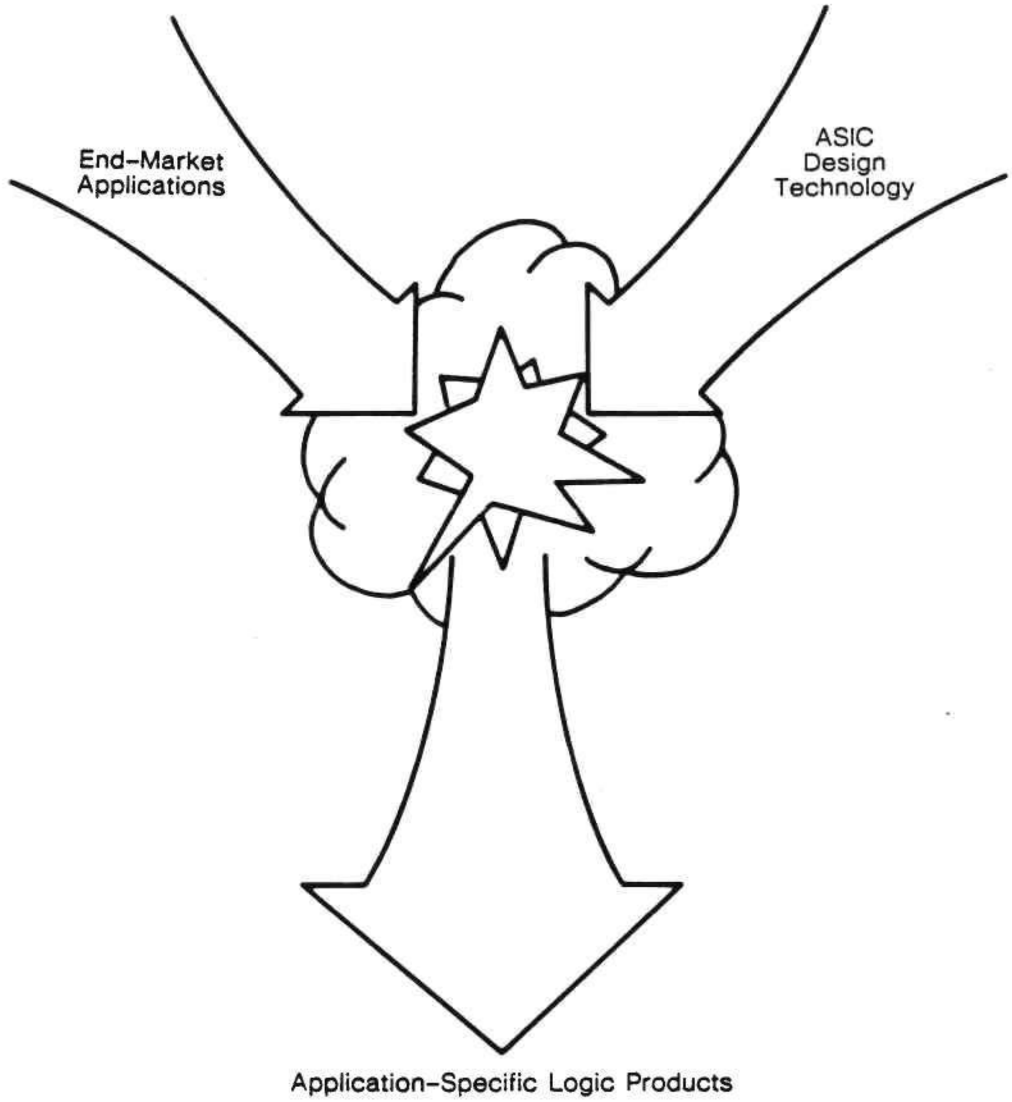
Excellence in manufacturing technology may create advantages for either the ASLP or the ASIC vendors. However, DATAQUEST believes that the basic thrust here is to create added value through applications in silicon, with manufacturing being of secondary importance.

The opportunity is available and it will go to the companies that can best combine the skills of the traditional catalog product and ASIC companies. The real key to success in ASLP is the ability to select, design, and market products that become the universally accepted standard. If this is done well, these companies will provide superior application solutions and excel at meeting the systems' needs of the customer.

Peter Savage
Howard Z. Bogert

Figure 1

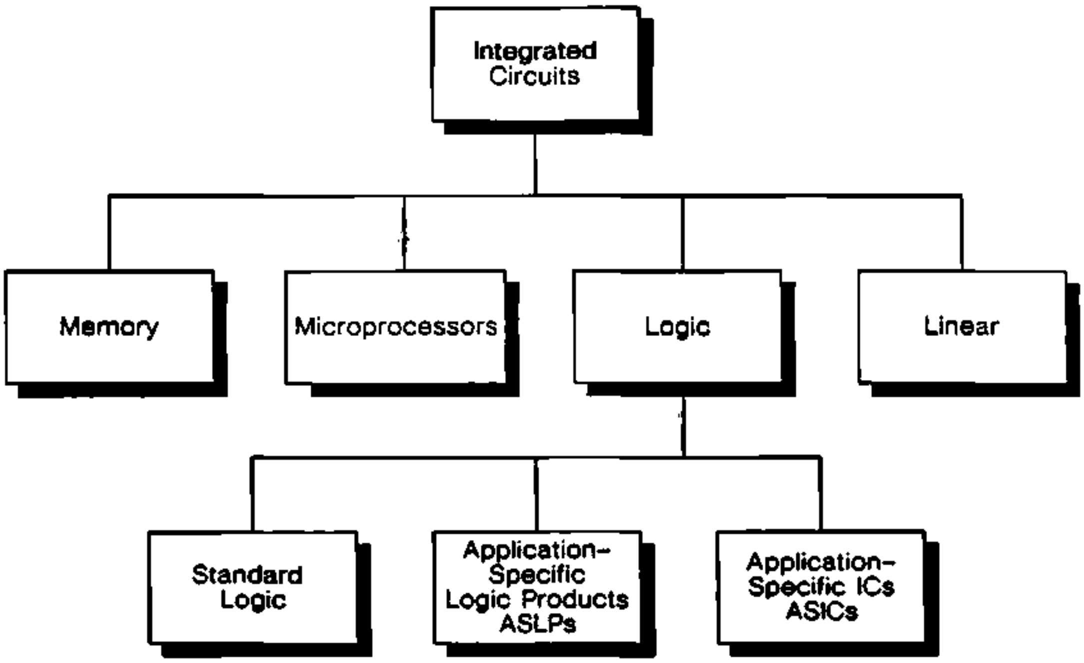
SOLVING THE DESIGN DILEMMA



Source: DATAQUEST
February 1986

Figure 2

PROPOSED EXPANSION OF LOGIC SEGMENTS



Source: DATAQUEST
February 1986

Table 1

PRODUCT TYPE EXAMPLES

Standard Logic	ASLP	ASIC
Bipolar logic ECL (10K, 100K, etc.)	Data communication	Cell-based designs (standard cells, compiled cells)
TTL (74/54LS, etc.)	Digital signal processing (DSP)	
CMOS 74/4000 series 74/54 hc, hct	Telecommunications circuits Display drivers Motion control	Field-programmable devices (PLDs) Full custom (hand-crafted designs) Gate arrays

Source: DATAQUEST
February 1986

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EUROPEAN RESEARCH NEWSLETTER

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HOW TO SUCCEED IN ASICs: INDUSTRY LEADERS SHARE THEIR THOUGHTS

SUMMARY

Recently, several top American application-specific IC (ASIC) vendors gathered in Silicon Valley to discuss the future prospects of the ASIC market. Although their strategies vary considerably, DATAQUEST observed a common theme running through their presentations. Most of the speakers emphasized that success in the ASIC market requires the following attributes:

- Leading-edge process technology (1.5-micron CMOS or below)
- Sophisticated CAD software using a common data base that can be run on a variety of personal computers
- Strong corporate commitment and service responsiveness
- Automated manufacturing and inventory control

The following are brief summaries of the major points made by six major ASIC vendors: LSI Logic, Monolithic Memories, Motorola, Oki Semiconductor, Texas Instruments, and VLSI Technology.

LSI LOGIC

Wilfred J. Corrigan, Chairman and founder of LSI Logic, observed that the crowded ASIC market leaves newcomers with no room for experimentation. Unlike LSI Logic, which could afford to learn through trial-and-error in 1981 since it was the only player, ASIC vendors must now be well prepared to survive the tough competition. What are the requirements for entering the ASIC market? Mr. Corrigan listed the following:

- Mainstream 1.5-micron CMOS process with high-density designs and high yields

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- Continuity of staff and products (no "flash-in-the-pan" efforts)
- Defect-free chips within four to five weeks
- Software and designs embedded into the CAD system
- Strong service orientation
- Domestic automated plants
- Large investment ($30 million to $50 million required to become major player)
- Long-term incentives for salespeople (due to long time from design to production)
- Installed customer base

Mr. Corrigan said that LSI Logic competes with only a handful of the 200 ASIC vendors in the marketplace. Most ASIC companies are focusing on niche markets and lack the manufacturing and CAD capabilities to attack larger markets. He expects to see a major shakeout among these vendors soon.

MONOLITHIC MEMORIES

Michael J. Callahan, Executive Vice President and Chief Operating Officer of Monolithic Memories, spoke briefly about MMI's approach to ASICs. Generally, MMI seeks high-volume products with unpredictable features that enable the company to capitalize on its programmable array logic (PAL) technology. Table 1 shows Mr. Callahan's characterization of the ASIC market segments.

Mr. Callahan believes that software must be an integral part of products across the ASIC spectrum. To achieve this goal, vendors must develop a CAD environment with a common data base. Moreover, standard product vendors must establish a separate ASIC manufacturing line (complete with automated inventory control) and a separate organization because of the totally different market demands placed on ASIC managers.

Table 1

ASIC MARKET CHARACTERISTICS

	FPLAs	Gate Arrays	Application-Specific Arrays	Standard Cells
Manufacturing Costs	Low	Moderate	Moderate	High
Nonrecurring Engineering	Normal	$20,000	$20,000	$35,000
Development Time	Real time	4 to 12 weeks	4 to 12 weeks	8 to 20 weeks
Risk	Very low	Medium	Medium	High
Architecture	Structured	Flexible logic	Mixed logic	Any mixed logic

Source: Monolithic Memories, Inc.

MOTOROLA

Kenneth G. Wolf, Corporate Vice President and General Manager at Motorola, discussed Motorola's shift to the ASIC market. From 1982, Motorola has had a timetable for its CMOS process development: 2-micron (1985), 1.5- to 1.25-micron (1987), 1.0-micron (1988), and 0.7-micron (1991). Motorola's ASIC division has the following capabilities: auto test and vector generation, silicon generation, test and fault generation, behaviorized modeling, systems simulation, and mixed mode development. In 1986, Motorola plans the following ASIC thrust:

- A 250-picosecond bipolar device
- A 40,000-gate, 1-micron CMOS array
- CMOS macrocells using 1.5- and 1.0-micron geometries and I/O flexibility
- A shift from standard cells to core-based macrocells (650C02 core in 1985, 650C05 in 1986) using 3-micron, single-layer and 2-micron, 2-layer HCMOS processes developed with NCR
- A 6,000-gate BIMOS array featuring 2.0- to 1.5-micron geometries
- A 125-picosecond ECL gate array (MCA 10,000)

- A "one-month chip" goal in manufacturing

- Utilization of direct-write on wafer and dedicated masks

Motorola also plans to develop "silicon generators" to generate subfunctions to meet function specifications and to combine these subfunctions with standard cells. Mr. Wolf believes that silicon compilers will only be used for selected functions (such as ALUs), not for all chips. Motorola is currently developing a silicon compiler.

OKI SEMICONDUCTOR

Jerry Crowley, President and Chief Executive Officer at Oki Semiconductor in Santa Clara, dispelled myths about the ASIC business by emphasizing the importance of automated manufacturing. He believes that "all creativity degenerates to hard work." Like memory makers, ASIC vendors must totally automate their design, manufacturing, and processes if they want to weather Japanese competition. To achieve this goal, Oki has pursued the following strategy:

- Developed an international CAD network with design centers in Japan, the United States, Europe, Hong Kong, and Singapore

- Developed six CAD software packages that run on IBM PCs (BINALY, ACTAS, FUNTASY, GALLOP, VILLA, and IDEAS)

- Installed a fully automated LSI packaging machine that features curing ovens, plastic molding, process control computer, die attach and bonding, and automatic inspection station

- Built an automated plant that transports 50 wafer lots daily using ceiling tracks to run deliveries

- Installed bar coding and transport in a peopleless ASIC plant using electron-beam, direct-write, and automatic inventory auditing

- Purchased a molding robot that handles 1 million units per month

Recently, Oki Semiconductor has achieved major ASIC breakthroughs using new automated techniques. These breakthroughs include:

- A standard cell 32-bit MPU (MVM6971) using 1.5-micron CMOS process and 224mm-square chip size; total design time was less than 12 months

- A 10,000-gate array (MSM78H000) using 2.0-micron CMOS process and dimensions of 99mm square and 154,450 square mils

- A digital signal processor (MSM6974) using 1.5-micron CMOS process, with dimensions of 124mm square and 191,981 square mils

Mr. Crowley concluded that most Japanese ASIC vendors are highly automated and, unless U.S. and European makers automate their ASIC design and manufacturing processes, they will forfeit the ASIC market to large Japanese vendors.

TEXAS INSTRUMENTS

William N. Sick, Executive Vice President of Texas Instruments, presented slides of TI's 1Mb DRAM (80,000 mil, 1-micron, 0.46-inch line) using 3-dimensional trench capacitors, and its 4Mb DRAM prototype using proprietary cells and a 0.384-inch length. The 4Mb DRAM was completed on schedule to the day using TI's new design automation system. Currently, TI has about 400 cells in its standard cell libraries and a second-sourcing agreement with Fujitsu to develop bipolar and CMOS gate arrays. TI aims at receiving 50 percent of its sales from four areas: ASICs, application processes, military, and CMOS and bipolar VLSI logic. In 1986, TI will use a 1-micron CMOS process from its DRAM work for ASIC devices, Mr. Sick said.

VLSI TECHNOLOGY

Alfred J. Stein, Chairman and Chief Executive Officer of VLSI Technology (VTI), believes that there are three keys to success in ASICs: a leading-edge process, software, and state-of-the-art manufacturing technology. VTI has established all three elements and is pushing its megacell approach. In the future, VTI will offer "full-chip composition," incorporating data path compilers, megacells, logic compilers, and ROM compilers. Common bus protocols will be used to eliminate interface circuits. These chips will feature fixed-height megacells, gate arrays, and standard cells on one chip. VTI is currently extracting megacells from standard products and inserting them into its megacell library, with the goal of developing cell-based structured arrays. In 1986, VTI will offer a 1.5-micron CMOS process, using double metal and poly. In 1987, it will have a 1.25-micron CMOS process using triple metal.

To market its ASIC devices, VTI has recently doubled its field sales force, opened new design centers, and signed agreements with Arrow Electronics, five European distributors, and three Japanese distributors. In addition, Mr. Stein said that Hewlett-Packard will market VTI's software.

QUESTION-AND-ANSWER PERIOD

After these presentations, the audience asked three questions:

- What are the keys to success in ASICs for major semiconductor makers?

  - Wilf Corrigan (LSI Logic) believes that major companies must cannibalize their standard product markets with ASIC products, but they should also focus on developing MPUs and putting them onto boards. Start-ups have already replaced TTL-compatible peripherals.

  - Alfred Stein (VTI Technology) believes that the top software people and systems must be assigned to ASIC development, since software accounts for 10 percent to 15 percent of mask costs.

  - Jerry Crowley (Oki Electric) believes that even the military market will see heavy ASIC competition. To survive, top makers must offer 10,000-gate arrays using 1.0-micron geometries and 100 MHz tolerances.

- Do ASIC vendors need to hook customers on their software?

  - Jerry Crowley believes that ASIC design software must be portable. Vendors should develop kits for various personal computers.

  - Michael Callahan (MMI) believes that customers can support several major software packages, but not too many.

  - Alfred Stein observed that ASIC users want a "total solution," not just software. The keys to success are technical support and first-time prototyping.

  - Wilf Corrigan asserted that if vendors are genuinely serious about the ASIC market, they must appoint a Vice President of Software (like LSI Logic) who reports directly to the President. In addition, ASIC vendors must have a high proportion of software programmers. Of LSI Logic's 1,400 employees, 300 are programmers.

- Will major Japanese makers succeed in the U.S. ASIC market?

  - Jerry Crowley observes that Hitachi, NEC, and other major Japanese companies are aggressively entering the market. He believes that the American perception of ASICs as a "protected market" is a total myth; Japanese companies are capable of penetrating the ASIC market here. Oki Semiconductor, for example, has 300 distributors, 175 representatives, and 20 field engineers with a total of 3,000 years of experience. Its American software director has a Ph.D. from MIT. For years, Japanese software engineers have been "hidden" within systems groups. The real issue is: Can these engineers be easily moved to ASIC groups? The corporate cultural barriers are formidable in Japan, where software development is often considered a proprietary, in-house activity, not a transparent protocol to be released to end users.

- Wilf Corrigan worries about the major Japanese companies because of their consistent focus and determination. American majors ("gorillas") get bored easily and may quickly tire of the competitive ASIC market. He believes that Japan will definitely be a major factor in the high-volume sector.

Peter Savage
Sheridan Tatsuno

Nielsen Dataquest

EUROPEAN RESEARCH NEWSLETTER

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1986-13

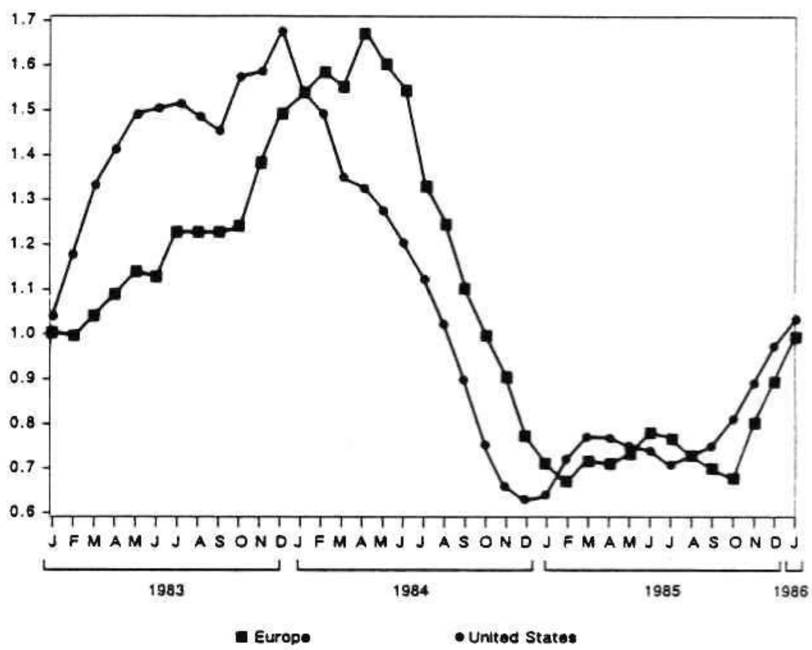
WEST EUROPEAN MARKET UPDATE
THE BOOK-TO-BILL IS NUMBER 1

SUMMARY

January was the month when the book-to-bill ratio reached the magic number 1. In Europe, unity was achieved for the first time in 15 months; in the United States, 1.04 was reported. Figure 1 depicts the book-to-bill ratio for the period from January 1983 to January 1986.

Figure 1

SEMICONDUCTOR BOOK-TO-BILL RATIO
UNITED STATES AND EUROPE



Source: Semiconductor Industry Association
DATAQUEST
March 1986

144/146 New Bond Street / London W1Y 9FD England / (01) 409-1427 / Telex 266195

1290 Ridder Park Drive / San Jose, CA 95131 / (408) 971-9000 / Telex 171973

DATAQUEST has considered the dynamics of the marketplace from the perspective of both users and manufacturers.

THE SITUATION AT THE USERS

Major users (with the notable exception of a large North European concern) are reporting that inventories have been reduced to acceptable levels. There remain some mix and profile problems, however, as not all of the purchasing excesses of 1984/1985 have been flushed out of the system. It is anticipated that this cleaning process will continue throughout the first half of 1986. A point of concern to the users is that running with the current lean inventories coupled with the residual mix problems is creating immediate internal-specific product shortages, which means that short-term demands on the vendors are increasing. Equipment build rate is being maintained and the economic indicators point to steady growth throughout the remainder of 1986.

Distribution is rebooking in order to restock and better align inventory with demand; the outlook is cautiously optimistic. Margins are running an average of 25 percent, discretes and linear are slightly better, and digital logic and memory are in the 20 to 25 percent range.

SITUATION AT THE MANUFACTURERS

Lead times are stretching out. Low-power Schottky logic, which sales engineers were finding difficult to place six months ago, is now on 8 to 10 weeks lead times, while octals are on 10 to 12 weeks lead times and the trend is upward.

Dynamic RAMs are on extending lead times, with the remaining manufacturers reacting to a combination of cost pressure and (in the case of the Japanese vendors) political pressure. The result is that 64K prices are now $0.90+, and 256K prices are edging above $2.

Considering book-to-bill ratios at the product level, we expect the major commodity product families to experience a positive book-to-bill for the first quarter of 1986. The good news is that this expected ratio change is due to the increase in the numerator rather than a decline in the denominator. Some manufacturers are reporting that the billings on the more volatile portions of their portfolios could be up as much as 25 to 30 percent in the first half of 1986 over the second half of 1985. In absolute terms, this almost brings them up to the first half of 1985 levels.

DATAQUEST FORECASTS

Table 1 lists DATAQUEST's estimates for West European semiconductor shipments by major technology for 1983 through 1986, and for 1990.

Figure 2 shows DATAQUEST estimates for quarterly shipments into Western Europe for 1985 through 1986. Shipments for 1985 and beyond are valued in constant dollars at average 1985 European exchange rates. (See Exchange Rate Quarterly Newsletter of February 26 in ESIS Volume IV).

By considering the current bookings level, industry backlog, and estimates on aging of current and forecast bookings, DATAQUEST has arrived at the quarterly split shown in Figure 2.

DATAQUEST estimates that the first quarter of 1986 will be the lowest billing point of the cycle at US$1,042 million, down 2.1 percent from the fourth quarter of 1985.

The book-to-bill ratio is now on its way up. Short-term demand is definitely increasing, prices are hardening, and a number of commodity backlogs are being reevaluated. DATAQUEST estimates that the recovery in billings will begin in the second quarter, with US$1,130 million, and continue through to the fourth quarter with US$1,476 million. Overall, DATAQUEST expects 1986 European semiconductor shipments to exceed those of 1985 by 6.3 percent--US$4,923 million in 1986 versus US$4,632 million in 1985.

DATAQUEST ANALYSIS

DATAQUEST estimates that only 73 percent of the installed worldwide production capacity will be utilized in 1986; furthermore, we do not expect full utilization to be achieved until the end of 1987. However, users should be aware that although excess production capacity exists, it is unmanned due to the substantial layoffs in 1985. This means that a personnel hiring and training cycle requiring a minimum of three months has to elapse before the capacity can be utilized. Thus, capacity in the industry is to all intents and purposes fixed for the next six months.

Lead times are stabilizing to more normal levels, and prices are recovering to the 1982/1983 values.

DATAQUEST believes that there is enough operational capacity to satisfy demand. To ensure that extremes in the demand/supply relationship are avoided, accurate, detailed demand forecasting and intelligent inventory control from both manufacturers and users is absolutely essential. Cooperation between users and vendors aimed at improving inventory control will, as well as improving operational efficiency, ensure that once the book-to-bill oscillation is under control, it stays controlled.

Analyzing industry records back to 1957 shows that without exception, a year of decline is followed by a least three years of sustained positive growth. Table 1 lists DATAQUEST's 1990 forecast for total semiconductor shipments as US$9,809 million, taking 1985 as a base year for a compound annual growth rate of 16.2 percent. This is consistent with the industry's long-term annualized growth rate over the last 30 years and reflects DATAQUEST's confidence in both continued product innovation and semiconductor penetration into emerging applications and markets.

Jim Beveridge*

*** NOTE**

Before going to press, we received news that the book-to-bill for February is 1.10, which is further confirmation that business is on the way up.

Table 1

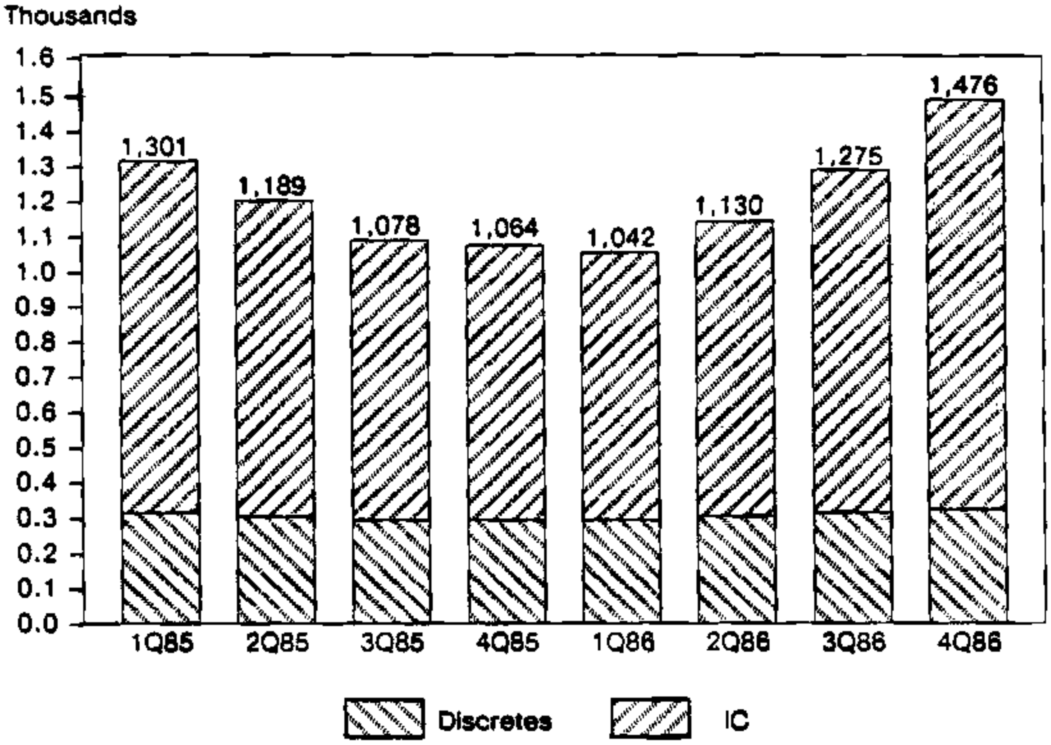
ESTIMATED EUROPEAN SEMICONDUCTOR SHIPMENTS
1983-1986 AND 1990
(Millions of Dollars)

Technology	1983	1984	1985	1986	1990
Total Semiconductor	$3,370	$4,805	$4,632	$4,923	$9,809
Integrated Circuits	$2,323	$3,634	$3,443	$3,679	$8,266
Bipolar Digital	483	724	694	695	1,262
MOS	1,227	2,092	1,855	2,074	5,494
Linear	613	818	894	910	1,510
Discretes	$ 866	$ 963	$ 960	$ [illegible]95	$1,161
Optoelectronics	$ 181	$ 208	$ 229	$ 249	$ 382
Weighted European Currency (Assumed per U.S. dollar) (Base 1978 = 100)	143.8	162.5	168.5	168.5	168.5

Source: DATAQUEST
March 1986

Figure 2

ESTIMATED EUROPEAN SEMICONDUCTOR QUARTERLY SHIPMENTS
1985-1986
(Thousands of Dollars)



Source: DATAQUEST
March 1986

Nielsen Dataquest
EUROPEAN RESEARCH NEWSLETTER

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1986-12

WORLD CONSUMPTION UPDATE: WORLD SEMICONDUCTOR CONSUMPTION REBOUNDS IN 1986

WORLD OVERVIEW

In 1985, semiconductor sales were down sharply in all major regions of the world. Of the four major regions--North America, Japan, Europe, and Rest of World (ROW)--North American sales showed the strongest decline at 27.0 percent. DATAQUEST believes that the worst is behind us, however. We expect growth in the first quarter of 1986 in all world regions, including North America. This projected first quarter growth should point the industry on the way to recovery and allow it to realize world growth of 16.4 percent in 1986. We believe that 1987 will be an exceptional year in all regional markets, with the world averaging 32.6 percent growth.

JAPAN BECOMES THE LARGEST MARKET

Our regional forecast points to some startling news in market size. As shown in Table 1, the Japanese market is projected to exceed the North American market in 1986.

Table 1

REGIONAL GROWTH RATES AND MARKET SHARE
(In Percent)

	Yearly Growth			Market Share		
	1985	1986	1987	1985	1986	1987
North America	(27.0%)	10.8%	34.9%	38.8%	36.9%	37.5%
Japan	(2.8)	28.4	30.6	34.8	38.4	37.8
Europe	(3.6)	6.3	29.8	18.7	17.1	16.7
ROW	(16.6)	14.7	37.1	7.7	7.6	8.0
Total	(15.0%)	16.4%	32.6%	100.0%	100.0%	100.0%

Source: DATAQUEST
February 1986

The U.S. market is expected to pick up some share again in 1987, although it is not expected to recover its former status. Note that much of the growth that Japan realizes in 1986 is due to currency exchange. Japan gains about 19.0 percent merely from currency exchange because of a strengthening yen to dollar. Our forecast also indicates that European consumption will decline as a percentage of the total between 1985 and 1987. The European market, however, gained considerable market share in 1985 relative to its 1984 level. That market is actually leveling to a normal growth cycle. Our data also indicate that the ROW region will grow slightly to 8.0 percent in 1987.

END MARKETS KEY TO MARKET STRENGTHS AND WEAKNESSES

The severity of regional market declines in 1985 was determined largely by each region's end-market focus. The computer/data processing market was exceptionally weak and, consequently, hurt those markets focusing heavily on this area. More stable were the applications areas of consumer electronics and telecommunications.

North America/U.S. Market

With a heavy 40 percent emphasis on computers, the North American market witnessed the most severe decline of all regional markets. The U.S. market noted a sales decline of 27.0 percent. Key to the weakness of the computer market was the computer OEMs' misjudgement of actual consumption. A buying/production cycle was created at the computer level that impacted component suppliers. Inventory in 1984 was accumulated far in excess of actual needs. This inventory is now perceived to be leveling to a more normal volume, which will lead to steady booking and shipment activity. Booking and shipment levels appear to be correcting in many product areas. It is this expectation that points to a 3.9 percent North American market growth in the first quarter of 1986. DATAQUEST believes that normal inventory depletion will continue the quarterly growth pattern through 1986, for a yearly total of 10.8 percent. In 1987, we expect quarterly growth to continue. We believe that 1987 will be a year of strong growth (34.9 percent) in the U.S. market. In terms of levels of consumption, however, it is not until 1987 that we expect consumption to return to the level of 1984.

Japanese Market

The Japanese market was among the more favorable in terms of the 1985 market decline. A heavy emphasis on consumer applications was largely responsible for this stability. DATAQUEST identifies the sales decline in the Japanese market at a modest 2.8 percent in 1985. As stated earlier, we expect the Japanese market to surpass the U.S. market in dollar volume in 1986. The exchange rate is responsible for a good portion of this increase. In yen, the Japanese market is expected to grow about 9.4 percent. Current exchange notes that the U.S. dollar is worth about 203 yen, down significantly from 1985's average of about 237 yen. Our current forecast, incorporating the yen valuation, shows the Japanese market growing 28.4 percent in 1986, far beyond the world average of 16.4 percent. In 1987, we expect Japanese market growth to be on a par with the world, at 32.6 percent.

European Market

With end-market focus primarily in the relatively stable and growing area of telecommunications, the European market was not as seriously affected as either the North American market or ROW market. The European market declined by approximately 3.6 percent in 1985. This modest decline allowed Europe to pick up market share relative to the world in 1985. It is expected, however, that this market share will revert to its normal level of about 16.6 percent (in 1984) of total sales. Note that Table 1 overstates Europe's market share because Europe gained over 2.0 percentage points in total market size in 1985. The decline in total percentage shown for years 1986 and 1987 brings Europe back to its 1984 market share of 16.6 percent.

ROW Market

The ROW region, like the Japanese market, focuses primarily on consumer-oriented products, a market that was relatively stable in 1985. Yet the ROW region also sees a large amount of activity from foreign and North American companies building computer equipment abroad. It is the balance of these factors that caused a market decline of 16.6 percent in 1985. As in other regions, we expect quarterly growth to be effective throughout 1986 and 1987. DATAQUEST projects ROW growth at 14.7 percent in 1986 and 37.3 percent in 1987.

WORLD PRODUCT TRENDS

In our quarterly world product forecast shown in Table 2, we project that MOS products will make a comeback in 1986. MOS and bipolar digital were the areas most strongly affected in 1985; both were down approximately 21 percent. The product area that noted the strongest decline, however, was MOS memory, which dropped about 36.3 percent worldwide. In this memory area, steep quarterly growth is required to pull it up from its 1985 trench. We believe that this growth is realistic and forecast that MOS memory will be up 12.0 percent in 1986. MOS microprocessor devices and MOS logic are also expected to show good growth that will continue to build momentum into 1987. Our estimated MOS technology growth in 1987 is a lofty 49.5 percent, raised through high recovery expectations for MOS memory and MOS micro devices. Bipolar products are also projected for growth, but they are not as dramatic in percentage terms as MOS digital products. Other product areas of linear, discrete, and optoelectronics that did not decline severely in 1985 are not expected to ramp up as quickly as harder hit product areas.

Malcolm G. Penn
Barbara A. Van
Howard Z. Bogert

Table 2

ESTIMATED WORLDWIDE QUARTERLY SEMICONDUCTOR CONSUMPTION
(Millions of Dollars)

	1985	Q1/86	Q2/86	Q3/86	Q4/86	1986	% CHG 1985-86
Total Semiconductor	24737	6354	6862	7389	8178	28783	16.4%
Total IC	18858	4751	5176	5642	6334	21903	16 1%
Bipolar Digital	3778	895	962	1053	1172	4082	8 0%
Memory	595	143	154	167	178	642	7.9%
Logic	3183	752	808	886	994	3440	8.1%
MOS Digital	10313	2551	2834	3147	3653	12185	18.2%
Memory	4008	903	1048	1186	1446	4583	14 3%
Micro Devices	2751	735	792	857	971	3355	22 0%
Logic	3554	913	994	1104	1236	4247	19 5%
Linear	4767	1305	1380	1442	1509	5636	18 2%
Discrete	4691	1258	1323	1370	1450	5401	15.1%
Optoelectronic	1189	345	363	377	394	1479	24.4%

	Q1/87	Q2/87	Q3/87	Q4/87	1987	% CHG 1986-87
Total Semiconductor	8657	9240	9827	10439	38163	32.6%
Total IC	6800	7339	7920	8439	30498	39.2%
Bipolar Digital	1233	1275	1302	1299	5109	25.2%
Memory	179	183	188	194	744	15.9%
Logic	1054	1092	1114	1105	4365	26.9%
MOS Digital	3973	4332	4746	5156	18207	49.4%
Memory	1584	1733	1928	2103	7348	60 3%
Micro Devices	1071	1192	1325	1467	5055	50 7%
Logic	1318	1407	1493	1586	5804	36 7%
Linear	1594	1732	1872	1984	7182	27.4%
Discrete	1445	1471	1468	1540	5924	9.7%
Optoelectronic	412	430	439	460	1741	17.7%

Source. DATAQUEST
February 1986

Nielsen Dataquest
EUROPEAN RESEARCH NEWSLETTER

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1986-11

EXCHANGE RATE QUARTERLY NEWSLETTER

FOURTH QUARTER 1985

DATAQUEST exchange rate tables involve data from many countries, each of which has different and variable exchange rates against the U.S. dollar. As far as possible, DATAQUEST estimates are prepared in terms of local currencies before conversion, when necessary, to U.S. dollars. DATAQUEST uses International Monetary Fund (IMF) average foreign exchange rates for historical data.

All forecasts are prepared assuming no changes in any exchange rate from the last complete historical year, in this case, 1984. During the course of the current year, as local currency exchange rates vary, the appropriate U.S. dollar value changes accordingly. To maintain consistency across all its analyses, DATAQUEST does not make ongoing adjustments to its forecasts for these currency changes during the current year.

As a result of this policy, as the year progresses the forecast numbers could become distorted, in dollars, should the European currencies deviate substantially from the previous year's rates.

DATAQUEST monitors the exchange rates on a weekly basis using IMF exchange rates supported by Financial Times exchange rates where IMF data are not yet available. (Financial Times is the accepted U.K. newspaper giving daily updates.) Each month effective exchange rates for the current year are calculated. This information is then used to assess the local currency's impact on U.S. dollar forecasts.

The purpose of this Newsletter, which will be updated quarterly, is to record these changes, and thus allow the reader to make any necessary adjustments when interpreting the data according to local practice. For each European region, Table 1 gives the local currency per U.S. dollar for 1984, third quarter 1985, and fourth quarter 1985, together with the latest estimate for the whole of 1985. Also shown, for reference purposes, are the same figures for the Japanese yen. As can be seen from this table, the weighted average for all the European currencies for 1985

144/146 New Bond Street / London W1Y 9FD England / (01) 409-1427 / Telex 266195
1290 Ridder Park Drive / San Jose, CA 95131 / (408) 971-9000 / Telex 171973

has so far declined 3.5 percent with respect to the U.S. dollar compared with 1984. This represents an increase of 1.3 percent in the exchange rate since the third quarter 1985. Table 2 shows the quarterly values for 1985 for the same regions.

Table 3 gives an example of how to interpret the effect of the currency shifts on the DATAQUEST forecast numbers. The table shows, for example, that the constant dollar forecast 1985 total European semiconductor market of $4,873, when adjusted to take account of the change in European currencies vis-à-vis the U.S. dollar, becomes $4,700.

Table 4 shows the monthly value of local currency per U.S. dollar for each European region and Japan in 1985.

Jennifer Berg

Table 1

EUROPEAN CURRENCIES--1984 TO 1985
(Local Currency per U.S. Dollar)

Region	1984	Q3 1985	Percent Change Q3-Q4	Q4 1985	Latest Estimate 1985	Percent Change 1984-85
Austria	20.00	20.02	10.5	18.11	20.68	(3.3)
Belgium	57.78	57.67	10.2	52.35	59.39	(2.7)
Denmark	10.36	10.29	10.1	9.35	10.59	(2.2)
Finland	6.01	6.01	7.8	5.57	6.20	(3.0)
France	8.74	8.69	10.3	7.88	8.98	(2.7)
Ireland	0.92	0.92	9.6	0.84	0.94	(2.2)
Italy	1,756.98	1,895.63	8.3	1,749.89	1,909.34	(8.0)
Luxembourg	62.34	57.56	10.0	52.31	59.35	5.0
Netherlands	3.21	3.20	10.2	2.91	3.32	(3.3)
Norway	8.16	8.34	5.0	7.95	8.64	(5.5)
Portugal	146.39	168.54	4.2	161.73	170.38	(14.1)
Spain	160.76	167.01	5.2	158.82	169.98	(5.4)
Sweden	8.27	8.39	7.6	7.80	8.60	(3.8)
Switzerland	2.35	2.35	10.1	2.13	2.46	(4.4)
United Kingdom	0.75	0.73	4.5	0.70	0.77	(2.8)
West Germany	2.85	2.85	10.5	2.58	2.94	(3.1)
Weighted Average (Base 1978 = 100)	162.50				168.48	(3.5)
Japan	237.45	238.64	15.2	207.23	238.57	(0.5)

Source: IMF
DATAQUEST
February 1986

Table 2

EUROPEAN CURRENCIES--1985 BY QUARTER
(Local Currency per U.S. Dollar)

	1985				
Region	Q1	Q2	Q3	Q4*	Total Year
Austria	22.87	21.70	20.02	18.11	20.68
Belgium	65.37	62.17	57.67	52.35	59.39
Denmark	11.64	11.08	10.29	9.35	10.59
Finland	6.78	6.42	6.01	5.57	6.20
France	9.96	9.41	8.69	7.88	8.98
Ireland	1.05	0.99	0.92	0.84	0.95
Italy	2,021.10	1,970.73	1,895.63	1,749.89	1,909.34
Luxembourg	65.37	62.17	57.56	52.31	59.35
Netherlands	3.68	3.49	3.20	2.91	3.32
Norway	9.37	8.89	8.34	7.95	8.64
Portugal	177.40	173.83	168.54	161.73	170.38
Spain	180.08	174.01	167.01	158.82	169.98
Sweden	9.26	8.94	8.39	7.80	8.60
Switzerland	2.76	2.59	2.35	2.13	2.46
United Kingdom	0.90	0.80	0.73	0.70	0.78
West Germany	3.26	3.08	2.85	2.58	2.94
Weighted Average (Base 1978 = 100)					168.48
Japan	257.68	250.73	238.64	207.23	238.57

*Forecast

Source: IMF
DATAQUEST
February 1986

Table 3

EFFECT OF CHANGES IN EUROPEAN CURRENCIES PER U.S. DOLLAR ON DATAQUEST FORECASTS--1984 VERSUS 1985 (Millions of Dollars)

	1984	1985	Percent Change 1984-85
European Semiconductor Consumption (At constant 1984 exchange rates)	$4,805	$4,873	1.4
Weighted European Currency (Assumed) (Base 1978 = 100)	162.50	162.50	N/A
Weighted European Currency (Latest Estimates)	162.50	168.48	(3.5)
Effective Consumption (1985 at Dec. year-to-date average exchange rates)	$4,805	$4,700	(2.0)

N/A = Not Applicable

Source: DATAQUEST
February 1986

Table 4

EUROPEAN CURRENCIES--1985 BY MONTH
(Local Currency per U.S. Dollar)

Region	Jan.	Feb.	Mar.	Apr.	May	June	FT July	FT Aug.	FT Sept.	FT Oct.	FT Nov.*	FT Dec.*	1985*	Percent Std. Dev.	1984	Percent Change 1984-85
Austria	22.24	23.13	23.25	21.69	21.89	21.53	20.49	19.61	19.95	18.58	18.15	17.62	20.68	9	20.08	(3.3)
Belgium	63.41	66.17	66.53	62.11	62.67	61.72	58.77	56.80	57.43	53.60	52.38	51.08	59.39	9	57.78	(2.7)
Denmark	11.32	11.78	11.83	11.06	11.18	11.00	10.48	10.10	10.30	9.59	9.36	9.11	10.59	9	10.36	(2.2)
Finland	6.64	6.85	6.85	6.44	6.47	6.36	6.09	5.92	6.02	5.68	5.57	5.48	6.20	8	6.01	(3.0)
France	9.70	10.07	10.11	9.41	9.47	9.34	8.88	8.52	8.66	8.07	7.88	7.68	8.98	9	8.74	(2.7)
Ireland	1.02	1.06	1.06	0.99	0.99	0.98	0.93	0.90	0.92	0.86	0.84	0.82	0.94	23	0.92	(2.2)
Italy	1949.00	2030.60	2083.70	1972.00	1986.10	1954.10	1914.40	1870.20	1902.30	1785.40	1751.20	1713.06	1909.34	6	1756.98	(8.0)
Luxembourg	63.41	66.17	66.53	62.11	62.67	61.72	58.77	56.48	57.43	53.60	52.26	51.00	59.35	9	62.34	5.0
Netherlands	3.58	3.73	3.74	3.49	3.52	3.45	3.28	3.14	3.19	2.98	2.91	2.83	3.32	9	3.21	(3.3)
Norway	9.17	9.45	9.48	8.90	8.96	8.82	8.45	8.23	8.34	7.91	7.78	8.15	8.64	7	8.16	(5.5)
Portugal	171.92	179.04	181.25	172.24	174.98	174.27	168.81	166.32	170.50	163.31	162.00	159.88	170.38	4	146.39	(14.1)
Spain	175.10	181.87	183.26	172.00	175.34	174.69	168.20	164.06	168.76	161.65	159.00	155.81	169.98	5	160.76	(5.4)
Sweden	9.06	9.32	9.41	8.97	9.01	8.85	8.49	8.30	8.39	7.95	7.79	7.67	8.60	7	8.27	(3.8)
Switzerland	2.66	2.80	2.81	2.59	2.62	2.57	2.42	2.29	2.33	2.17	2.12	2.11	2.46	10	2.35	(4.4)
United Kingdom	0.88	0.91	0.89	0.81	0.80	0.78	0.72	0.72	0.74	0.71	0.69	0.69	0.77	47	0.75	(2.8)
West Germany	3.17	3.29	3.31	3.08	3.11	3.06	2.91	2.79	2.84	2.64	2.59	2.51	2.94	9	2.85	(3.1)
Weighted Average (Base 1978 = 100)	--	--	--	--	--	--	--	--	--	--	--	--	168.48	6	162.50	(3.5)
Japan	254.18	260.24	258.63	251.67	251.54	248.99	241.75	237.21	236.95	214.73	204.36	202.59	238.57	9	237.45	(0.5)

*Forecast

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Nielsen Dataquest

EUROPEAN RESEARCH NEWSLETTER

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1985 EUROPEAN TELECOMMUNICATIONS CONFERENCE--
EUROPEAN INITIATIVES AND COOPERATION

SUMMARY

DATAQUEST's 1985 European Telecommunications Industry Conference was held in Frankfurt, West Germany, late in November. The conference was well attended by management representing the majority of companies active in the European telecommunications arena. A total of 83 organizations were represented, of which 38 were European, 8 Japanese, and 37 international.

The speakers discussed the following topics:

- The present and future strategies of the European PTTs
- The application of ISDN in future networks
- The status and outlook of collaboration between the major European telecommunication manufacturers

A list of speakers and topics can be found at the end of this newsletter.

Three panel discussions took place. The first panel comprised senior representatives of European PTTs and government bodies. The second was composed of DATAQUEST's own European analysts and the third consisted of representatives of the manufacturers working together within the "Big 4" European cooperation agreement.

144/146 New Bond Street / London W1Y 9FD England / (01) 409-1427 / Telex 266195

1290 Ridder Park Drive / San Jose, CA 95131 / (408) 971-9000 / Telex 171973

SPEAKER HIGHLIGHTS

A list of speech titles, speakers, and highlights of the speeches follows.

- "DATAQUEST Review--European Cooperation and Future Prospects"; Edward M.A. Mier, Associate Director and Manager, European Telecommunications Industry Service, DATAQUEST (U.K.)

  In his opening speech, Mr. Mier outlined the scope of the conference, noting the issues at stake within the European telecommunications market. He particularly emphasized the political nature of the European environment, which is still largely dominated by PTT policies but facing an era of change in the wake of the world tide of slowly liberalizing markets. As a preface to the invited PTT speakers who represented the two ends of the scale of open and closed market philosophy, and speakers from the industry who viewed their thoughts regarding their future market opportunities, Mr. Mier set the scene with some controversial points. He especially underlined the need for a competitive arena in Europe to encourage indigenous manufacturers to develop world market products. This, he said, is the most effective mechanism to strengthen the European telecommunications industry--supporting a "Fortress Europe" would not provide a successful long-term solution, he added.

- "The Achievements and Future Goals of EEC Telecommunications Policy"; Michel Carpentier, Director General, Information Technology and Telecommunications Task Force, Commission of the European Communities (Belgium)

  Mr. Carpentier reminded the audience that although the United States represents 35 percent of the world telecommunication market and Japan 11 percent, no European country represents more than 6 percent. Only a cohesive European market can resist the onslaught from the United States and Japan, he said.

  Mr. Carpentier stated that by the year 2000, 60 percent of the information technology products are expected to be telecommunications related, with betwen 30 and 60 million jobs in the EEC depending on it. By that time, private markets will have grown to similar size of the public markets.

  The goals of the Information Technology and Telecommunications Task Force are as follows:

  - A common strategy for advanced networks
  - The creation of community-wide markets
  - Promotion of collaboration in research and development
  - Improved service in the less-developed community areas
  - Coordinating the European negotiating position

Mr. Carpentier believes that ISDN and OSI are essential to these goals, and that common standards through a stronger CEPT would help create the Europe-wide market.

- "Taking Initiatives in Line with Common European Objectives"; Henri Bustarret, Director of International and Industrial Affairs, French PTT (France)

  Mr. Bustarret sees a danger in the lack of an effective European competitor to IBM and AT&T. Unless one emerges, he believes that European manufacturers could pair up with one or the other of these two U.S. giants, leading ultimately to the disintegration of European manufacturing. He applauded the "Big 4" link-up between Italtel, Alcatel-Thomson, Siemens, and Plessey as being a step in the right direction, and noted that the sharing of European experience, the pooling of development efforts, and the convergence of industrial projects are the keys to success.

- "Motivating Cooperation in a Liberalized Environment"; The Rt. Hon. John Butcher M.P., Parliamentary Under Secretary of State of Industry, Department of Trade and Industry (U.K.)

  Mr. Butcher said that Europe-wide cooperation is needed to compete in the world telecommunications market. This cooperation could be best achieved by creating a European liberalized market, because only a free market can respond to the range of customer demands.

  Holding back liberalization in some countries would result in less efficient business communications, reducing the international competitiveness of the industry of such a country.

  Market forces are much more effective in motivating cooperation than government programs. There is a need for early agreement on Europe-wide homologation standards and specifications to provide a more open market, he added.

  He concluded that the telecommunications world is going through a period of unprecedented rapid change. In this environment, the opportunities can only be best realized in a liberalized market.

- "Implementation of a Published National Plan within an Evolving European Framework"; Augusto Vighi, Director, Istituto Superiore della Poste e delle Telecommunicazioni, (I.S.P.T.) Italy

  Mr. Vighi described the current and future organization of telecommunications in Italy and the plans for its development over the next ten years. This period will see the introduction and increasing penetration of digital transmission and switching, bringing with it ISDN.

Mr. Vighi indicated that the Italian view is that the PTT will provide a monopolized basic digital bearer service, while the terminal equipment and enhanced value-added services markets will be open to competition.

- "Aligning National Plans to Integrate with the Future European Area"; Dipl.-Ing Ronald Dingeldey, President, Fernmeldetechnisches Zentralamt (FTZ), Deutsche Bundespost (W. Germany)

  Mr. Dingeldey outlined how the Deutsche Bundespost (DBP) has been preparing for the opening up of the European marketplace. In order to accommodate the coming changes, he does not believe it is necessary for the DBP to change its fundamental policies regulating current approval and procurement. He stated that he believed that a change in the legal provisions, a deregulation, or even the dissolution of the DBP as per foreign models would not benefit the Federal Republic of Germany.

- "The Telex Story--Parallels to be Drawn"; Roberto Rocchio, Director, Olteco (Olivetti Telecommunicazioni S.p.A.), Italy

  Mr. Rocchio outlined the reasons why teletext had been forecast to be an excellent growth opportunity for PTT and the manufacturers. He then looked at the reasons why it has failed to live up to expectations, and concluded that it was mainly due to the incompatibilities in implementation specifications between the various PTTs operating in Europe. He stressed that there is a clear requirement for a forum where European industry and administration can jointly plan for the future in a way that would be beneficial to all of Europe.

- "The Decline or Growth of Datacom Networks with ISDN"; Claude Fosseprez, Managing Director, Telecommunication and Data Systems (TDS), Philips International (Netherlands)

  Mr. Fosseprez stated that the business user community believes that public communications networks will never be able to meet all requirements of all business users at an acceptable price level. For this reason, the business community will continue to make extensive use of private communications networks, which will be continuously adapted to achieve the lowest cost per bit and highest degree of added functionality, he continued.

  This will be achieved by exploiting all available public network service offerings and private terminal equipment. Moreover, before ISDN is implemented, many corporations will have already installed their own integrated networks based upon private networks.

  The Philips view is that packet switching is more suitable for data transmission than ISDN's circuit-switching principle. The best way to implement packet switching is to provide private rather than public switching equipment, Mr. Fosseprez concluded.

- "The Japanese ISDN: NTT's Information Network Systems"; Sheridan M. Tatsuno, Industry Analyst, Japanese Semiconductor Industry Service, Dataquest Incorporated (U.S.A.)

  Mr. Tatsuno presented DATAQUEST's view on the development of the Japanese ISDN (INS) program and discussed the Nippon Telegraph and Telephone (NTT) role in it.

  Mr. Tatsuno emphasized that NTT's plan demonstrates the company's long-term major aspiration to become the world's largest communications organization. The company's research and development program based within the context of the total Japanese industry's activities includes significant advances in the fields of network digitalization, home and business services, satellite technology, optical fiber development, and semiconductors. Semiconductors, Mr. Tatsuno noted, are critical to the fifth-generation computer program. The Japanese determination to keep their lead in the fifth-generation computer area is based on their belief that this will be the critical element of all future telecommunications hardware.

- "The Burdens and Benefits of Setting an Example", John A.C. King, Corporate Director, Marketing and Corporate Strategy, British Telecom (U.K.)

  Mr. King reviewed British Telecom's experiences over its first 12 months as the now-privatized U.K. telecommunications operating company (O.C.). Mr. King described the strategy that BT has adopted as the first European O.C. to find itself in a privatized/deregulated market and discussed the implications for the future.

  Mr. King said that British Telecom was clearly aware of the need to react swiftly to the pressures of technology and rapidly changing user needs as well as to the regulatory and political environment that has driven it from its more sedate PTT position to becoming a leading-edge, user-driven organization.

- "The Rationale for the 'Big 4' Initiative"; Marisa Bellisario, Managing Director and Chief Executive Officer, Italtel (Italy)

  Mrs. Bellisario explained the underlying motivations for the "Big 4" cooperation partnership. The ultimate objective was to increase product competitiveness, a prerequisite not only to defend the European market from the U.S. and Japanese challenge, but also to enter important new markets.

  The alliance was the first step leading to common development activity of European telecommunications projects. It was Mrs. Bellisario's view that this was the only viable solution that would enable European companies to fully profit from their resources and overcome fragmentation.

- "Aligning Product Strategies--Compromises and Opportunities"; J.S. Whyte, Executive Chairman, Plessey Telecommunications and Office Systems Ltd. (U.K.)

  Mr. Whyte noted that well-arranged collaborative developments in the "Big 4" agreement are fundamental to economic survival in the industry. Over and above the agreement, it is also necessary to agree to new European standards before the 1990s and to ensure that the joint developments are actively designed in and supported by the PTTs. The aim is to match the technology and price competitiveness of America and Japan, he said.

- "IDSN--The Common Denominator for the Future"; Dr. Peter Bocker, Executive Director, Siemens A.G. (West Germany)

  Dr. Bocker said that in the past, telephone and telex services had been predominant. There is now a rapid increase in the number of telecommunications services, a process that is expected to continue for the next five years.

  He forecast that by 1995, 50 percent of terminals will have non-voice applications and that 15 percent of those services will use broadband 140-Mbps transmission.

  There is a need for a wide variety of non-voice services that are less expensive than what is available today and can be provided at no cost penalty to the basic telephone user, Dr. Bocker said.

  Siemens believes that these needs can be largely satisfied by ISDN, with access to all services provided through standard interfaces. Public value added or enhanced services can also be offered within the ISDN network, Dr. Bocker added.

- "European Companies Competing Outside their Home Markets"; Christian Fayard, President, Alcatel Thomson International (France)

  Mr. Fayard, representing the view of the "Big 4" competitive stance in world markets, noted that European companies would only be successful in the future if they pooled their resources in order to match the force of the American and Japanese competition.

  He underlined that the research and development expenditure required to maintain today's digital central office technology was on the order of $100 million to $300 million annually. None of the individual European markets are big enough to support such separate indigenous programs. However, by pooling resources and markets, the "Big 4" will be in a strong position. In 1985 they held a 30 percent market share of the world shipments of digital central office systems. Their combined domestic market represents 25 percent of the total world market. Further, between them they have sold their digital switching products in 72 world markets.

DATAQUEST ANALYSIS--PTTs

In the currently fast-growing and very volatile European telecommunications environment, many manufacturers are complaining that the national PTTs are responsible for Europe falling behind the United States and Japan. This conference was consequently a good forum to bring manufacturers and PTT representatives together to exchange views and discuss future strategies in Europe regarding liberalization of the markets. The U.K. PTT was represented by Mr. Butcher, the government's minister responsible for telecommunications within the Department of Trade and Industry. His presence injected an element of confrontation into the conference, as the measurement criteria and goals being applied to the deregulated British telecommunications environment were in many cases dramatically opposite those being applied by representatives of the other three PTT-controlled countries.

Mr. Butcher called for the removal of artificial barriers that had been erected in the form of nationalistic procurement and tight approval procedures. Mr. Dingeldey defended the German position by noting that the Bundespost's exclusive right to set up and operate telecommunications networks was not being seriously contested at present in his country.

DATAQUEST believes that the PTTs will be forced to agree to the liberalization of their market, primarily in the area of premises equipment, sooner rather than later. This movement is already being seen in France, Italy, and the Netherlands, as well as in Sweden, and is at the top of the agenda for most of the European PTTs. The critical question, however, is how to liberalize European markets without exposing European industry to a competitive onslaught for which they will be unprepared. A possible solution is to immediately open intra-European national boundaries, but only slowly lower the international defense barriers of "Fortress Europe."

DATAQUEST'S VIEWS ON ISDN

Digital transmission techniques within public telecommunications networks make sound economic sense, and will offer capabilities for better performance and price per bit. Digital architecture within the central office switches is cost effective for similar reasons, particularly within the context of a future all-digital network. A common standardized hierarchical digital architecture based upon, for example, 64-Kbps, "n" times 64-Kbps, 2.048-Mbps, 34-Mbps, and 140-Mbps bandwith steps is a logical development of digital implementation.

It is also clear that "basic" telecommunication services should be provided by the public networks, either by a PTT monopoly or by a limited number of competing common carriers. The growth of the traditional market of voice communications is leveling off, and greater growth is being experienced in the non-voice communications markets.

In order to continue to grow, many PTTs see the non-voice communications markets as essential. Thus CCITT has standardized the "2B + D" interface as the basic customer interface to ISDN networks. This interface comprises a 64-Kbps channel for digital, pulse code modulated (PCM) voice, a clear 64-Kbps channel for data transmission, and a 16-Kbps signaling channel for call setup for both other channels.

Here a number of questions arise:

- Will every telephone user want a 64-Kbps data channel?

- Will every data user want a telephone?

- Will every data user want 64 Kbps?

Many users believe that the answer to these questions will never be yes.

In addition, the PTTs have plans to provide enhanced or value-added services within the ISDN networks. These services cover a wide variety of capabilities; for example, voice messaging, teletext, and high-speed facsimile. In some countries, there are plans to provide some enhanced services within the PTT monopoly. It is claimed that all these capabilities, including the 2B + D interface, can be provided at no cost penalty to the simple telephone user.

It is at this stage of the discussion that many users, particularly in large businesses, start to feel decidedly uneasy. There is a concern that ISDN will not be offered in a flexible, cost-effective way that will enable businesses to tune the communications facilities to the needs of their companies. There is further concern that enhanced services may be subsidized by the basic services. Many users strongly believe that all but the most basic services should be open to competition.

Many companies are totally dependent on telecommunications to keep their businesses running. The banking fraternity relies upon enhanced capabilities built into their own private corporate networks to give them a competitive edge. These companies will probably never commit their total communications to public networks. There must therefore be the capability for very basic, high-bandwidth, totally transparent leased-circuit-type service within the ISDN architecture. This will enable large corporations to provide their own value-added features through privately provided equipment obtained from the competitive market.

It has been said that ISDN is a solution in search of a problem; a solution that is very much the brainchild of the PTTs and their traditional suppliers. DATAQUEST's view is that the goals for ISDN will not be achieved until the gap between implementation and real user needs has been narrowed. The PTTs and the manufacturers must pay much closer attention to the requirements of the business customers that generate the highest revenue.

JOINT COLLABORATION

With all the recent activities in Europe on this front, DATAQUEST as well as others has written much on the benefits of joint collaboration. We have emphasized the critical need for reducing resource duplication among the major manufacturers in Europe to ensure their long-term survival, particularly in the area of central office switching.

Streamlining the Italian telecommunications industry through the friendly merger of the two major players, Italtel and Telettra, and now the attempts at similar streamlining by the U.K. manufacturers GEC and Plessey, are the inevitable results of the spiraling costs associated with today's research and development programs in the converging areas of digital voice and data communications.

The telecommunications industry has been presented with a new challenge. After decades of relatively little technological advancement, technology today has few boundaries. Users are being exposed to many new, enticing product solutions. Indeed, the choice is often bewildering. The challenge is to advance the technology through cost-effective programs. These should minimize resource duplication between manufacturers, yet do so in a competitive environment so as to present users with a choice of solutions from which they can adopt the most appropriate to their needs.

Joint collaboration is one solution to the challenge. The question in Europe is: will it be successful, and if not, what are the alternatives.

Jim Beveridge
Edward Mier
Edward Richardson

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RESEARCH BULLETIN

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SGS TAKES AT&T PRODUCTS TO MARKET

Under a five-year worldwide marketing agreement announced in London, SGS Microelectrica SpA will be instrumental in making commercially available AT&T products that had previously only been used in AT&T equipment. The five-year agreement covers the marketing and sale of linear bipolar and high-voltage integrated circuits widely used in telecommunications, data processing, and a broad range of industrial applications. The agreement is exclusive in Europe, and nonexclusive outside of Europe.

This agreement, made between AT&T's Component and Electronic Systems Division and SGS, also allows for cooperation in the joint definition of new products. Both existing and newly developed products will bear the SGS logo. Based on advanced AT&T design technology, the products will be manufactured by AT&T and marketed worldwide by SGS. We understand, however, that where specific customer packaging requirements go beyond the scope of AT&T's capability, SGS will undertake such packaging, and where a technology compatibility exists, SGS will also enter into fabrication.

AT&T will provide design support to SGS customers from AT&T design centers in Munich, West Germany, and Paris, France. The initial product lineup will consist of 25 key communication devices. SGS anticipates that a catalog of product offerings, expected to be the most comprehensive in the industry, will be available to customers this summer.

It is significant that AT&T was the instigator of this agreement, adding still further credibility to SGS's recognized position as the world leader in high-power linear integrated circuits. In our opinion, this agreement will reinforce SGS's position as a major player in the semiconductor arena, with one of the most powerful linear and high-voltage IC product portfolios on the market. This will help SGS achieve its stated objective of ranking among the top 15 world leaders, with revenues in excess of $1 billion, by the end of the decade.

Peter Savage

Nielsen Dataquest

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THE STANDARD OF LOGIC PRICING

OVERVIEW

A recent survey of system cost calculation has served to highlight a number of interesting facts concerning the current pricing of standard logic. The data used in this study were compiled from the inputs of 10 manufacturers during the week beginning January 20, 1986. Current manufacturer's U.K. list prices in pounds for quantities of 1,000 and 10,000 pieces were obtained. It was explained that since the prices were for calculation purposes, we required the current list price, not a subjective quote or mix price.

For the standard logic portion we chose popular devices operating within the range of 0 to 30 MHz, that is, in CMOS, we chose the standard 4000 series and the high-speed 74HC series; in bipolar, we chose the low-power Schottky 74LS series. The types noted in Table 1 were chosen to represent the three families. Standard commercial DIL packages were specified in each case.

Table 1

STANDARD LOGIC DEVICES

Function	Scale of Integration	Number
Quad 2-Input NAND Gate	Gate	74LS00, 74HC00, 4011
Dual D Flip-Flop	SSI	74LS74, 74HC74, 4013
Quad 2-Input Multiplexer	MSI	74LS157, 74HC157, 4519
Counter, 4-bit Binary	MSI	74LS161, 74HC161, 4161
Octalbus/Line Driver	MSI Octal	74LS240, 74HC240 (No 4000 equivalent)

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OBSERVATIONS

The following points emerged from an analysis of Tables 2 through 7.

HCMOS has now achieved price parity with LSTTL. The data showed closely matching price ranges: two of the major manufacturers have identical price lists for the two families. We expect the majority of manufacturers to follow shortly.

The 4000 CMOS prices are now at their lowest level since the introduction of the family. The average gate price for 1,000 pieces was 40 percent lower than the 74 series prices--the highest price input was lower than the lowest 74LS gate price received. This is surprising, since DATAQUEST cost models estimate that a 4000 series gate costs more to manufacture than its LSTTL counterpart. We believe that capacity is now more closely aligned with demand and that, in the next two to six months, prices will increase to 1982/1983 levels.

A factor all families have in common is a large spread in the level of field pricing. We believe that this is due to a lack of sensitivity to market price levels from some manufacturers, combined with the survey's being undertaken at a point of inflexion in the pricing. Manufacturers either had recently introduced increased prices or were about to introduce new price matrices.

Finally, standard logic is no longer the exclusive domain of the large corporations. Three recent additions to the family are Integrated Device Technology's 74FCT and 74AHCT, which are range speed and output compatible with Fairchild's 74FAST; VTC Inc.'s (Eagan, Minnesota) 74ACT CMOS series, which is ALS compatible; and Monolithic Memories' group of 74ACT devices, which was introduced in 1985.

Jim Beveridge

Table 2

LOW-POWER SCHOTTKY PRICING
COMMERCIAL PLASTIC
(Dollars)

	74LS00		74LS74		74LS157		74LS161		74LS240		Kit Price	
	Qty. 1	Qty. 10	Qty. 1	Qty. 10	Qty. 1	Qty. 10	Qty. 1	Qty. 10	Qty. 1	Qty. 10	Qty. 1	Qty. 10
Highest	$0.382	$0.183	$0.398	$0.236	$0.852	$0.327	$1.091	$0.358	$1.077	$0.519	$3,800	$18,061
Lowest	$0.172	$0.137	$0.230	$0.183	$0.289	$0.204	$0.372	$0.235	$0.472	$0.415	$1,534	$13,113
Median	$0.242	$0.159	$0.297	$0.207	$0.442	$0.267	$0.559	$0.307	$0.722	$0.459	$2,262	$15,587

Table 3

HIGH-SPEED CMOS PRICING
COMMERCIAL PLASTIC
(Dollars)

	74HC00		74HC74		74HC157		74HC161		74HC240		Kit Price	
	Qty. 1	Qty. 10	Qty. 1	Qty. 10	Qty. 1	Qty. 10	Qty. 1	Qty. 10	Qty. 1	Qty. 10	Qty. 1	Qty. 10
Highest	$0.382	$0.215	$0.398	$0.236	$0.852	$0.339	$1.091	$0.415	$1.077	$0.582	$3,800	$20,006
Lowest	$0.136	$0.109	$0.196	$0.157	$0.286	$0.235	$0.380	$0.305	$0.503	$0.403	$1,502	$13,170
Median	$0.236	$0.170	$0.283	$0.172	$0.425	$0.296	$0.549	$0.355	$0.685	$0.492	$2,178	$16,545

Table 4

4000 SERIES CMOS PRICING
COMMERCIAL PLASTIC
(Dollars)

	4011		4013		4519		4161		Kit Price	
	Qty. 1	Qty. 10	Qty. 1	Qty. 10	Qty. 1	Qty. 10	Qty. 1	Qty. 10	Qty. 1	Qty. 10
Highest	$0.167	$0.136	$0.257	$0.200	$0.343	$0.257	$0.472	$0.358	$1,240	$9,510
Lowest	$0.097	$0.079	$0.140	$0.113	$0.217	$0.180	$0.365	$0.300	$ 819	$6,721
Median	$0.139	$0.113	$0.204	$0.164	$0.272	$0.213	$0.415	$0.329	$1,030	$8,194

Source: DATAQUEST
February 1986

Table 5

REPRESENTATIVE SELECTION OF LSTTL INPUTS (Dollars)

	74LS00		74LS74		74LS157		74LS161		74LS240		Average Selling Price	
	Qty. 1	Qty. 10	Qty. 1	Qty. 10	Qty. 1	Qty. 10	Qty. 1	Qty. 10	Qty. 1	Qty. 10	Qty. 1	Qty. 10
Company 1	$0.184	$0.170	$0.230	$0.207	$0.289	$0.280	$0.372	$0.336	$0.529	$0.472	$0.320	$0.293
Company 2	$0.382	$0.183	$0.398	$0.236	$0.852	$0.327	$1.091	$0.358	$1.077	$0.519	$0.759	$0.325
Company 3	$0.200	$0.143	$0.257	$0.200	$0.343	$0.257	$0.400	$0.300	$0.529	$0.415	$0.346	$0.263

Table 6

REPRESENTATIVE SELECTION OF HCMOS INPUTS (Dollars)

	74HC00		74HC74		74HC157		74HC161		74HC240		Average Selling Price	
	Qty. 1	Qty. 10	Qty. 1	Qty. 10	Qty. 1	Qty. 10	Qty. 1	Qty. 10	Qty. 1	Qty. 10	Qty. 1	Qty. 10
Company 1	$0.382	$0.183	$0.398	$0.236	$0.852	$0.327	$1.091	$0.358	$1.077	$0.519	$0.759	$0.325
Company 2	$0.267	$0.177	$0.349	$0.217	$0.426	$0.339	$0.579	$0.415	$0.824	$0.582	$0.489	$0.346
Company 3	$0.136	$0.109	$0.196	$0.157	$0.293	$0.235	$0.380	$0.305	$0.503	$0.403	$0.302	$0.242

Table 7

REPRESENTATIVE SELECTION OF 4000 SERIES INPUTS (Dollars)

	4011		4013		4519		4161		Average Selling Price	
	Qty. 1	Qty. 10	Qty. 1	Qty. 10	Qty. 1	Qty. 10	Qty. 1	Qty. 10	Qty. 1	Qty. 10
Company 1	$0.153	$0.126	$0.217	$0.179	$0.217	$0.180	$0.365	$0.300	$0.239	$0.196
Company 2	$0.167	$0.136	$0.257	$0.200	$0.343	$0.257	$0.472	$0.358	$0.310	$0.237
Company 3	$0.097	$0.079	$0.140	$0.113	$0.253	$0.203	$0.415	$0.329	$0.226	$0.182

Source: DATAQUEST
February 1986

Nielsen Dataquest

EUROPEAN RESEARCH NEWSLETTER

ESIS Code: Vol. IV, Newsletters
1986-7

JAPAN'S SHIFT TO INNOVATION: A BOOM IN BASIC RESEARCH LABS

"Good imitators, but poor inventors." For years, Japanese industry has been strong in manufacturing, but weak in innovative research. However, DATAQUEST believes that this situation is rapidly changing. As shown in Table 1, Japanese electronics makers will open at least 76 basic research laboratories between 1984 and 1988. These laboratories will focus on a wide variety of leading-edge technologies, such as 4Mb and 16Mb DRAMs, 32-bit MPUs, standard cells, 3-dimensional CAD systems, VLSI design expert systems, automotive electronics, telecom ICs, optoelectronics, gallium arsenide, bioelectronics, voice recognition/synthesis, ceramic packaging, diamond substrates, and new materials. Given an average investment of $25 million to $33 million each, we estimate that these laboratories represent a total investment of between $1.9 billion and $2.5 billion.

What impact will these laboratories have on the West? DATAQUEST believes that 1986 will be a major turning point for Japanese industry. We expect an increasing flow of innovative products from Japan within the next few years. To remain internationally competitive, Western companies must continue investing heavily in R&D and improve their manufacturing capabilities.

Jim Beveridge
Sheridan Tatsuno

Table 1

NEW JAPANESE ELECTRONICS R&D LABORATORIES (1984-1988)

Company	Research Activities (Location)	Opened	Millions of Dollars
Asahi Chemical	Gate arrays, standard cells (Atsugi)	12/85	$ 25.0
Asahi Optical	Optical disks (Englewood, Colorado)	1985	$ 0.5
Canon	Materials, AI (Atsugi)	02/85	$ 50.0
Data General Japan	Minicomputers (Koda)	12/85	$ 5.0
Dupont Japan	Electronics (Yokohama)	11/86	$ 75.0
Fuji Photo Film	CMOS image sensors	1985	N/A
Fujitsu	CAD, supercomputers, ICs (Kawasaki)	12/87	$100.0
Fujitsu	Mie R&D building postponed	1985	N/A
Fujitsu	Home electronics (main plant)	09/86	$ 17.5
Fujitsu/ Tohoku Digital	HEMT, opto, GaAs center (Sendai)	1985	$ 0.5

(Continued)

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Table 1 (Continued)

NEW JAPANESE ELECTRONICS R&D LABORATORIES (1984-1988)

Company	Research Activities (Location)	Opened	Millions of Dollars
Hitachi	64Mb DRAM, biochips (Tokyo Central)	10/85	N/A
Hitachi Chemical	Electronics (Tsukuba)	1988	N/A
Hitachi Works	Bioelectronics (Kokubu)	02/85	N/A
Hokushin Electric	Ceramic components (Showaza)	02/86	$ 3.5
Honda	Reseach office (California)	09/84	N/A
IBM Japan	Computers, OA, workstations (Daiwa)	07/85	N/A
Japan Automation	CAD/CAM (Fuji)	03/85	$ 15.0
Japan Victor (JVC)	3-micron LSIs (Yamato)	04/85	N/A
JIRA	Laser technology center (Chiba)	1985	$ 1.0
Kanto Electronics	Joint semiconductor R&D (Nagano)	1985	N/A
Kanto Electronics	ICs, peripherals (Silicon Valley)	1984	N/A
Kawasaki Steel	New IC materials (Kawasaki)	03/85	N/A
KDD	Switching, software (Kamifuku-Oka)	02/88	$ 25.0
Kobe Steel	Research office (North Carolina)	09/84	N/A
Konishiroku	New materials (Silicon Valley lab)	03/85	$ 0.3
Kyocera	Electronic materials (Vancouver, WA)	1985	$ 10.0
Kyowa Electric	New materials (Chofu)	09/85	$ 5.0
Matsushita Electric	Sub-micron 16Mb DRAMs (Kadoma)	10/85	$100.0
Matsushita Electric	Biochips, thin film (Kawasaki)	04/86	$ 3.0
Matsushita Electric	R&D plan (Taiwan & West Germany)	1986	N/A
Matsushita Electronics	4Mb, next-generation ICs (Tokyo)	09/85	$ 80.0
Matsushita Reiki	Electronics (East Osaka)	07/85	$ 10.0
Mazda	Electronics (Yokohama)	1986	N/A
Minolta	Optoelectronics, thin films (Osaka)	11/84	$ 15.0
Mitsubishi Electric	Optical components (Obune)	08/85	$ 15.0
Mitsubishi Electric	Semiconductors (Research Triangle)	1984	N/A
Mitsubishi Electric	4Mb DRAMs, X-ray, E-beam (Itami)	12/85	$ 90.0
Mitsubishi Electric	Original CMOS MCUs	1985	N/A
Mitsubishi Electric/ Mitsubishi Kasei	Joint materials research	11/85	$ 1.5
MITI/MPT	Basic technology research center	1986	$ 56.0
MITI/STA	New joint R&D system (Tsukuba)	1985	N/A
MITI/Tokyo University	Bioholonics Computer (Tsukuba)	1985	N/A
Nakamichi	Consumer electronics (California)	09/84	N/A
NEC	VLSI, AI, bioelectronics (Tsukuba)	06/87	$ 65.0
NEC	32-bit MPU, GaAs, Opto (Sagamihara)	1985	$100.0
NEC/MOE Physics Lab	Synchrotron for 1Mb+ DRAMs (Tsukuba)	01/85	N/A
Nippon Denso	Electronics (Aichi Prefecture)	08/89	N/A
Nippon Denso	Auto electronics (Michigan)	1986	N/A
Nissan Motors	Electronics	10/85	$ 8.0
NMB Semiconductors	CMOS DRAMS, EEPROMs (Tateyama)	1985	N/A
NTT/Hitachi/Toshiba	64Mb+ DRAM synchrotron (Atsugi)	1988	$ 30.0
NTT/KDD	Transmission think-tank	1985	$ 0.8
Oki Electric	1-micron VLSI R&D center (Hachioji)	1985	$ 46.5
Oki Electric	CAD, OA, LAN, E-mail (Takasaki)	11/85	$ 25.0
Ono Measuring	Sensors, measuring (Yokohama)	10/89	$ 25.0
Osaka Titanium	VLSI wafers (Saga)	09/85	$ 10.0
Ricoh	Optoelectronics, materials (Yokohama)	04/86	$ 50.0
Sanken Electric	Semiconductors (Saitama)	1985	$116.0
Sanyo	Bioelectronics, AI, FA (Tsukuba)	10/85	$ 38.5
Sharp	0.8- to 1.2-micron VLSI, (Fukuyama)	09/85	N/A
Sony	Optical media (Portland, Oregon)	1984	N/A
Sumitomo Electric	IC materials (Raleigh, N. Carolina)	1984	N/A
Tamura Works	Semiconductors (Tokyo)	02/85	N/A
Tateishi Electric	Telecommunications (Machida)	03/86	$ 15.0
TDK	Components (Ichikawa)	N/A	N/A
Tokyo Electron (TEL)	Ultra LSI equipment (Nirasaki)	12/85	$ 8.0
Tokyo Sanyo	Semiconductors	02/86	$ 15.0
Toshiba	4 and 16Mb DRAMs (Kawasaki)	04/85	$110.0
Toshiba	ASICs, LANs, CAD (Horikawa)	01/87	$100.0
Toshiba Ceramics	16Mb ceramic substrates	1985	$ 11.6
Toyo Oxygen	IC gas equipment (Kawasaki)	1986	$ 10.0
Toyo Technica	CAD software (Atsugi)	12/84	$ 7.4
Yaesu Musen	Satellites, wireless (California)	1985	N/A
Yaskawa Electric	Robots, factory automation (Okura)	04/86	$ 7.5
Yazaki Industries	Hybrid ICs (Shizuoka)	06/85	N/A

N/A = Not Available

Source: DATAQUEST
February 1986

Nielsen Dataquest

EUROPEAN RESEARCH NEWSLETTER

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1986-6

DRAM PRICES: STABLE AND RISING

The heyday of the supercheap 64K DRAM is history as prices slowly climb from their July 1985 spot price low point of \$0.35 to a more stable \$0.70 to \$0.85 contract ASP. The embattled 256K DRAM ASP has also stabilized, settling at a contract price of \$2.20 at year-end 1985. Spot prices for both of these parts are slightly lower.

64K DRAM

Several events in the past eight weeks have been responsible for the turnaround of the steep price spiral for 64K DRAMs, including:

- Texas Instruments' hard-line refusal of orders below a 90 cent ASP
- The exit from the 64K market of former heavyweights--Fujitsu, Intel, Mostek, Motorola, National, and Toshiba
- The strengthening of the Japanese yen relative to the U.S. dollar
- Dumping accusations made by the U.S. Department of Commerce

The results of these events are reflected in the quarterly shipment figures listed in Table 1.

The contract price for the 64K DRAM rapidly slid below the experience curve to a low point in the third quarter of approximately \$0.70. We believe that 64K DRAM pricing will stabilize, with the price hovering around a \$0.90 to \$1.00 contract ASP through 1986 (see Table 2). The 64K DRAM experience price curve (see Figure 1) illustrates how approximately \$1.3 billion in premiums above the experience price line gained in 1983 and 1984 have been partially offset by the approximate \$300 million loss incurred in 1985.

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256K DRAM

The 256K DRAM price decline has been one of the fastest declines in memory. As with the 64K DRAM, multiple forces were responsible for the 256K price slide:

- The release of the part during the worst recession in electronics history
- A wait-and-see attitude regarding the introduction of the 256K replacement--the 1-Mbit DRAM
- The 64K DRAM's being more than price competitive with the 256K part in 1985

With current prices at between $1.90 and $2.10, we expect price declines to slow as production comes into line with the order rate. We estimate variable costs to be $0.85 for the most efficient manufacturers (see Table 3). Prices should be higher than $2.00 to make a profit. The only non-Japanese manufacturer producing parts in the United States is Micron Technology. Fujitsu, Hitachi, and NEC rank as the highest producers. Prices (see Table 2) are expected to drop to $1.65 by year-end 1986. The 256K DRAM experience price curve (see Figure 2) illustrates how earlier gains made in late 1983 and in 1984 ($556 million) have been partially offset by losses in 1985 ($324 million).

1-MBIT DRAM

This year will be the first year of production for the 1-Mbit DRAM (see Figure 3). Depending on the production capability of the primary supplier, Toshiba, unit volumes could range from 6.5 million to 35 million units. The two scenarios we are closely scrutinizing are shown in Table 4. Volume production is not expected to be required until 1987, when major end users will begin ordering this part in quantity. We will keep our clients informed as to which situation occurs.

BUYER ADVISORY

DRAM prices (both unit and price per bit) are significantly below their respective experience price curves (see Figures 1, 2, and 4). The question is, How long can semiconductor manufacturers sell parts at half the expected experience curve price and remain in business?

The unit volumes required to bring prices back in line with expectations, even if prices remain at current levels, are unreasonably high (4.5 billion 64K parts at $0.90, and $1.75 billion 256K parts at $2.00). Companies that have invested in semiconductor plants that cost $100 to $200 million each and that plan on recouping their investments by selling DRAMs had better have deep pockets or be able to utilize their facilities for other technologies (i.e., gate arrays).

One of the ways companies are cutting their costs is through process and yield enhancements (Table 3). Reduced die sizes and improved techniques have substantially reduced costs to the point where efficient manufacturers can make marginal profits at prices of $0.90 and $1.90 for the 64K and 256K DRAMs, respectively.

Another way to cut costs is to strategically ship inventoried products at prices more favorable than those at the time when the product was produced. The inertia of the 1984 boom market left many semiconductor manufacturers holding excess inventory of 64K DRAMs in the first half of 1985. We estimate that 160 million 64K DRAMs have been inventoried since the first quarter of 1985 (see Table 1), with the majority of those parts having been built in Japan. We believe that this inventory will be strategically sold in 1986 as demand increases, thus leaving near-term production capacity available for other products.

OUTLOOK

We foresee DRAM prices stabilizing; in some cases (64K DRAMs) they will rise, but in all cases a slowing of the downward price trend will occur. Political pressures, the effects of international exchange rates, capacity utilization, and improved productivity all will result in stabilized near-term prices.

By the third quarter of 1986, the resumption of slow, gradual DRAM price reductions will occur. We foresee 64K DRAM contract prices going no lower than $0.80 and 256K DRAMs gravitating around $1.90 each through the first half of 1986. Acting as a bellwether for pricing, DRAM spot prices will be slightly higher than contract prices for the 64K part, while the 256K spot prices will gradually decline, signaling the market trend toward higher use and the production economies yet to be realized by this part.

We advise buyers to work closely with their preferred vendors now to prepare for a tightened 256K market in the first half of 1986 and the resumption of slower overall price reductions beginning in the third quarter of this year.

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Jim Beveridge
Mark Giudici

Table 1

ESTIMATED 1984 AND 1985 DRAM QUARTERLY SHIPMENTS

	1984					1985				
	Q1	Q2	Q3	Q4	Total	Q1	Q2	Q3	Q4	Total
64K DRAM										
Units (millions)	157.7	192.1	237.5	265.4	852.7	165.0	150.0	135.0	150.0	600.0
Percent Change	-	24.0%	18.1%	9.0%	129.1%	(37.7%)	(9.1%)	(10.0%)	11.1%	(29.7%)
May 1985 FCST 64K							235.0	240.0		
Excess inventory (DQ 5/85 FCST--1st half 1985 actuals)							70.0	90.0		
256K DRAM										
Units (millions)	2.6	6.6	11.7	17.0	37.9	20.7	30.9	56.2	86.3	194.3
Percent Change	135.0%	150.0%	99.0%	45.0%	2,129.0%	21.0%	49.0%	82.0%	54.0%	412.7%

Table 2

ESTIMATED AVERAGE SELLING PRICES (ASP) AND SPOT MARKET PRICES FOR 64K AND 256K DRAMS

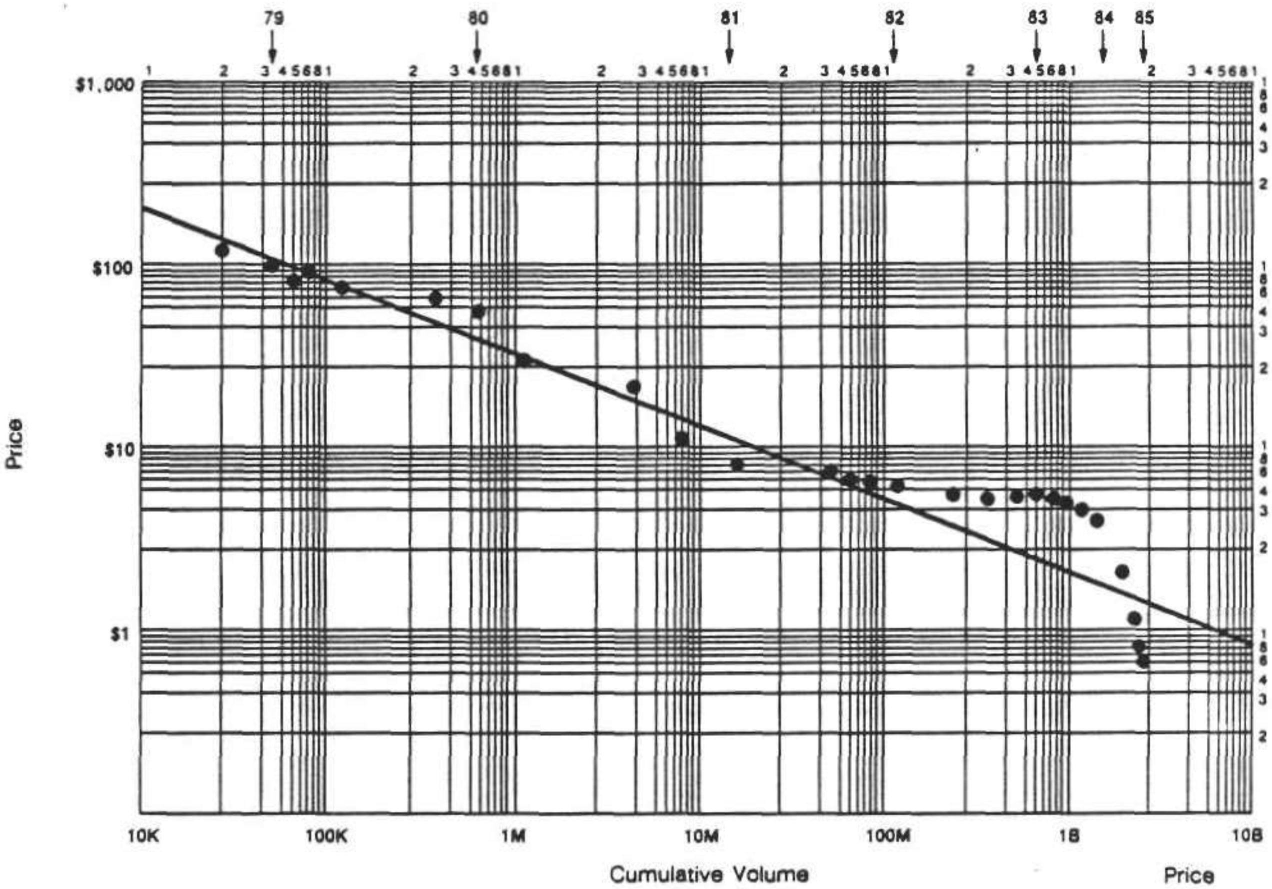
	1985					1986				
	Q1	Q2	Q3	Q4	Total	Q1	Q2	Q3	Q4	Total
64K DRAM										
ASP	$1.70	$1.10	$ 0.80	$ 0.80	$1.30	$ 0.90	$ 0.90	$ 0.90	$ 0.90	$ 0.90
Spot	$0.70	$0.50	$ 0.35	$ 0.50	-	$ 0.50	$ 1.10	$ 1.10	$ 1.05	-
256K DRAM										
ASP	$9.00	$7.00	$ 2.80	$ 2.20	$5.75	$ 2.00	$ 1.80	$ 1.70	$ 1.65	$ 1.70
Spot	$4.00	$3.25	$ 2.50	$ 2.00	-	$ 1.75	$ 1.50	$ 1.60	$ 1.50	-
1Mb DRAM	N/A	N/A	$160.00	$125.00	-	$50.00	$35.00	$25.00	$15.00	-

N/A = Not Applicable

Source: DATAQUEST
January 1986

Figure 1

64K DRAM EXPERIENCE PRICE CURVE



Source: DATAQUEST
January 1986

Table 3

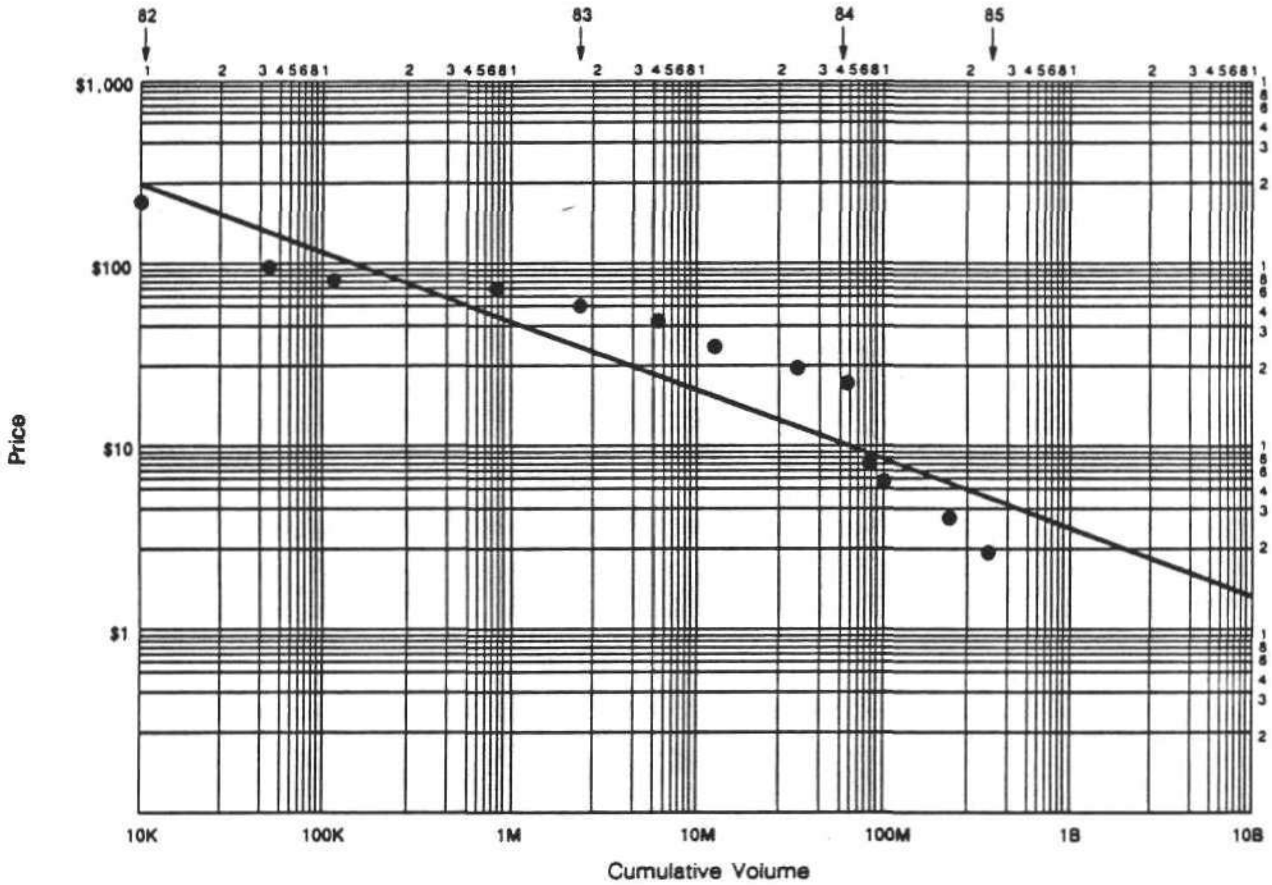
DRAM COST MODEL

	64K		256K	
	1985	1986	1985	1986
Wafer Sort				
Wafer Size (inches diameter)	5.0	5.0	6.0	6.0
Processed Wafer Cost ($)	70.0	70.0	100.0	90.0
Die Size (square mils)	25,000	25,000	45,000	38,000
Gross Die/Wafer	706	706	565	669
Unyielded Die Cost at Sort ($)	0.0991	0.0991	0.1770	0.1345
Sort Cost/Die ($)	0.0118	0.0101	0.1592	0.0534
Wafer Sort Yield (%)	86	86	75	78
Sorted Die Cost ($)	0.1297	0.1277	0.4455	0.2415
Assembly				
Assembly Cost/Die ($)	0.06	0.05	0.10	0.09
Assembly Yield (%)	0.95	0.95	0.90	0.92
Assembled Die Cost ($)	0.2334	0.2208	0.6400	0.3950
Final Test				
Test Time/Assembly (seconds)	4.0	3.5	30.0	15.0
Test Cost/Hour ($)	25	25	45	25
Test Cost/Assembly ($)	0.0049	0.0046	0.24	0.0411
Final Test Yield (%)	0.90	0.92	0.90	0.90
Tested Unit Cost ($)	0.2902	0.2664	0.7546	0.5547
Mark, Pack, and Ship				
Back-End Cost (99% yield)	0.03	0.02	0.10	0.10
Total Variable Cost/Part	0.3202	0.2864	0.8546	0.6547

Source: DATAQUEST
January 1986

Figure 2

256K DRAM EXPERIENCE PRICE CURVE



Source: DATAQUEST
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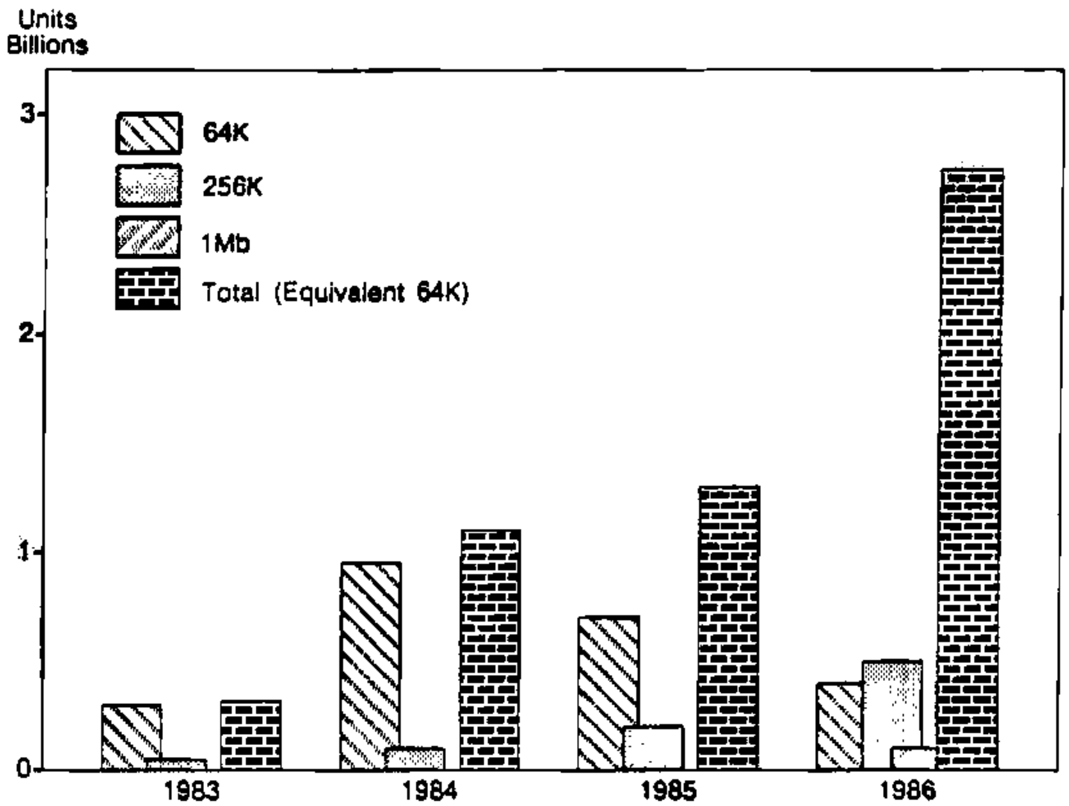
Figure 3

DRAM SHIPMENTS



Source: DATAQUEST
January 1986

Table 4

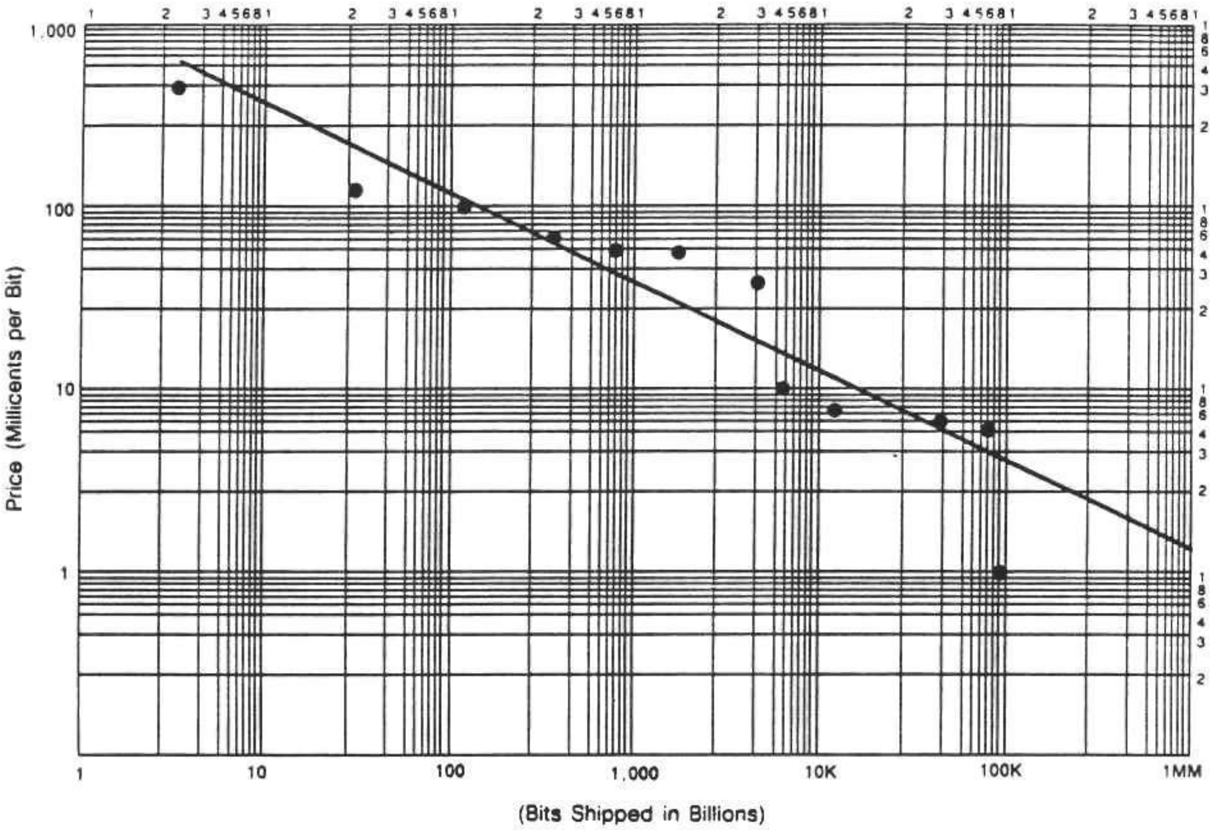
TWO 1-MBIT PRODUCTION SCENARIOS

	1986				
	Q1	Q2	Q3	Q4	Total
Scenario 1--					
Toshiba has limited production					
Units (millions)	0.50	1.00	2.00	3.00	6.50
ASP	$35.00	$30.00	$22.00	$16.00	$21.50
Scenario 2--					
Strong Toshiba ramp up					
Units (millions)	2.00	4.00	11.00	18.00	35.00
ASP	$33.00	$23.00	$16.00	$13.00	$16.20

Source: DATAQUEST
January 1986

Figure 4

DRAM EXPERIENCE CURVE



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January 1986

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EUROPEAN RESEARCH NEWSLETTER

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1986-5

OUTLOOK FOR THE EUROPEAN SEMICONDUCTOR INDUSTRY

EXECUTIVE SUMMARY

In 1975, the European companies' worldwide market share stood at 18 percent. Since that time, this share has steadily eroded, reaching an all-time low in 1984 of 11 percent. In 1975, three European companies ranked among the top 10 world suppliers. Today, only Philips retains a top 10 ranking.

Given this stark scenario, what possibilities lie in store for the European semiconductor industry? Further decline to eventual novelty value, or renewed strength and international competitiveness? The obvious answer would be the former of the two options; however, we do not believe that this will transpire. Since 1980, there has been a fundamental change in the competitive European environment. For this reason, the latter outlook is the more likely scenario, and indeed the first results are already starting to emerge.

BACKGROUND--WHERE ARE WE COMING FROM?

The European semiconducutor market has always been an open market, with the U.S. semiconductor companies traditionally supplying between 50 and 60 percent of the total demand. At the outset, however, the European companies established an early foothold in the emerging semiconductor technology and indeed have several world firsts to their credit. Despite this, they in general failed to keep pace with their U.S. counterparts. Traditionally, the companies were part of large, vertically integrated industrial and/or electrical companies, a fact that gave rise to the following set of characteristics:

- In-house requirements dominating their product and market strategies
- Inherent bureaucracy forcing slow business reactions and decision making

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- Strong aversion to business risk

- Strong technology and R&D focus

- Protected home market

These characteristics resulted in a market strategy that focused on domestic demand as the number 1 priority, with the Rest of Europe and the Rest of World markets relegated to a somewhat detached second and even a more distant third place, respectively. Serving non-domestic markets was generally viewed as opportunistic--a place to sell excess products or capacity--rather than as a valid market in its own right.

The problems associated with a narrow market base, lack of international product strategy, and lack of competitiveness started to surface with the advent of the commodity IC in the 1960s. In general, the European semiconductor companies failed to keep pace with the product and manufacturing advances, which were dominated at that time by the U.S. companies. Some did attempt to compete in these areas, but most failed to achieve the necessary volume required to compete effectively.

Before long, the combination of strong (internationally focused) marketing, aggressive pricing, and low-cost, volume manufacturing capability resulted in the U.S. companies dominating this rapidly emerging market. By the mid-1970s, most of the European companies had conceded this market to the increasingly dominant U.S. semiconductor industry.

In many ways, the situation then is reminiscent of the present U.S. and Japanese semiconductor industry confrontation on commodity MOS ICs. Given this background, it is hardly surprising that the 1970s saw Europe's share of the worldwide semiconductor market decline. With few exceptions, the European semiconductor companies either were forced into niche markets or into markets that were relatively unattractive to other suppliers because of duty or other cost disadvantages, or because of low-volume demand.

EUROPE IN THE 1980s

By 1980, Europe's decline was endemic, so much so that even the European governments were showing concern. At the same time, a new breed of European manager was starting to emerge, one more entrepreneurial in nature, willing to take risks, internationally focused, and altogether more flexible and pragmatic than his predecessors.

It was not only Europe's semiconductor industry that was in trouble, its whole electronics industry was becoming increasingly uncompetitive, in many instances saved only by protectionist measures or captive markets.

In part, this very demise of Europe's electronics industry can be directly attributed to the failure of Europe's semiconductor industry to support it. Denied timely access to the latest semiconductor technology, Europe's equipment manufacturers were relegated to using obsolescent technology in their equipment designs. In contrast, because the latest in IC technology was readily available in the United States, the local U.S. companies could incorporate these into their designs much earlier to win and control key markets through feature, cost, price, and performance advantages.

The demise of Europe's computer industry is a classic example of just such a market lost to the United States through such means.

A fourth element also came into play--the meteoric rise of the U.S. dollar against the local European currencies since 1980. This provided the European companies with an instantaneous manufacturing cost advantage over their U.S. counterparts.

Along with the increasing recognition that too much reliance on non-European technology was putting Europe's electronics companies at risk came the appreciation that timely access to technology was not in itself sufficient. What was needed in addition was a different market strategy, one based on improved international competitiveness and trading openly in world markets.

Nowhere was this more evident than in the European semiconductor industry, where it was obvious that the small domestic markets were unable to support effectively a strong semiconductor base. And yet, without a strong local semiconductor base, the European electronics industry was committed to further decline. A series of events has unfolded that has paved the way for a significant change in the European environment. Already the downward trend has been arrested substantially, and some key statistics have even started to reverse direction.

For example, 1985 saw the European semiconductor companies' worldwide market share increase--for the first time in more than 10 years--from 11 percent to 12 percent, as shown in Figure 1. Based on the existing committed and scheduled capital and R&D investments of, for example, European Silicon Structures (ES2), Ferranti, Matra-Harris, MEDL, Mietec, Philips, SGS, Siemens, and Thomson, this trend is likely to continue throughout this decade. By 1990, the European companies' share should reach at least 15 percent, possibly even more.

Since 1981, Plessey, Ferranti, SGS, and Thomson have all outperformed the worldwide semiconductor market growth, although in three of these years the world semiconductor markets were steeped in deep recession (see Figure 2).

Figure 1

EUROPEAN COMPANIES WORLDWIDE MARKET SHARE PROJECTION
(Percent of Dollars)

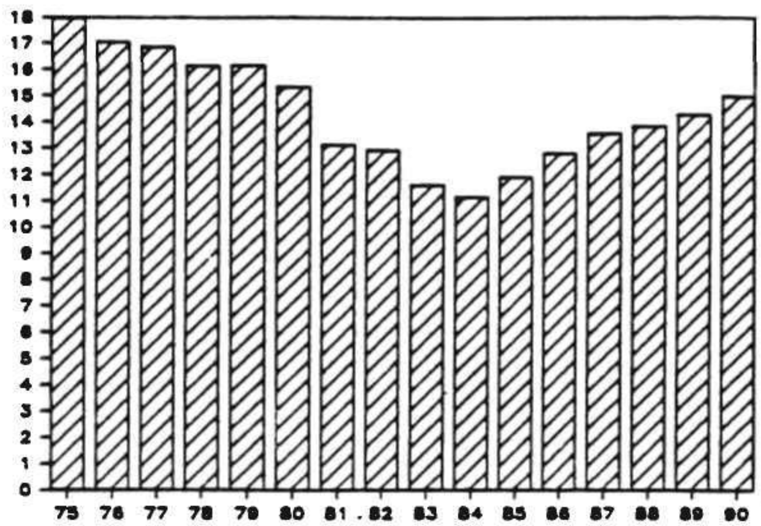
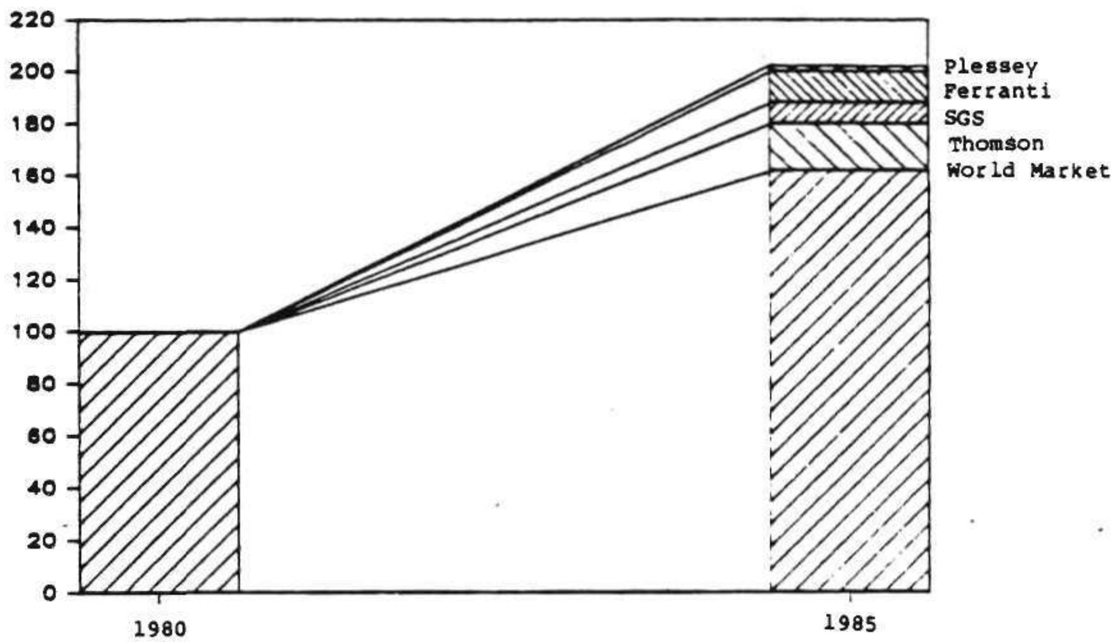


Figure 2

RELATIVE GROWTH IN SEMICONDUCTOR SHIPMENTS
(Base 1981 = 100)



Source: DATAQUEST
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Significantly, the value of product exported by the European companies to non-European countries has risen from 27 percent in 1979 to 36 percent in 1985. Despite this increase, the penetration of this market still represents only 5 percent share. A mere doubling of this figure to 10 percent, which in itself is not too aggressive a target, would increase the European companies' worldwide market share to 16 percent and their exports to 50 percent, while maintaining their present 40 percent share of the European market. None of these hypotheses are unreasonable--on the contrary, all are readily achievable.

Many European companies are already demonstrating the courage and determination necessary to make it happen. Thomson's recent acquisition of Mostek's assets in the United States is a good example. Acquired at a bargain price, Mostek's assets provide Thomson with a substantial increase in MOS capability together with an established U.S. sales and marketing effort just when the semiconductor market is starting to show positive signs of recovery.

Similarly, through a self-build strategy, SGS, one of the early forerunners of the new European initiative, is also uniquely positioned to capitalize on the impending market upturn. SGS has invested substantially in five new 125mm wafer fabrication lines since 1983 in addition to its partially completed 150mm line in Phoenix, Arizona.

EUROPE--THE WAY AHEAD

We believe that with the plans and strategies that are already in place, the European companies can readily regain their 1980 worldwide market share by 1990. Two fundamental changes are taking place:

- Companies are forming across-the-border alliances.
- European start-ups are increasing.

Strategic Alliances

The major European semiconductor companies are developing strategic alliances that will enable them to target worldwide markets in a cost-effective manner. An example of this is the Philips-Siemens Mega-project. This alliance will result in Europe having a state-of-the-art process capable of building 4-Megabit DRAMs and 1-Megabit SRAMs. Both Philips and Siemens have a large internal demand for such devices in their consumer, computer, and telecommunications products. This volume will provide the opportunity to rapidly ramp down the cost learning curve so as to compete successfully in the world marketplace.

In addition, Thomson, France, and MEDL, U.K., have announced a development project to cooperate on application-specific ICs (ASICs), a market estimated at around $4 billion worldwide by 1990. Plessey and Ferranti are already among the fastest-growing companies in this sector, which represents one of the major growth market opportunities for the European semiconductor companies.

Similar agreements exist between Thomson and Oki; SGS and Toshiba, and LSI Logic; and Philips and Texas Instruments.

The seeds of cooperation across national and international barriers have already been sewn, both at the component and end-equipment levels. We believe that this trend will continue. There is no place for blinkered nationalism in the global markets of the 1990s.

European Semiconductor Start-Ups

Along with strategic alliances, the second fundamental change under way is the emergence of the European semiconductor start-up. Though not as prolific as in the United States, the momentum is growing. Matra-Harris, Mietec, Inmos, and Integrated Power Semiconductors have already made substantial progress in their respective fields and, more recently, a new venture, ES2, was launched.

Led by a pan-European team of highly experienced semiconductor veterans, ES2's target market is the fast turnaround ASICs. The financing for ES2 is European, $65 million in total, and the operations span the European continent with a factory planned in France, headquarters in Germany, and R&D in the United Kingdom.

Integrated Power Semiconductors (Scotland) is a technology leader in developing "intelligent" power ICs; Mietec (Belgium) is focusing on ASICs for the automotive, industrial and telecommunications markets, specializing in high-voltage, high-drive, mixed technology ICs; Inmos is pioneering the concept of parallel processing with the Transputer, a 32-bit highly integrated microprocessor building block; and Matra-Harris is specializing in high-performance CMOS ICs.

These up-and-coming companies form a vital part of the future European growth. They will need encouragement and support to make it through to the big league and take their place in the world markets. And no one is under any illusions as to the enormity of the task ahead.

DATAQUEST ANALYSIS

The world semiconductor industry is currently undergoing great changes. Part of these changes will involve a period of natural selection--those companies that can adapt to the new realities will survive and prosper. More and more it is the quality of management and strength of financing that will determine the eventual winners and losers.

Europe may in the past have been outmanufactured and outmarketed, but it is determined not to be outmaneuvered. There is no shortage of the raw materials for success. Today's European managers are inherently every bit as resourceful, pragmatic, opportunistic, and hungry as their U.S. and Japanese counterparts. European R&D programs are on a par with the best in the world. European financial institutions have the funds for investment, and European governments can implement the necessary fiscal and social reforms.

But, most importantly, the realization that sustained economic growth depends on Europe having a world class electronics industry has dawned. Europe now has the will to grow substantial market share in the world semiconductor market. The first results are already starting to emerge.

Malcolm Penn

Nielsen Dataquest

EUROPEAN RESEARCH NEWSLETTER

ESIS Code: Vol. IV, Newsletters
1986-4

EUROPEAN MARKET UPDATE--DISTRIBUTION TRENDS

INTRODUCTION

The European semiconductor market experienced outstanding growth in 1984, with consumption growth of 43 percent in U.S. dollars over 1983. Consumption peaked at the turn of the year, and 1985 was a year of falling order books and austerity. This newsletter looks at the impact of the changing market situation on manufacturers and, in particular, distributors of semiconductors.

DISTRIBUTION MARKET ANALYSIS

DATAQUEST's estimates for the European semiconductor market, given in Table 1, show that for the years 1983 through 1986, the compound annual growth rate (CAGR) is 14.0 percent, which is in line with the long-term CAGR for the worldwide semiconductor industry. However, 1984 was a year of exceptional growth, and, due to a number of factors, 1985 was a year of marginal decline. The cyclic nature of the semiconductor market is a phenomenon that has existed throughout the history of the industry, with periods of rapid growth and investment followed by periods of austerity and consolidation.

Table 1

EUROPEAN SEMICONDUCTOR MARKET ESTIMATES
(Millions of U.S. Dollars)

	1983	1984	1985	1986	CAGR %
Total Semiconductor	$3,370	$4,805	$4,639	$4,997	14.0
Annual Growth Rate %	6.4	42.6	(3.5)	7.7	

Source: DATAQUEST
January 1986

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These cycles have significant impact, not only on the manufacturers but also on the distributors of semiconductors. Although distributors do not have the problems associated with manufacturing, they do increase investment during growth phases; this investment takes the form of:

- Increased inventory to meet projected demand
- Increased staff to support a growing market
- Increased capital and ongoing expenditure for facilities, test, and systems support

During periods of recession, distributors, like manufacturers, take measures to minimize the market impact on their businesses. These generally include some or all of the following:

- Physical reduction of inventory levels
- Reduction of inventory value
- Increased sales activity
- Temporary hold on capital investments

Table 2 shows DATAQUEST's estimates of the European distribution market both at the value of manufacturer shipments and at the resale value to the end customer. The table also gives an idea of the changes in inventory and profitability from year to year.

Table 2

EUROPEAN SEMICONDUCTOR DISTRIBUTION MARKET ESTIMATES
(Millions of U.S. Dollars)

	1983	1984	1985	1986
Total Resales to Market	$1,243	$1,799	$1,673	$1,757
Distributor Purchases	$1,042	$1,561	$1,103	$1,294
Change in Inventory	$ 135	$ 275	($ 130)	$ 20
Sales Profit Margin %	27.0	28.5	26.3	27.5
Effective Margin %	16.2	13.2	34.0	26.4
Share Manufacturers' Revenues %	30.9	32.5	23.5	25.9

Source: DATAQUEST
January 1986

Analysis of Table 2 reveals several key factors. Firstly, during the latter part of 1984, distributor inventory increased sharply as additional manufacturing capacity became available in response to order book levels, which had been increasing since the first quarter of 1983. By the end of 1984, end-customer demand was declining sharply, the book-to-bill ratio was below 1.0, and shipments from manufacturers to distributors were still running at a high level.

Further, the mismatch of supply and demand had a dramatic impact on the market prices of commodity products--those that distributors see as high-activity and high-business-level parts. One of the benefits of being franchised by a semiconductor manufacturer is that the inventory held and purchased by the distributor at the regular distributor buy price is price-protected by the manufacturer against falling market prices. In effect, this means that manufacturers, for the most part, regard distributor stocks as their own stock and credit the distributor for the price difference if market forces dictate a new, lower distributor buy price on all stock held. This does not generally work in reverse; when prices are rising, the distributor then makes more profit. During 1985, prices on fast-moving logic and memory products fell significantly. This meant that distributors had to claim high levels of price protection, thereby reducing the value of their inventory. At the same time, reduced sales expectations encouraged distributors to also reduce the volume of products held in inventory. This procedure has several effects:

- It increases distributor profitability in the short term.
- It reduces the new stock orders on manufacturers.
- It adversely affects manufacturers' revenues and profits.

Also, distributor sales forces pursued new orders with increased vigor and became more creative in their package offerings, in efforts not only to reduce inventory and increase sales but also to optimize profit. This can further reduce manufacturers' sales in the short term.

All of these factors combined present a picture for 1985 that looks gloomy for the manufacturers, but less gloomy for the distributors. While we believe that distributors will achieve less revenue in 1985 than 1984 (down 7.0 percent versus a market decline of 3.5 percent) due to both product mix and pricing issues, we also believe that bottom line profit will improve because of price protection and inventory reduction.

Furthermore, there are indications that the market is beginning to recover. A number of manufacturers are reporting increased business activity and bookings, particularly from their distributors, who are seeing customer demand rising to levels that necessitate distributor restocking--the early signs of market upturn.

OUTLOOK

In what might be termed an average year of approximately 16 to 18 percent market growth, distributors tend to increase inventory by 13 to 14 percent. DATAQUEST's forecast for the European semiconductor market in 1986 currently projects an increase over 1985 of 7.7 percent. A recent poll of European distributors indicates that distributors expect resales to grow by 5 percent in 1986, with the profile slanted more positively in the second half of the year. This scenario would mean an increase of 17.3 percent in distributor purchases from manufacturers over 1985 levels. It would include only nominal inventory growth for 1987, after a 29.4 percent decline in 1985 from 1984. Assuming that the sales margin for a distributor is in the range of 27 to 28 percent, this increase of both revenue and inventory would bring the effective 1986 distributor profit back into the range of 26 percent. Inventory increases less quickly than revenue as distributors both become more efficient and maintain a level of price protection while semiconductor prices continue to fall.

DATAQUEST also believes that the role of the semiconductor distributor is changing, as the market moves toward more complex components and toward customized integrated circuits. Although commodity memory products will continue to form a large part of the integrated circuit market, much of the current distribution business is conducted in the area of logic circuits. DATAQUEST's forecasts show that the total European logic market will grow from $1,207 million in 1984 to $3,255 million by 1990, a CAGR of 18 percent. During that same period, the application specific integrated circuit (ASIC) market is forecast to grow from $476 million to $2,022 million, with a corresponding CAGR of 27.3 percent. The existing standard logic market is estimated to grow from $731 million in 1984 to $1,233 million by 1990, at a CAGR of 9.1 percent.

This means that distributors, in order to protect existing business levels and to maintain market share, will be forced in increasing numbers to support the emerging ASIC market. To do this effectively, distributors will have to align themselves more closely to the key ASIC manufacturers and to invest, not so much in inventory as in the tools and systems that allow their customer base easy access to designs and products of the principals. Although the cost of entry is falling, this changing situation means that distributors will have to invest not only in equipment and products, but also in people with the skills to instill customer confidence in the medium term. The benefits will include increased business and longer-term engagements, with more predictable inventory control and profitability. DATAQUEST believes that distributors will make the transition and that the most successful will be those who act as true interfaces between manufacturers and markets, presenting to both what is in their respective best interests.

Adrian Tarr

Nielsen Dataquest

EUROPEAN RESEARCH NEWSLETTER

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1986-3

U.K. DISTRIBUTION

SUMMARY

As part of an ongoing survey of European semiconductor distribution, DATAQUEST has taken a detailed look at the distribution market in the United Kingdom. The results for 1984 and 1985 show that, as in the 1980 through 1981 demand cycle, the majority of distributors did not react quickly enough to the fast-changing business climate at the end of 1984; thus they had to manage through 1985 with an excess inventory situation. Manufacturers in general responded well to the situation, although they received a number of complaints regarding allocation and price-protection practices. For the first time, DATAQUEST has included estimates of the rankings of manufacturers and distributors by sales value to the U.K. distribution market for 1985.

SIGNIFICANT EVENTS--1984 AND 1985

1984 Boom Time

For the most part, 1984 was characterized by a thriving distribution marketplace. Early in the year, it became clear that commodity items were becoming scarce; so in order to control demand, distributors increased prices and placed large stocking orders against manufacturers. Manufacturers responded by increasing their distributor costs, and wave upon wave of price increases flowed through the system. By mid-year, it was not uncommon for LSTTL gates to change hands for as much as £3 each in quantities up to 10,000. Allocation procedures were put in place by a number of manufacturers. These proved effective in reintroducing a measure of stability into the market, providing fair and reasonably realistic delivery dates by which a distributor could manage his business. Companies that were not on allocation and had limited capacity found that many of their factories' resources were tied up in scheduling,

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and that even when they were rescheduled, the delivery schedules were, for the most part, works of fiction. In the fourth quarter of 1984, these same companies were still trying to grapple with the boom when the bubble burst.

1985 Bust Time

The classic signs of the commodity bust started: an order that was scheduled for delivery in October (but with customer-required date of ASAP) arrived nine months early. The allocation system became elastic and magically stretched to include all one wished to order; at the same time, there was a notable reduction in telephone traffic from purchasers. It all combined to indicate that the wind of change was now blowing in the other direction. DATAQUEST believes that the United Kingdom started to feel the effects before the rest of Europe; this could well be due to U.S. dealers and the U.K. market having better-than-average communications, because of the common language, coupled with the below-forecast sales of home computers (a previously strong area in the United Kingdom), which freed up a substantial amount of allocated capacity at the beginning of 1985. The net result was that in the fourth quarter of 1984, U.K. distributors held back order placements while their counterparts in Germany were still pushing for orders.

Price Protection

When the downturn came, distributors were hit by the falling prices and the need for revaluation of their inventories. The actual price-protection mechanisms employed by various manufacturers differed to a large degree. For example, some principals price protected the entire stock and allowed distributors to ship and debit product within a specified price window. Others price protected the last three months of inventory and allowed distributors certain stock return rights.

At the other end of the spectrum, there were manufacturers who either price protected nothing or price protected to such a limited extent that high distributor costs forced distributors to pass the majority of new quotes directly to the manufacturers' marketing departments. The net effect of this was to clog up the distributors' administrative channels, leading to poorer response times and consequent loss of market share.

Billings Decrease

A DATAQUEST analysis of the impact that inventory adjustments and margin decreases have on semiconductor suppliers' billings is outlined in Table 1. It illustrates how a 10 percent decrease in distributor end sales in 1985, when combined with the estimated inventory and margin changes, resulted in a 31 percent decrease of semiconductor shipments to distributors.

Table 1

ANALYSIS OF U.K. DISTRIBUTION SHIPMENTS--1984-1985
(Millions of Pounds Sterling)

Total U.K. Semiconductor Market 1984	£818
Percent Distribution	35%
Total Distribution Buy 1984	£286
Inventory Growth Estimate 1984	£50
Therefore, Distribution Sales at Cost	£236
Distribution Margin Estimate Percent	29%
Therefore, Distribution Resale 1984	£333
Estimated Distribution Resale Decline 1985/1984 Percent	10%
Therefore, Distribution Resale Market 1985	£300
Estimated Distributor Margin Percent	26%
Therefore, Distribution Sales at Cost	£222
Estimated Inventory Decline 1985	£25
Total Distribution Buy 1985	£197
Decline in Semiconductor Shipments to Distribution 1985/1984 Percent	31%

Source: DATAQUEST
January 1986

Distributor Rankings

DATAQUEST's estimates of the semiconductor portion of the U.K. distributors' 1985 turnover are shown in Table 2.

Table 2

ESTIMATED 1985 SEMICONDUCTOR REVENUES OF 30 LEADING U.K. DISTRIBUTORS (Millions of Pounds Sterling)

Distributor	1985
Macro	£35
STC	26
Jermyn	24
RS	18
Farnell	16
Memec	13
Newey & Eyre	9
Radio R	8
Access	8
Rapid Recall	7
Micromark	7
Impulse	7
VSI Elec.	7
Abacus	7
Gothic Crel	7
Norbain	7
Hawke	6
BA	6
Diologue	5
Celdis	5
Man. Skyline	4
Polar	4
Quarndon	4
Pronto	3
Axiom	3
Semi. Spec	3
Intel	2
Kudos	2
DTV	2
Barlec	2
Others	43
Total	£300

Source: DATAQUEST
January 1986

Table 3 shows DATAQUEST's estimates for the sales of the leading semiconductor suppliers to the U.K. marketplace. Figures are given at distributor sale value, i.e., including the distributor's margin.

Table 3

ESTIMATED 1985 SEMICONDUCTOR REVENUES OF 25 LEADING SEMICONDUCTOR MANUFACTURERS IN THE U.K. DISTRIBUTION MARKET
(Millions of Pounds Sterling)

Supplier	1985
Texas Instruments	£32
Motorola	26
National Semiconductor	22
Philips	20
Intel	18
NEC	14
Hitachi	13
AMD	11
Signetics	10
Fairchild	9
Hewlett-Packard	7
Thomson	7
Toshiba	7
RCA	7
Siemens	6
SGS	6
Ferranti	5
Mostek	5
ITT	5
Fujitsu	4
Plessey	3
General Instrument	3
Telefunken	3
Analog Devices	2
MEDL	2
Others	53
Total	£300

Source: DATAQUEST
January 1986

OUTLOOK

DATAQUEST forecasts that the U.K. distributors' resale activities will grow by 5 percent in 1986, with the majority of the growth taking place in the second half of the year. The first six months will see the continuation of the inventory reprofiling that has been a feature of 1985. DATAQUEST estimates that the value of inventory will hold very much constant over the year, with manufacturers using tactics such as "two for one" deals to realign stocks. This means that the manufacturers swap excess products which are turning slowly for new or faster-moving items. The advantage is that the manufacturers reprofile distributors while holding their billings and share of distributors turnover positive. In the fourth quarter, DATAQUEST expects inventories to increase again as distributors stock for 1987. We further expect a modest margin recovery to 27 percent, it being difficult to envisage a further strengthening given a sales increase of only 5 percent.

Taking the assumptions on 1986 sales, inventory, and margin--and applying the same analysis depicted in Table 1--yields a resale market of £315 million, distributor sales at cost of £230 million, and a semiconductor buy value for U.K. distributors of £235 million. This represents a 19 percent increase over 1985 in billings for semiconductor manufacturers.

Jim Beveridge

Nielsen Dataquest

EUROPEAN RESEARCH NEWSLETTER

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1986-2

JAPANESE AND EUROPEAN SEMICONDUCTOR AGREEMENTS

Both Japan and the European community recognize the importance of promoting industrial cooperation and averting trade wars. However, over the years, friction between the European Economic Community (EEC) and Japan has increased. The main reason for this friction is the widespread view in Europe that the Japanese are penetrating European markets while restricting the flow of European goods to Japan. Japan's investment in the EEC has been high, particularly in the high-technology area. EEC investment in Japan has been much smaller, and it has been mostly limited to traditional areas such as chemicals.

One of the ways for Japanese companies to broaden their markets in other countries is through agreements with local companies. Especially in the case of Europe, it is important for a Japanese company to be viewed as willing to cooperate locally, for political and economic reasons. For example, for a European state-controlled telecommunications authority (PTT), a Japanese product produced or developed through an agreement with an indigenous company would be viewed far more favorably for procurement than a product having no local link at all.

Thus, through alliances in Europe, the Japanese get increased market penetration. In addition, their major customers get a local supplier and the Japanese company gets access to local technology and/or products for less cost and in a shorter space of time than if a go-it-alone policy was adopted.

The benefits are not one-sided, though. The European partner gets the same advantages: an increased market penetration outside Europe, a quick and low-cost way of acquiring advanced technology and/or products, and a broader customer base.

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Table 1 lists all semiconductor agreements signed between Japanese and European companies in 1985, as well as some agreements from previous years. It is interesting to note that, apart from ICL, there is an absence of U.K. companies in the list of alliances. There seems to be a reticence on their part to get involved with Japanese companies. Two reasons could account for this situation--a general unwillingness to share their unique technologies and an unwillingness or inability to raise the necessary money to finance such alliances.

Iza Hallberg

Table 1

JAPANESE-EUROPEAN SEMICONDUCTOR AGREEMENTS

Date	Companies	Agreement
1985 (Nov.)	Matsushita, Philips	Matsushita will second-source Philips' 68070 MPU. This device contains a CPU, a memory management unit, direct memory access control, an I2C bus, an RS-232-C interface, and three counters/timers--all on the same chip.
1985 (Oct.)	Hitachi, Thomson	Under this cross-licensing agreement, Thomson will second-source Hitachi's 6800 CMOS 8-bit microcontrollers. In return, Thomson will provide Hitachi with telecommunications LSI technology.
1985 (July)	Toshiba, Siemens	This is a joint venture in DRAMs. Siemens agreed to pay Toshiba for design, testing, and production data on Toshiba's 1-Mbit DRAM. Siemens will thus speed up production of its megabit products. Both companies agreed on a cross-license agreement for the entire field of semiconductor component patents with mutual worldwide rights. Toshiba will gain access to Siemens' telecom technology.
1985 (May)	Oki, Voest Alpine	These companies plan a joint plant to be built in Austria to manufacture DRAMs, MPUs, and gate arrays.
1985 (May)	Oki, Thomson	Oki will supply a VLSI assembly line to the new Thomson plant in Maxeville, France, and a wafer fab line at the Eurotechnique plant in Rousset, France.

(Continued)

Table 1 (Continued)

JAPANESE-EUROPEAN SEMICONDUCTOR AGREEMENTS

Date	Companies	Agreement
1985 (May)	Toshiba, Olivetti	They are taking steps toward an alliance. Toshiba is buying 20 percent of Olivetti Japan to become a strategic supplier to Olivetti and, therefore, to Europe.
1985 (April)	Fuji, Thomson	Thomson will second-source Fuji's power modules. Fuji gets money; Thomson gets technology of high-power modules.
1985 (Mar.)	Kyocera, Philips	Philips will develop, produce, and sell electronic data networks in Japan.
1984	NMB (Minebea), Inmos	NMB acquired a license to manufacture Inmos' 256K CMOS DRAM, and Inmos will buy half of NMB's production. The two companies will also work toward a 1-Mbit chip.
1984 (Feb.)	Oki, Thomson	Under an alternate source agreement, Thomson will manufacture Oki's 2- and 3-micron families of CMOS gate arrays and Oki will manufacture Thomson's 2- and 3-micron families. These products will be simultaneously marketed by both companies on a worldwide basis.
1984 (June)	Fujitsu, ICL	The companies extended their 1981 cooperation agreement until 1991. Fujitsu will supply gate arrays to ICL; both companies will develop new products and become committed to OSI (the computer standard).
1984 (Oct.)	Hitachi, AMI	Gould AMI and Hitachi signed an alternate-source agreement for Hitachi's family of codecs (S44230 series), with AMI (Austria Microsystems International) marketing the products in Europe.
1982 (Ongoing)	Toshiba, SGS	In a continuing joint-venture agreement to develop CMOS process technology, both companies are jointly expanding CMOS logic. Manufacture will be in Italy and Japan jointly. SGS gets a modern, high-yield 3-micron CMOS process; Toshiba gets increased market penetration. The relationship will be extended to other technologies. The latest agreement is for telecom ICs.

Source: DATAQUEST
January 1986

Nielsen Dataquest

EUROPEAN
RESEARCH
NEWSLETTER

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1986-1

CHALLENGES IN AUTOMOTIVE ELECTRONICS

Attached is a copy of a talk given by Jerome G. Rivard, Chief Engineer to the Ford Motor Company, at DATAQUEST's recent Semiconductor Industry Conference in Tuscon, Arizona.

The text covers in detail the challenges and opportunities facing the automotive electronics community. As such, we believe that the subject matter will be of particular interest to the design marketing and quality managers of semiconductor suppliers serving the automotive marketplace.

Please address any questions related to this article to DATAQUEST in London.

Jim Beveridge

144/146 New Bond Street / London W1Y 9FD England / (01) 409-1427 / Telex 266195

1290 Ridder Park Drive / San Jose, CA 95131 / (408) 971-9000 / Telex 171973

CHALLENGES IN AUTOMOTIVE ELECTRONICS

Jerome G. Rivard
Chief Engineer
Electrical and Electronics Division
Ford Motor Company

INTRODUCTION

Good Morning. Once again I'm happy to be addressing my colleagues in the electronics community. The past couple of days have been most rewarding in terms of the information that's already been exchanged.

One hundred years ago, in 1885, Karl Benz, a German engineer, built the first workable automobile, a one cylinder, three-wheeled vehicle. We can imagine the challenges faced by Mr. Benz and other auto pioneers. There were basic vehicle needs to start, steer, run, and stop reliably.

Today, we're faced with quite a different set of challenges that I'm hopeful will be met in the near future.

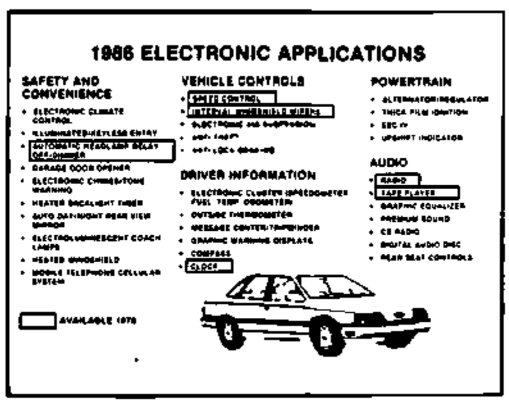
Accordingly, I think the title selected — "Challenges in Automotive Electronics" — is most appropriate for this conference. There's no question that the auto industry's long term viability hinges on our mutual efforts to be innovative, cooperative, and driven by a dedicated commitment to achieve uncompromising levels of quality. I can't emphasize enough that achieving *world class quality* is our major challenge in the automotive electronics arena. The automotive industry realizes that the vehicle's electronic, electrical and mechanical systems must be in harmony. It's a little bit like Frank Sinatra's lyrics in the old song about "Love and Marriage" — you know the one where he sings that . . . "you can't have one without the other." *That's* domestic harmony that keeps people together. Vehicle harmony keeps people loyal to their car company and it attracts *new* owners. We know that today's auto buyer has a wide choice in automobiles. We also know that today's consumer will take his business across the street (or across the world) if his vehicle fails to deliver top-notch, world-class performance.

FORD'S LONG TERM QUALITY TARGETS

At Ford, we've established long term quality targets *and* through the major contributions of the semiconductor industry, we've made good progress over the past few years but much work remains to be done, and we *need* additional help to achieve our goals. We can say with certainty that progress in the area of vehicle quality will require *new* approaches to both *engineering* and *manufacturing* motor vehicles. It will *also* require fresh, new approaches to the manufacturer-supplier relationship. The results of all these activities must make us cost competitive on a global basis while enhancing our quality levels.

Today, I'll discuss the current state of automotive electronics from a quality point of view . . . look at areas of specific concern that require our attention now . . . and review some electronic technologies where further development will usher in a host of automotive applications.

I think it's helpful to see where the automobile has progressed in terms of electronic applications.



This slide puts into perspective the significant presence of electronics in the automobile. The influence is rather remarkable when you think back only ten years when less than 20 per cent of these electronic systems were available.

NEED FOR CONSISTENT SUPPLIER QUALITY

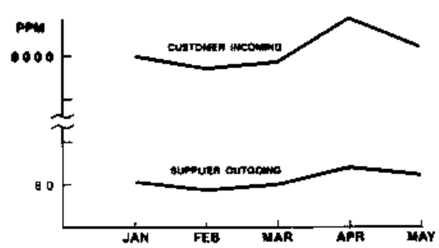
Let me say, here, that I think our semiconductor suppliers, overall, can do an excellent job of building quality parts. It's simply a matter of consistency. We need to see quality parts produced *each day* of the week. I hope some of the suggestions I'll make in the next few minutes will assist our suppliers in meeting quality levels that are consistent, day-in and day-out.

At Ford's Electrical and Electronics Division, we've set some quality goals for ourselves. By 1990, we have a goal to have *integrated circuit* quality levels of below 50 parts per million and *electronic module* quality below 400 parts per million for 5,000 hours of operation which is equivalent to 100,000 miles (or 10 years of vehicle life). These quality levels are certainly attainable but, frankly, we need to first resolve some important issues with you, our semiconductor suppliers.

The first area where we need to harmonize our efforts is in the way that quality is measured.

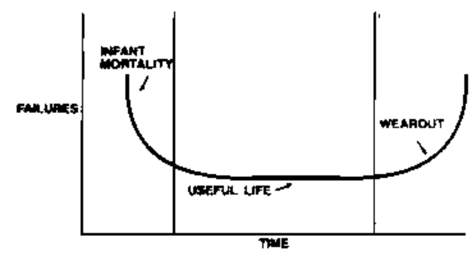
What's happening is this. Our incoming quality level at Ford — and I'm sure elsewhere — differs *dramatically* from what our suppliers are telling us about their outgoing quality levels. You'll note from the slide that there's *quite* a difference and what this tells me is that there's a *measurement problem* that needs to be made right. We're using different methods to measure quality. We're *out of step* on this issue quite significantly.

SUPPLIER OUTGOING QUALITY VERSUS CUSTOMER INCOMING QUALITY



It appears that major differences exist in outgoing and incoming test programs . . . inadequate component specifications related to part application . . . or several other factors could come into play here. To improve this situation, there are several actions I would like to see our suppliers take.

CLASSIC BATHTUB CURVE
BURN-IN



As a semiconductor supplier, and to help us understand the reasons for early field failures, you should be gathering "burn-in-data" on your components — and have a good idea how this data *helps you* as a quality screen. I also hope that you would share this data with us. We would like to know, for example, what your "infant mortality" rate is — and how long and at what temperature should we be burning parts in?

During the burn-in process, is it possible that some parts are being damaged by electrostatic discharge? Is burn-in the best screen for all parts? It's essential that we learn the answers to these kinds of questions. Customer satisfaction and loyalty are at stake!

TEST WITH COMPUTER AIDS

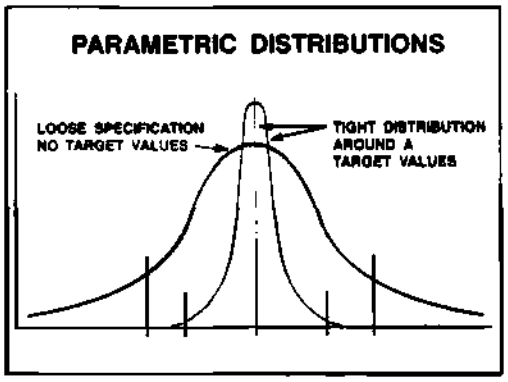
I strongly urge suppliers — who provide Ford Motor Company with complex microcomputers — to utilize computer aids to help develop designs capable of fault elimination that approaches *100 per cent*.

We'd like you — our suppliers — to visit our manufacturing plants to see, first hand, how your parts are processed. And, during your visits, pick up some *failed* parts and take them back to your company for a *thorough* failure analysis.

Once you've analyzed failed parts, tell us what's been discovered. More importantly, make the design, process, and test program changes required. If you think that we're doing something to damage parts, don't hesitate to tell us. The old days of doing business are gone, I hope, forever. We're not going to "shoot the messenger" for bringing us bad news.

WORK WITH US AND SHARE INFORMATION

Also, I would like you to insist on "correlation" and to make your test engineers available to work with us. And, please, don't tie our hands with "non-disclosure" agreements for information which is not really secret. Work with us as partners who *trust* each other and *share* information.



Another area we need to address is *specifications*. We have to stop thinking in terms of *tolerances* but, rather, design circuits to *target values*. At Ford, our specifications will soon emphasize target values and we'll expect our suppliers to provide parts with very tight distributions around our target values.

This approach will provide for better design margins in Ford products and this means better quality . . . reliability . . . and better yields for you.

Something else to consider is *electrostatic discharge* which is becoming a larger factor in quality and reliability concerns. You probably know that the major problem involving ESD is in the *latent damage* which shows up in the field. Let's be certain that our people are aware of this problem and that manufacturing plants and integrated circuits are up to the latest standards of ESD protection.

At Ford, we've tightened our requirements to 2000 volts — the industry standard *Human Body Model* — and we've adopted the so-called Charged Device Model which is widely used in Japan. This last model simulates the effects of *charged* machinery such as integrated circuit handlers.

Once again, I would ask you to visit our plants and tell us if you think there's an area where we can improve. I would like our suppliers to understand Ford facilities as they relate to ESD considerations. Of course, it works both ways because I continually encourage people from our Division to visit supplier plants. Getting to know each other's facilities makes good business sense for the manufacturer and supplier team to follow. Only good results can be expected from visiting and understanding each other's facilities.

OUR CHALLENGES . . . AND OPPORTUNITIES

Now, let's look at some specific areas that present us with an array of challenges . . . and opportunities.

Ford, along with most of the electronics industry, believes that surface mounted devices offer the best potential for improving electronic packaging density. Another benefit of SMD's is enhanced reliability. Ford has, in fact, committed itself to implementing surface mounted device technology and we've initially targeted radios and engine control modules. By the end of 1985, Ford will have placed a cumulative total of 84 million SMD's with an expected increase to an annual 3 billion SMD's in the 1990's.

Let me give you a good news-bad news perspective on the current state of surface mounted devices. Looking at advantages, I've mentioned the important benefit of higher component density. To date, board space savings has amounted to one third to one half — and permitted more circuit functions and complexity. In addition, SMD's provide us with a meaningful size and weight reduction at the module level.

The SMD process is highly automatable.

Surface mounted devices also provide improved shock and vibration characteristics and because of the shorter interconnects, there's lower electromagnetic and radio frequency interference susceptibility.

Now, taking a look at the other side of the coin, here are some areas that need to be improved.

Consider the importance of machine compatibility with package tolerances — and the board layout. Time and time again, we've seen that incompatible equipment and parts just don't mix. I'd also like to remind you that electrostatic discharge can be a problem if the parts are not packaged with conductive tapes.

There's a current lack of component availability and standardization. For example, small outline transistor packages vary in footprint and body sizes. This results in various problems with circuit layout and manufacturing.

Plastic "J" leaded quad packs require improved planarity since problems are occurring during subsequent reflow solder operations. We would like to have less than a 2 mil variation across all leads.

We would like to see IC suppliers improve their component reliability by evaluating packaged components through various soldering processes — including wave soldering, infra-red and vapor phase. Let me just remind you that we have other in-plant processes that affect component reliability. We think, therefore, that component reliability can also be improved by joint Ford-Supplier programs that identify critical in-plant processes and assess their impact on component reliability.

Moving on, we need to have SMD tape and reel standards because, from a user perspective, the ability to utilize a reel on any given machine is a significant advantage. An industry standard is also needed for a superior, conductive plastic embossed tape.

We would also consider it to be a positive step to see the development of SMD packaging with lower thermal resistance.

Tape automated bonding offers the potential for quality improvement, size reduction, and better thermal management.

We believe that the semiconductor industry needs to bring this technology into the mainline manufacturing system and we strongly encourage the industry's action in this area.

Looking at testability issues, we feel that *significant improvements* are required for handling equipment involving small outline transistors, small outline integrated circuits, and quad packaging

Currently, the co-planarity of device leads may be *distorted* by test equipment handlers and burn-in sockets.

When required, there's a need to develop effective methods of applying "burn-in" and other conditioning screens to SMD packaged IC's. When evaluating devices that are packaged as small outline integrated circuits, test sockets are required for quick insertion and removal. These test sockets are very expensive and the handling process results in a high probability of damaging the parts when they're mounted or removed from the sockets. Now, even though this particular problem may be unique to the test equipment makers, we all retain a vested interest in the development of the right equipment.

QUALITY IS THE GOAL

I hope that the concerns I just presented will be acted upon by our semiconductor suppliers at a quicker pace. I know you're working on many of these concerns already. The resolution of these issues will help bring us the quality products that are demanded in today's global automotive market — and, as a spin-off benefit, answer the needs of the electronics market in general.

BETTER BUSINESS PRACTICES

Next, I'd like to switch gears for a few minutes and talk about *better ways* of doing business.

Ford Motor Company is encouraging its suppliers to *plan* for quality through new, improved business and manufacturing practices

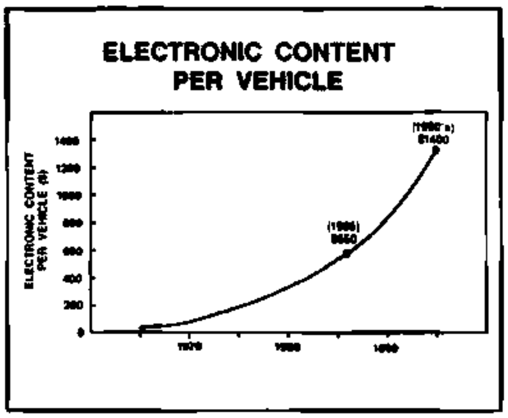
We're encouraging a no-secrets, up-front, open relationship with each supplier. We're reducing our supplier base to those companies who meet "best in quality" credentials from planning to manufacturing Ford is looking for long term, partnership-type relationships.

One technique we'd like to see *all* of our suppliers adopt is *statistical process control*. In what should be considered to be ancient history, most manufacturers used screens to weed out bad parts. No more! This method is both wasteful and costly Establishing a statistically-controlled process simply means that the quality level can be controlled, maintained, and improved based on reproducible; consistent results Screening should be practiced primarily for monitoring and feedback purposes, not to eliminate unacceptable parts. Unfortunately, screens (i.e., burn-in), are still required to weed out infant mortality.

SPC MEANS PRODUCT UNIFORMITY

A key benefit of SPC is the ability to consistently produce product uniformity. As I mentioned earlier, at Ford we're designing to *target values* and our specifications will soon reflect this. Moreover, we *expect* tight distributions around these target values — and these target values are attainable through statistical process control and design of experiments.

Now that we've looked at some areas of mutual concern, I would like to talk about a number of electronic technologies and their automotive applications.



Let me remind you that by the 1990's, electronic content per vehicle should be about $1400 worldwide. The U.S. electronics content per vehicle today is projected to be $650. One conclusion we can draw with certainty is the need for technological breakthroughs and a need for the highest product quality to support this expanded electronic content.

ELECTRONIC TECHNOLOGIES AND THEIR AUTOMOTIVE APPLICATIONS

Memories

The expanded use and sophistication of microprocessors in automobiles has required large amounts of read-only memory, ROM, and the need to turn around new ROM codes quickly. Let me just say that the strides the industry is making toward cost effective EPROM and E^2PROM is most appreciated. In fact, EPROM's have significantly helped our 1986 engine control program.

With respect to alterable memory, I would encourage suppliers of microcomputers with EPROM or E^2PROM technology to insure that all designs are 100% testable down to the cell level.

Power Devices

With the continued growth of automotive electronic systems, the use of power devices will increase substantially. Recently, power devices and control circuitry have been combined on a single IC, resulting in a *smart* power device. This development opens the door to new applications which could include power supplies, electronic relays, multiplex wiring, and actuator drivers.

For these applications to become "real-world," we need lower costs and further reductions in on-resistance. Smart power devices need to be capable of being utilized in a multiplexed wiring system.

For starters, we need a maximum cost of $2.00 for a 20 amp high-side switch which has on-resistance performance of less than one volt.

For widespread automotive applications, we need to drive the cost down to $1.00 and have a one-tenth volt drop across the device.

Microprocessors

There's no sense in reviewing the obvious — the tremendous advances we've had in microprocessor technology. There are, however, a few areas where certain developments would represent major progress — and make a great deal of sense.

Most automotive computers are part of systems which have high power loads. Today, discrete power devices interface between the computers and the loads. The auto industry needs the combination of computer and power driver technology on the same chip. This will reduce our module complexity and size while improving overall reliability.

Data sharing, through inter-computer data communication links, is another worthy goal that promises many customer benefits including vehicle reliability and added functional content. A good example would be data sharing between the vehicle's engine module and electronic instrumentation. This would eliminate redundant sensors.

We're looking for cost effective digital signal processing for application to our audio products. The fast pace at which design rules are shrinking will hopefully bring the day closer when the DSP complex functions can be implemented on a die size which is cost competitive — on a system basis — with today's analog approaches.

Sensors

Another key technology with strong automotive ties is sensors — and the need for sensors continues to increase. I'm looking for the development of *smart* sensors — the integration of electronics into sensing elements. This accomplishment would enable us to perform signal conditioning, self diagnostics, and simple vehicle computations.

We also need new sensor developments to meet such automotive applications as fluid level checks and condition, non-contacting rotary and linear position, accelerometers for use in ride and handling control, accurate and durable mass air flow management, and in-cylinder engine parameters.

FULL SERVICE SENSOR SUPPLIER CAPABILITIES

I'd just like to interject a thought here on sensor suppliers. We've found that those companies who have *full service* capability provide us with the best sensor products. Full service means a sensor supplier who has outstanding capabilities in technology, design expertise, manufacturing, and application experience.

Along with the potential sensor developments and company capabilities I just mentioned, we'll need advances in distributing power and information throughout the vehicle.

Multiplex Wiring

There's no question that the wiring harness has become complex and bulky. Multiplex wiring offers a solution to the ever-growing nest of wires. Our vision calls for a multiplex wiring system that consists of a "bus" that's made up of power and ground wires and a pair of signal wires that interconnect all of the vehicle's modules, sensors, and actuators. Each of these products would have an intelligent interface to the bus. To achieve this vision, we need continued development of key technologies by our electronic suppliers. These key technologies include smart power high side drivers and H drivers with ratings of 4, 10, 20 and 40 amps. These devices should have overload protection and provide status feedback.

Microcomputer features we would be happy to see include CMOS with a "sleep mode" for low key off current, on-chip E^2PROM to help us minimize the number of unique modules and microcomputer codes, additional on chip RAM, and an on-chip serial port for the logic portion of the multiplex signal interface.

There's a need for a line driver with low voltage drop — and an on-chip line receiver, both, which operate from 10 to 16 volts DC.

Finally, on our multiplex wiring "want list," are insulator piercing connectors that are reliable in an automotive environment. This development would, of course, ease the connection to the multiplex wiring bus.

SUMMARY

Over the past several minutes, I've reviewed the key challenges and opportunities facing those of us in the electronics community. I have no doubt that all of these challenges and opportunities will be fully exploited.

I began this talk by emphasizing the need for quality parts and I want to end on the same note.

I urge all of you to consider the issue of quality, its short-term and long range implications.

Quality products — supported by a quality *attitude* throughout the industry — is the key to the present and the future

Quality electronics, designed and manufactured to exacting standards, will *earn* us the worldwide consumer acceptance we all aspire to. This may sound like a philosophy we all learned in Engineering 101, but, unfortunately one that hasn't always been fully embraced.

Ford has the Q1 Preferred Quality Supplier Program that provides recognition to suppliers who have consistent high levels of product quality. These suppliers are rated on a number of criteria that take into consideration the supplier's overall quality effort. Here are the semiconductor company facilities rated Ford Q1.

- Cherry Semiconductor, East Greenwich, Rhode Island
- General Instruments, Hicksville, New York
- Motorola, Phoenix, Arizona
- NEC, Fukui City, Japan
- RCA, Mountaintop, Pennsylvania
- Sprague, Concord, New Hampshire
- Texas Instruments, Dallas, Texas
- Toshiba, Kawasaki, Japan

I congratulate the management and employees of these firms for their dedication to quality workmanship.

At Ford, we're committed to make quality an inherent ingredient of our corporate culture. It must be a *basic* commitment in every employee's work ethic.

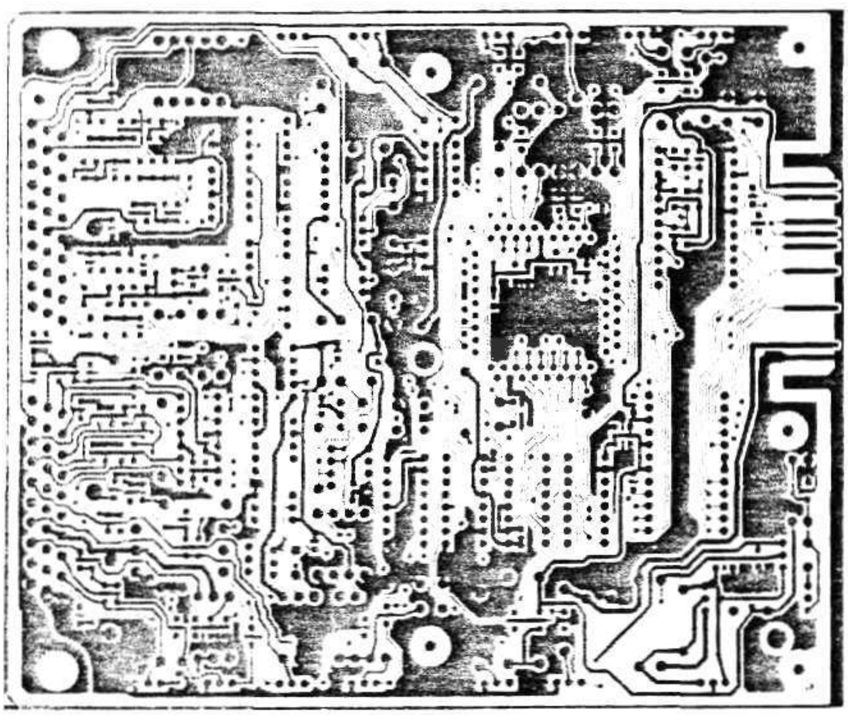
I hope that all of our suppliers (and potential suppliers) adopt a similar corporate-wide perspective.

FORD PLUS YOU! LET'S MAKE IT A SUCCESSFUL PARTNERSHIP

In closing, I'd just like to emphasize that the *time* to move forward on the worldwide electronics front has never been more pressing.

We can *identify* our challenges. We can *see* our opportunities. We can take *action* to achieve our mutual goals.

The automotive industry and Ford Motor Company welcome your ideas, innovation, and enthusiasm.



Nielsen Dataquest

EUROPEAN RESEARCH NEWSLETTER

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PRELIMINARY 1985 EUROPEAN MARKET SHARE ESTIMATES

SUMMARY

DATAQUEST's preliminary 1985 estimates of European semiconductor revenues for the 25 leading European, U.S., and Japanese suppliers total US$4,171 million compared with an estimated $4,170 million in 1984. This shows essentially zero growth compared with our estimated 2 percent dollar decline for the European semiconductor market. These 25 companies accounted for approximately 87 percent of the $4,805 million market in 1984 and should improve this share to 88 percent in 1985.

The revenue growth picture of the 25 companies was substantially better in local currencies than in U.S. dollars. When measured in terms of local currencies, the estimated 1985 revenues of the leading 25 suppliers grew approximately 5 percent against 1984 revenues. The phenomenon of the exchange rate tends to mask the real growth of the European suppliers that, on average, derive approximately 72 percent of their total worldwide semiconductor revenues in Europe.

During 1985, all European currencies declined against the U.S. dollar, as they had since 1981. The average regional exchange rates during 1985 were 1 to 14 percent below their respective average 1984 rates. (See ESIS Volume IV, Exchange Rate Quarterly Newsletter, for further details.)

DATAQUEST's complete 1985 European market share estimates are scheduled for publication in May 1986.

SEMICONDUCTOR SUPPLIERS

Table 1 shows DATAQUEST's estimates of the 1985 IC, discrete, and optoelectronic revenues in Europe for the leading 25 suppliers in Europe. Of these 25 companies, 8 are European-based, 13 are U.S.-based, and 4 are Japanese-based. Table 2 compares the 1984 and 1985 estimated European semiconductor revenues of these companies.

144/146 New Bond Street / London W1Y 9FD England / (01) 409-1427 / Telex 266195

1290 Ridder Park Drive / San Jose, CA 95131 / (408) 971-9000 / Telex 171973

Table 1

ESTIMATED 1985 EUROPEAN SEMICONDUCTOR REVENUES OF 25 LEADING SUPPLIERS (Millions of U.S. Dollars)

Company	IC	Discrete	Opto	Total
Philips-Signetics	$388	$185	$23	$596
Signetics	$104	$ 0	$ 0	$104
Texas Instruments	$455	$ 9	$10	$474
Motorola	$246	$126	$ 4	$376
Siemens*	$155	$ 85	$50	$290
Thomson Semiconductors	$147	$ 91	$ 2	$240
Intel	$230	$ 0	$ 0	$230
National Semiconductor	$215	$ 2	$ 1	$218
SGS	$157	$ 39	$ 0	$196
ITT	$100	$ 90	$ 0	$190
NEC	$178	$ 5	$ 1	$184
Hitachi	$161	$ 6	$ 2	$169
AMD	$156	$ 0	$ 0	$156
Telefunken Electronic	$ 48	$ 54	$36	$138
Fairchild	$101	$ 7	$ 3	$111
Toshiba	$ 55	$ 13	$ 6	$ 74
Fujitsu	$ 71	$ 0	$ 0	$ 71
RCA	$ 56	$ 13	$ 2	$ 71
Plessey	$ 58	$ 0	$ 8	$ 66
Ferranti	$ 50	$ 15	$ 0	$ 65
Analog Devices	$ 53	$ 0	$ 0	$ 53
Monolithic Memories	$ 46	$ 0	$ 0	$ 46
General Instrument	$ 23	$ 12	$ 9	$ 44
Hewlett-Packard	$ 0	$ 6	$35	$ 41
Matra-Harris	$ 36	$ 0	$ 0	$ 36
General Electric-Intersil	$ 21	$ 8	$ 6	$ 36
Intersil	$ 21	$ 1	$ 0	$ 22

*Includes Litronix

Source: DATAQUEST
January 1986

Table 2

ESTIMATED 1985 VERSUS 1984 EUROPEAN SEMICONDUCTOR REVENUES OF 25 LEADING SUPPLIERS
(Millions of U.S. Dollars)

Company	1984	1985	Annual Growth
Philips-Signetics	$546	$596	9.16%
Signetics	$ 90	$104	15.56%
Texas Instruments	$522	$474	(9.20%)
Motorola	$385	$376	(2.34%)
Siemens*	$280	$290	3.57%
Thomson Semiconductors	$210	$240	14.29%
Intel	$225	$230	2.22%
National Semiconductor	$237	$218	(8.02%)
SGS	$180	$196	8.89%
ITT	$171	$190	11.11%
NEC	$203	$184	(9.36%)
Hitachi	$201	$169	(15.92%)
AMD	$170	$156	(8.24%)
Telefunken Electronic	$133	$138	3.76%
Fairchild	$110	$111	0.91%
Toshiba	$ 82	$ 74	(9.76%)
Fujitsu	$ 58	$ 71	22.41%
RCA	$ 88	$ 71	(19.32%)
Plessey	$ 51	$ 66	29.41%
Ferranti	$ 67	$ 65	(2.99%)
Analog Devices	$ 44	$ 53	20.45%
General Instrument	$ 50	$ 44	(12.00%)
Monolithic Memories	$ 36	$ 46	27.78%
Hewlett-Packard	$ 41	$ 41	0.00%
Matra-Harris	$ 37	$ 36	(2.70%)
General Electric-Intersil	$ 43	$ 36	(16.27%)
Intersil	$ 21	$ 22	(4.80%)

*Includes Litronix

Source: DATAQUEST
January 1986

Japanese suppliers, having made strong gains in the European market in 1984, lost ground slightly in 1985. DATAQUEST estimates that overall Japanese semiconductor revenues in Europe will decrease approximately 6.6 percent over 1984 figures, reaching $567 million, or 12.0 percent of the European market, in 1985. This represents a 1985 market share decrease of 0.6 percent from the Japanese companies' 1984 European market share of 12.6 percent.

The penetration of Japanese companies in the bipolar digital, linear, and discrete markets has been negligible; their market remains almost exclusively in the MOS IC arena.

European-based companies gained approximately 2 percent market share from the Japanese and U.S.-based suppliers. This brought their market share back up to their 1983 level of approximately 36 percent.

The U.S. and Japanese suppliers' loss of market share can largely be attributed to the rapid decline in the value of the commodity memory and logic markets, where the U.S. and Japanese companies generated much of their revenues in 1984, and where European companies have not been major participants. The bipolar logic market, which is dominated by major U.S. companies, declined by an estimated 4 percent in 1985; and the MOS memory market, which is dominated by Japanese and U.S. companies, declined by an estimated 24 percent. Companies that rely heavily on these products for their revenues, particularly MOS memory, have been severely affected by the rapid decline in market prices as suppliers with excess capacity have vied to win business in a shrinking market. European companies, with less dependence on these products and higher activity levels in the products that grew in 1985, were able to recover previously lost share.

Table 3 shows DATAQUEST's estimates of the 1985 IC, discrete, and optoelectronic worldwide revenues for the leading 10 European suppliers, and Table 4 compares the 1984 and 1985 estimated Worldwide revenues of these companies.

Table 3

ESTIMATED 1985 WORLDWIDE SEMICONDUCTOR REVENUES OF 10 LEADING EUROPEAN SUPPLIERS (Millions of U.S. Dollars)

Company	IC	Discrete	Opto	Total
Philips-Signetics	$808	$235	$25	$1,068
Signetics	$470	$ 0	$ 0	$ 470
Siemens*	$205	$140	$75	$ 420
Thomson Semiconductors	$197	$123	$ 4	$ 324
SGS	$240	$ 60	$ 0	$ 300
Telefunken Electronic	$ 68	$ 61	$41	$ 170
Plessey	$ 89	$ 0	$10	$ 99
Ferranti	$ 78	$ 20	$ 0	$ 98
Inmos	$ 85	$ 0	$ 0	$ 85
Semikron	$ 0	$ 48	$ 0	$ 48
Matra Harris	$ 42	$ 0	$ 0	$ 42

*Includes Litronix

Source: DATAQUEST
January 1986

Table 4

ESTIMATED 1985 VERSUS 1984 WORLDWIDE SEMICONDUCTOR REVENUES OF
10 LEADING EUROPEAN SUPPLIERS
(Millions of U.S. Dollars)

Company	1984	1985	Annual Growth
Philips-Signetics	$1,325	$1,068	(19.40%)
Signetics	$ 765	$ 470	(38.56%)
Siemens*	$ 450	$ 420	(6.67%)
Thomson Semiconductors	$ 301	$ 324	7.64%
SGS	$ 335	$ 300	(10.45%)
Telefunken Electronic	$ 161	$ 170	5.59%
Plessey	$ 82	$ 99	20.73%
Ferranti	$ 105	$ 98	(6.67%)
Inmos	$ 146	$ 85	(41.78%)
Semikron	$ 40	$ 48	20.00%
Matra Harris	$ 41	$ 42	2.44%

*Includes Litronix

Source: DATAQUEST
January 1986

DATAQUEST's preliminary 1985 estimates of worldwide semiconductor revenues for the 10 leading European suppliers total $2,654 compared with an estimated $2,986 in 1984. This shows an 11.1 percent decline compared with our estimated 16.6 percent dollar decline for the worldwide semiconductor market. These 10 companies accounted for approximately 10.4 percent of the $28,676 million market in 1984, and increased slightly to 11.1 percent in 1985.

IC Suppliers

Preliminary DATAQUEST estimates for the 15 leading IC suppliers in Europe in 1985 are shown in Table 5. Collectively, these suppliers show an estimated 0.1 percent IC revenue growth. These companies represent approximately 80 percent of the estimated 1985 market. The major revenue gains were made by Plessey, Fujitsu, Thomson, ITT, SGS, Philips-Signetics, Fairchild, and Intel, all of which either maintained or improved their respective market share.

Table 5

ESTIMATED EUROPEAN INTEGRATED CIRCUIT REVENUES OF
15 LEADING SUPPLIERS
(Millions of U.S. Dollars)

Company	1984	1985	Annual Growth
Texas Instruments	$477	$455	(4.61%)
Philips-Signetics	$351	$388	10.54%
Signetics	$ 90	$104	15.56%
Motorola	$265	$246	(7.17%)
Intel	$225	$230	2.22%
National Semiconductor	$233	$215	(7.73%)
NEC	$198	$178	(10.10%)
Hitachi	$193	$161	(16.58%)
SGS	$137	$157	14.60%
AMD	$170	$156	(8.24%)
Siemens*	$160	$155	(3.13%)
Thomson Semiconductors	$125	$147	17.60%
Fairchild	$ 97	$101	4.12%
ITT	$ 87	$100	14.94%
Fujitsu	$ 58	$ 71	22.41%
Plessey	$ 45	$ 58	28.89%

*Includes Litronix

Source: DATAQUEST
January 1986

Bipolar Digital Suppliers

Preliminary DATAQUEST estimates for the 14 leading bipolar IC suppliers in Europe in 1985 are shown in Table 6. Tables 7 and 8 break the estimates down into bipolar memories and bipolar logic, respectively.

In a 1985 European bipolar digital market of $758 million, DATAQUEST estimates that Texas Instruments supplied approximately 26 percent of the market, compared with the second largest bipolar digital supplier, Philips-Signetics, which supplied approximately 12 percent of the market. SGS, Plessey, Siemens, Monolithic Memories, and Thomson showed the most significant growth in this technology.

Table 6

ESTIMATED EUROPEAN BIPOLAR DIGITAL REVENUES OF
14 LEADING SUPPLIERS
(Millions of U.S. Dollars)

Company	1984	1985	Annual Growth
Texas Instruments	$207	$195	(5.80%)
Philips-Signetics	$ 82	$ 90	9.76%
Signetics	$ 71	$ 79	11.27%
Fairchild	$ 62	$ 70	12.90%
Motorola	$ 69	$ 68	(1.45%)
AMD	$ 55	$ 57	3.64%
National Semiconductor	$ 58	$ 45	(22.41%)
Monolithic Memories	$ 29	$ 37	27.59%
Siemens*	$ 24	$ 31	29.17%
Ferranti	$ 26	$ 28	7.69%
SGS	$ 11	$ 20	81.82%
Harris	$ 20	$ 19	(5.00%)
Intel	$ 20	$ 19	(5.00%)
Thomson Semiconductors	$ 14	$ 17	21.43%
Plessey	$ 9	$ 13	44.44%

*Includes Litronix

Table 7

ESTIMATED EUROPEAN BIPOLAR MEMORY REVENUES OF
8 LEADING SUPPLIERS
(Millions of U.S. Dollars)

Company	1984	1985	Annual Growth
AMD	$23	$25	8.70%
Monolithic Memories	$19	$24	26.32%
Philips-Signetics	$18	$23	27.78%
Signetics	$17	$23	35.29%
Texas Instruments	$19	$22	15.79%
Fairchild	$15	$17	13.33%
Harris	$15	$15	0.00%
Thomson Semiconductors	$ 8	$10	25.00%
Motorola	$ 9	$ 9	0.00%

Source: DATAQUEST
January 1986

Table 8

ESTIMATED EUROPEAN BIPOLAR LOGIC REVENUES OF 12 LEADING SUPPLIERS
(Millions of U.S. Dollars)

Company	1984	1985	Annual Growth
Texas Instruments	$188	$173	(7.98%)
Philips-Signetics	$ 64	$ 67	4.69%
Signetics	$ 54	$ 56	3.70%
Motorola	$ 60	$ 59	(1.67%)
Fairchild	$ 47	$ 53	12.77%
National Semiconductor	$ 53	$ 40	(24.53%)
AMD	$ 32	$ 32	0.00%
Ferranti	$ 26	$ 28	7.69%
Siemens*	$ 22	$ 27	22.73%
SGS	$ 11	$ 20	81.82%
Intel	$ 19	$ 19	0.00%
Monolithic Memories	$ 10	$ 13	30.00%
Plessey	$ 9	$ 13	44.44%

*Includes Litronix

Source: DATAQUEST
January 1986

MOS Suppliers

The 15 leading 1985 MOS suppliers in Europe accounted for approximately 81 percent of the estimated market, as shown in Table 9. This represents a 2 percent increase in market share from 1984. Intel, the dominant MOS supplier, increased its lead in MOS slightly from approximately 10 percent in 1984 to 11 percent in 1985. NEC and Philips-Signetics vied for second place, and Texas Instruments and Hitachi battled for fourth place. Together, these five companies accounted for approximately 44 percent for the 1985 European MOS market. The biggest growth was shown by Thomson, Fujitsu, ITT, Philips-Signetics, Intel, and SGS, all of which exhibited above average market growth.

Tables 10, 11, and 12 show DATAQUEST's estimates of 1984 and 1985 revenue for European MOS memory, MOS microprocessor, and MOS logic, respectively, for the leading suppliers. Tables 13 and 14 show DATAQUEST's estimates of 1983 and 1984 European NMOS and CMOS revenues, respectively, for the leading suppliers.

Table 9

ESTIMATED EUROPEAN MOS REVENUES OF
15 LEADING SUPPLIERS
(Millions of U.S. Dollars)

Company	1984	1985	Annual Growth
Intel	$205	$211	2.93%
NEC	$187	$166	(11.23%)
Philips-Signetics	$147	$162	10.20%
Signetics	$ 7	$ 11	57.14%
Texas Instruments	$173	$148	(14.45%)
Hitachi	$179	$147	(17.88%)
Motorola	$135	$120	(11.11%)
AMD	$108	$ 93	(13.89%)
Thomson Semiconductors	$ 60	$ 75	25.00%
Siemens*	$ 88	$ 70	(20.45%)
National Semiconductor	$ 75	$ 64	(14.67%)
Fujitsu	$ 53	$ 62	16.98%
SGS	$ 62	$ 61	(1.61%)
ITT	$ 53	$ 60	13.21%
Toshiba	$ 68	$ 52	(23.53%)
RCA	$ 58	$ 45	(22.41%)

Table 10

ESTIMATED EUROPEAN MOS MEMORY REVENUES OF
11 LEADING SUPPLIERS
(Millions of U.S. Dollars)

Company	1984	1985	Annual Growth
Texas Instruments	$136	$115	(15.44%)
Hitachi	$143	$109	(23.78%)
NEC	$111	$ 91	(18.02%)
Intel	$ 95	$ 85	(10.53%)
Fujitsu	$ 49	$ 53	8.16%
Toshiba	$ 59	$ 39	(33.90%)
AMD	$ 56	$ 35	(37.50%)
Siemens*	$ 38	$ 24	(36.84%)
Mostek	$ 74	$ 23	(68.92%)
Mitsubishi	$ 16	$ 21	31.25%
Thomson Semiconductors	$ 24	$ 21	(12.50%)

*Includes Litronix

Source: DATAQUEST
January 1986

Table 11

ESTIMATED EUROPEAN MOS MICROPROCESSOR REVENUES OF
12 LEADING SUPPLIERS
(Millions of U.S. Dollars)

Company	1984	1985	Annual Growth
Intel	$96	$114	18.75%
NEC	$60	$ 59	(1.67%)
Motorola	$38	$ 49	28.95%
AMD	$43	$ 47	9.30%
Philips-Signetics	$30	$ 35	16.67%
Signetics	$ 4	$ 8	100.00%
Hitachi	$27	$ 29	7.41%
National Semiconductor	$30	$ 29	(3.33%)
Thomson Semiconductors	$15	$ 28	86.67%
RCA	$16	$ 16	0.00%
SGS	$16	$ 13	(18.75%)
Siemens*	$14	$ 13	(7.14%)
Texas Instruments	$15	$ 13	(13.33%)

Table 12

ESTIMATED EUROPEAN MOS LOGIC REVENUES OF
13 LEADING SUPPLIERS
(Millions of U.S. Dollars)

Company	1984	1985	Annual Growth
Philips-Signetics	$113	$119	5.31%
Signetics	$ 0	$ 0	0.00%
Motorola	$ 52	$ 52	0.00%
ITT	$ 48	$ 50	4.17%
SGS	$ 33	$ 35	6.06%
Siemens*	$ 36	$ 33	(8.33%)
Plessey	$ 23	$ 29	26.09%
Thomson Semiconductors	$ 21	$ 26	23.81%
National Semiconductor	$ 28	$ 23	(17.86%)
RCA	$ 33	$ 23	(30.30%)
Texas Instruments	$ 22	$ 20	(9.09%)
MEDL	$ 15	$ 19	26.67%
AMI	$ 16	$ 16	0.00%
NEC	$ 16	$ 16	0.00%

*Includes Litronix

Source: DATAQUEST
January 1986

Table 13

ESTIMATED EUROPEAN NMOS REVENUES OF
12 LEADING SUPPLIERS
(Millions of U.S. Dollars)

Comapny	1984	1985	Annual Growth
Intel	$203	$203	0.00%
NEC	$164	$137	(16.46%)
Texas Instruments	$143	$121	(15.38%)
Hitachi	$135	$101	(25.19%)
AMD	$108	$ 91	(15.74%)
Philips-Signetics	$ 77	$ 81	5.19%
Signetics	$ 7	$ 11	57.14%
Siemens*	$ 81	$ 67	(17.28%)
Thomson Semiconductors	$ 42	$ 49	16.67%
Fujitsu	$ 34	$ 48	41.18%
Motorola	$ 66	$ 39	(40.91%)
SGS	$ 38	$ 36	(5.26%)
ITT	$ 32	$ 33	3.13%

*Includes Litronix

Table 14

ESTIMATED EUROPEAN CMOS REVENUES OF
12 LEADING SUPPLIERS
(Millions of U.S. Dollars)

Company	1984	1985	Annual Growth
Motorola	$69	$81	17.39%
Philips-Signetics	$70	$81	15.71%
Signetics	$ 0	$ 0	0.00%
National Semiconductor	$49	$52	6.12%
Hitachi	$44	$46	4.55%
RCA	$58	$45	(22.41%)
Toshiba	$47	$42	(10.64%)
NEC	$23	$29	26.09%
Thomson Semiconductors	$18	$26	44.44%
SGS	$24	$25	4.17%
Matra-Harris	$20	$25	25.00%
Texas Instruments	$20	$23	15.00%
ITT	$16	$22	37.50%

Source: DATAQUEST
January 1986

Linear Suppliers

DATAQUEST estimates that the 1985 European linear market reached $894 million, or approximately 25 percent of the total IC market. As shown in Table 15, the 10 leading 1985 linear suppliers in Europe accounted for approximately 81 percent of the market in 1985, an increase from approximately 80 percent in 1984. The major supplier, Philips-Signetics, remained unchanged with approximately 15 percent market share, slightly ahead of Texas Instruments and National Semiconductor, each with approximately a 12 percent share.

In 1985, the European linear IC market was one of the stronger sectors, growing about 9 percent from its 1984 level. This compares with the overall European total semiconductor and IC markets, which declined approximately 2 percent and 3 percent respectively.

Table 15

ESTIMATED EUROPEAN LINEAR REVENUES OF 10 LEADING SUPPLIERS (Millions of U.S. Dollars)

Company	1984	1985	Annual Growth
Philips-Signetics	$122	$136	11.48%
Signetics	$ 12	$ 14	16.67%
Texas Instruments	$ 97	$112	15.46%
National Semiconductor	$100	$106	6.00%
SGS	$ 64	$ 76	18.75%
Motorola	$ 61	$ 58	(4.92%)
Thomson Semiconductors	$ 51	$ 55	7.84%
Siemens*	$ 48	$ 54	12.50%
Analog Devices	$ 44	$ 53	20.45%
ITT	$ 34	$ 40	17.65%
Telefunken Electronic	$ 35	$ 37	5.71%

*Includes Litronix

Source: DATAQUEST
January 1986

Discrete Suppliers

Table 16 shows DATAQUEST's preliminary estimates of 1984 and 1985 European discrete revenues for the 12 leading suppliers. Collectively, these 10 suppliers accounted for 79 percent of the total market, up from 75 percent in 1984. Seven of the ten leading suppliers are European-owned companies accounting for 53 percent of the total market. There are no Japanese-owned companies among the leading suppliers. Philips-Signetics maintained its market leadership with approximately 19 percent market share, with Motorola in second place with approximately 13 percent market share.

Table 16

ESTIMATED EUROPEAN DISCRETE REVENUES OF 10 LEADING SUPPLIERS (Millions of U.S. Dollars)

Company	1984	1985	Annual Growth
Philips-Signetics	$179	$185	3.35%
Signetics	$ 0	$ 0	0.00%
Motorola	$117	$126	7.69%
Thomson Semiconductors	$ 85	$ 91	7.06%
ITT	$ 84	$ 90	7.14%
Siemens*	$ 85	$ 85	0.00%
Telefunken Electronic	$ 54	$ 54	0.00%
SGS	$ 43	$ 39	(9.30%)
International Rectifier	$ 30	$ 33	10.00%
Semikron	$ 27	$ 30	11.11%
Brown-Boveri	$ 22	$ 24	9.09%

*Includes Litronix

Source: DATAQUEST
January 1986

Optoelectronic Suppliers

Table 17 shows DATAQUEST's preliminary estimates of the 1984 and 1985 European optoelectronic revenues for the five leading suppliers. Siemens maintained its leadership position with approximately 21 percent of the European market, with Telefunken Electronic and Hewlett-Packard vying for second place, each with approximately 15 percent market share. The European-based suppliers exhibited an overall market strength in optoelectronics with three of the top five suppliers being European based.

Table 17

ESTIMATED EUROPEAN OPTOELECTRONIC REVENUES OF 5 LEADING SUPPLIERS (Millions of U.S. Dollars)

Company	1984	1985	Annual Growth
Siemens*	$35	$50	42.86%
Telefunken Electronic	$33	$36	9.09%
Hewlett-Packard	$34	$35	2.94%
Philips-Signetics	$16	$23	43.75%
Signetics	$ 0	$ 0	0.00%
Texas Instruments	$18	$10	(44.44%)

*Includes Litronix

Source: DATAQUEST
January 1986

Exchange Rates

Table 18 lists the 1984 and 1985 exchange rates used in compiling the attached market share estimates.

Jennifer Berg

Table 18

AVERAGE 1984 AND 1985 EXCHANGE RATES
(Local Currency Per U.S. Dollars)

Country	1984	1985
Austria	20.00	21.29
Belgium	57.78	61.19
Denmark	10.36	10.92
Finland	6.01	6.35
France	8.74	9.26
Greece	112.72	125.13
Ireland	0.92	0.93
Italy	1757.00	1961.83
Luxembourg	62.34	61.12
Netherlands	3.21	3.42
Norway	8.16	8.79
Portugal	146.39	173.65
Spain	160.76	173.25
Sweden	8.27	8.80
Switzerland	2.35	2.53
United Kingdom	0.75	0.75
West Germany	2.85	3.03
Japan	246.08	237.45

Source: DATAQUEST
January 1986

Nielsen Dataquest
EUROPEAN RESEARCH NEWSLETTER

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AUSTRIA MICROSYSTEMS INTERNATIONAL-- DEDICATED TO SERVING EUROPE

OVERVIEW

American Microsystems Inc. (AMI), founded in 1966 in Santa Clara, California, was the first dedicated custom MOS integrated circuit manufacturer. In 1981, AMI was acquired by Gould Inc., a major multinational electronic equipment manufacturer, to provide a high-level semiconductor capability within Gould Inc. Today, AMI operates as a separate entity within the Gould group and, in addition to operating as a merchant supplier of custom and semicustom devices, supports the in-house requirements.

Also in 1981, AMI formed a joint venture called Austria Microsystems International (AMI-Austria) with Voest-Alpine, Austria's largest nationalized industrial group. Voest-Alpine, headquartered in Linz, Austria, has a lineage stretching back more than one hundred years and has traditionally been involved in the steel manufacturing industry. Today, however, with 75,000 employees and estimated revenues of $5.5 billion, 75 percent being derived from exports, the company is a very diverse organization. It was Voest-Alpine's diversification program that led to the establishment of AMI-Austria, in which it holds a 49 percent interest and four seats on the board of directors. The remaining 51 percent interest is held by AMI, which also has four members on the board of directors.

DEDICATED TO EUROPE

AMI-Austria is headquartered at Schloss Premstatten, near Graz, Austria, where, co-sited with the $100 million Voest-Alpine designed and constructed wafer fabrication and manufacturing facility, are the company's central custom and semicustom design center, and marketing operations.

144/146 New Bond Street / London W1Y 9FD England / (01) 409-1427 / Telex 266195

1290 Ridder Park Drive / San Jose, CA 95131 / (408) 971-9000 / Telex 171973

This totally integrated facility, employing 466 persons and occupying 13,000 square meters, houses:

- Design
- Maskmaking
- Wafer fabrication
- Wafer testing
- Assembly
- Final testing
- Quality assurance (incoming and outgoing)
- Shipping

Built on a modular concept, for easy future expansion, the facility went on-line very quickly and, in 1984, was producing 4-inch wafers with 15 different MOS processes. Conversion to 5-inch wafer production began in 1985. The facility is currently running at the rate of 1,400 wafer starts per week, with a corresponding 150,000 assemblies per week. Planned expansion will take these production levels to 6,000 wafer starts and 700,000 assemblies per week.

AMI-Austria prides itself in its ability to provide a four-week turnaround on 64K and 128K ROMs, from customer code approval to volume shipment of packaged parts. This is being accomplished by means of:

- A ROM data link, connecting the facility in Austria directly with each of the regional sales/marketing offices in Europe, where customers can input their EPROM pattern data
- In-house maskmaking capability
- E-beam lithography

AMI-Austria took delivery of its Varian E-beam lithography system in August 1984. By mid-October, the system had been commissioned and was operational. DATAQUEST believes that this was the first E-beam lithography system of its type installed in Europe.

This fast turnaround on ROM products is equally well supported in wafer fabrication with:

- Five Canon aligners
- Six photoresist stations for both positive and negative photoresist
- Two Tegal plasma etchers

- Ten diffusion ovens

- Two ion implanters

The same high degree of investment in capability and capacity can be seen at the device testing level. The following key items of test equipment give AMI-Austria the flexibility to address the diverse requirements of the European ASIC market to which the company is dedicated:

- Two Sentry VIIs

- Two Sentry 21-2s

- Two Tekeda T3320s

- One LTX TS88 with DX90

- One Xincom 5582

PRODUCTS AND MARKETS SERVED

In addition to ROM products, which range from 16K to 256K in NMOS and 64K in CMOS, AMI-Austria has in its product portfolio application-specific standard products (ASSPs), some of which have been gained by strategic alliances with other major semiconductor manufacturers. The most recent and key strategic alliances have been:

- The acquisition of the architecture from NEC for the uPD7720 digital signal processor, which AMI-Austria will initially fabricate in NMOS until the reciprocal agreement yields a CMOS version

- A product transfer agreement with Mitel Semiconductor for the transfer of seven products, including the ISDN chip set

AMI-Austria sees these product additions as complementing its own range of high-performance LD/DTMF dialer chips developed specifically to meet the requirements of the European telecommunications market. The company believes that these new products will further strengthen the revenues derived from this market.

The largest proportion of AMI-Austria's revenues are derived from full custom, standard cell, and gate array products. For full custom, 16 CMOS and 9 NMOS process technologies are available, ranging from 2-micron to mature 5-micron processes. AMI-Austria's experience and expertise in these process technologies is attracting and increasing the customer base for the company's foundry service.

The full library of digital and analog standard cells complemented with a family of macrocells are realized in 3-micron silicon-gate HCMOS, either single or double metal. During 1985, AMI-Austria will implement its fourth generation of standard cell products in a 2-micron double-metal HCMOS process. The total number of fully documented cells in AMI's libraries exceeds 300 (360 if soft cells are included).

AMI-Austria's range of gate arrays spanning from 300 to 10,000 gates can be fabricated in either 3-micron single- or double-metal CMOS, 2-micron double metal CMOS, and for applications requiring operation at supply voltages up to 13 volts in 5-micron single metal CMOS.

To support both full and semicustom products, AMI-Austria has fully integrated systems of advanced computer-aided design (CAD) tools. These design tools, which enable gate array and standard cell design, feature the following capabilities:

- Schematic capture
- Netlist generation
- Full simulation--timing and functional
- Automatic placement and routing
- Back annotation

To provide the systems engineer with the ability to design and control in-house circuit and system architecture, AMI-Austria has introduced a totally new CAD system concept, Super SCEPTRE, which uniquely combines wide-ranging design capabilities with low-cost development hardware. DATAQUEST believes that this combination, further enhanced with service, support, ease of access to local design centers, and a strong product portfolio, is the key to success in the growing ASIC market.

DATAQUEST CONCLUSIONS

With Gould AMI, which has some 18 years of experience in custom VLSI, as its parent, AMI-Austria already has a head start on other ASIC start-ups in penetrating this high-growth market. Furthermore, any new process technology that AMI develops, debugs, and introduces for volume production is transferred to AMI-Austria, thus alleviating the need for AMI-Austria to allocate human and financial resources to the development of such processes. This then allows AMI-Austria to concentrate on the keys to success previously discussed.

DATAQUEST believes that AMI-Austria was number one in MOS ASIC revenues in Europe in 1984, and that it will retain that position in 1985.

Peter Savage

Nielsen Dataquest

EUROPEAN RESEARCH NEWSLETTER

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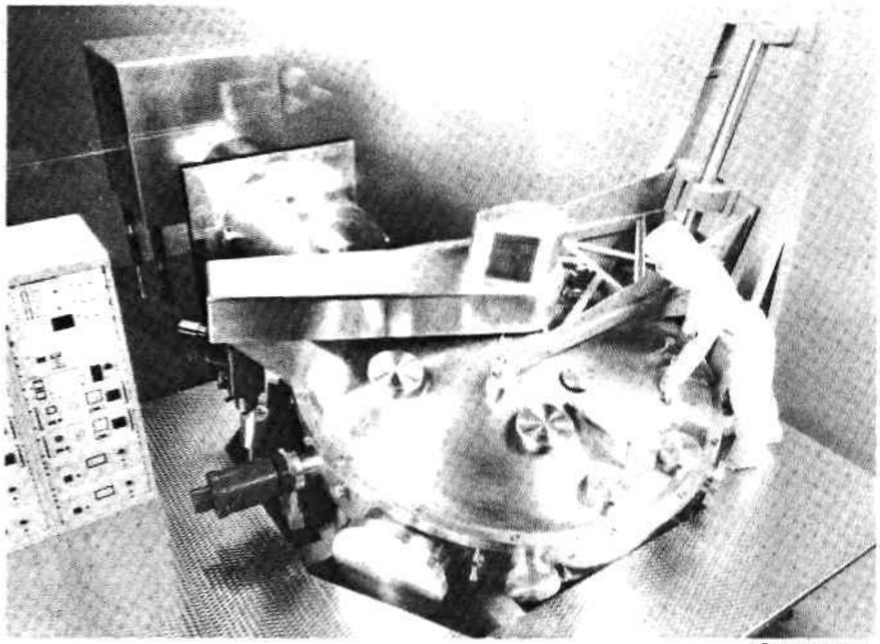
OXYGEN IMPLANTATION MOVES INTO PRODUCTION

SUMMARY

The demand for faster, more rugged, more reliable semiconductor devices for use in harsh military and aerospace environments continues to increase. To cope with this demand, new silicon-on-insulator (SOI) technologies have been developed. Of these technologies, the formation of an insulating substrate by the implantation of oxygen has, for cost reasons, good commercial potential and looks likely to oust silicon on sapphire (SOS) as the number one SOI technology. Because of the lack of production equipment, however, oxygen implantation has, until now, been confined to the R&D laboratory. But with its OXIS machine (see Figure 1), equipment manufacturer VG Semicon (England) is moving the technology from the laboratory into production.

Figure 1

OXIS OXYGEN IMPLANTER
(Scale Model)



Source: VG Semicon

SOI TECHNOLOGY

During the 1970s, RCA generated interest among the semiconductor industry in a technology known as silicon on sapphire. This technology made use of the fact that the crystal structure of sapphire closely resembles that of silicon. It was therefore possible to grow a thin layer of silicon on a sapphire substrate. Building devices on this substrate allowed a high degree of isolation to be achieved between the different parts of the circuit, as well as between the circuits and the bulk silicon of the wafer. In practical terms, this isolation resulted in a number of application benefits that are common to all SOI technologies.

Advantages

In practical terms, the ICs produced using a CMOS/SOI technology are:

- Latch-up free--The high insulator factor between the N&P transistors stops the formation of parasitic bipolar transistors. In standard CMOS processes these circuits, if triggered, can cause short circuits to occur between supply and ground. As circuit geometries become tighter, this latch-up effect increases. However, this is not a problem with SOI.

- Faster--The lower parasitic capacitance achieved by placing thin-layer active devices on insulating substrates allows faster switching speeds.

- Radiation hard--A by-product of the processing is that, since the active part of the circuit is isolated from the bulk of the silicon by the substrate, disruptive electron generation by radiation is dramatically reduced. This is a prerequisite for many aerospace/military projects.

- Lower in cost--Because of complex processing requirements, the cost of producing SOS wafers is high. DATAQUEST estimates that the cost of a processed SOS wafer is $500. Because of this prohibitive cost handicap, other, lower-cost silicon-on-insulator technologies are emerging. The creation of an insulating layer by oxygen implantation looks the most promising for future production processes. This technique gives all the advantages of SOS at approximately half the cost.

Equipment Design Difficulties

The processing of buried oxide by oxygen implantation is akin to the popular ionic implantation used for source-drain implants. The major difference is the high density of implantation required to achieve an effective substrate. Doping levels of 2×10^{18} cm^{-2} are desirable.

The high doping level required creates two problems for equipment manufacturers. First, it is necessary to create a high enough beam current so that the implantation time allows an acceptable throughput rate to be achieved. Second, the power dissipated in the wafer must be kept within close tolerance limits so that the wafer is not physically damaged during implantation. Ideally, the process should be controlled down to 400 degrees C.

VG Semicon has adopted a novel approach to solving these problems. Realizing that stretching the existing ion implantation technology was not good enough, the company set out to design a new beam source. To aid its R&D effort, VG enlisted the help of the U.K. Atomic Energy Authority (UKAEA) research laboratories in Harwell and Culham, England. Together they designed a plasma source that supplies a beam current of 150mA (100mA at the surface of the wafer).

VG is confident that this process is a winner. The UKAEA notes that the techniques used could yield a beam current of up to 60 amperes. A 200kV field extracts and accelerates the ions through a mass selection magnet, thus ensuring that only high-purity oxygen is implanted into the wafers. Accurate control of the beam ensures that a uniform insulating layer of silicon dioxide 2,500A thick and 0.5 micron below the surface is formed.

Wafer cooling is simplified by rotating the wafers in and out of the beam rather than activating the beam to scan the wafers. VG believes that this improves the overall reliability of the machine, as well as ensuring a uniform wafer implantation density.

MARKETS

The major markets for SOI technologies are military and aerospace projects. The U.S. Strategic Defense Initiative (SDI) and increased spending on communication satellites are two prominent driving forces behind the growth in this segment. The largest military market is in North America; Table 1 shows DATAQUEST's estimates of semiconductor consumption in the U.S. military sector from 1984 through 1990.

We estimate that radiation-hardened devices represented approximately 11 percent of the $1,159 million U.S. military semiconductor market in 1984. We expect this market share to increase to 15 percent by 1987, as demand increases for electronic insertion into space systems.

Outside the military market, a number of companies--ASEA Hafo (Sweden), MEDL (England), and RCA (USA), for example--are using SOI technology to produce custom ICs. Designers claim that SOI technologies allow them to simplify the design and layout of complex LSI circuits, which leads to faster design cycle times.

Table 1

ESTIMATED U.S. MILITARY SEMICONDUCTOR CONSUMPTION BY TECHNOLOGY
(Millions of Dollars)

	1984	1985	1986	1987	1988	1989	1990
Bipolar Logic	$ 295	$ 360	$ 424	$ 488	$ 559	$ 575	$ 661
Bipolar Memory	133	144	155	168	181	195	288
MOS Logic	109	117	145	188	244	222	273
MOS Memory	140	170	200	243	280	322	370
MOS MPU	89	102	130	149	172	196	225
Linear	175	195	210	231	254	275	300
Discrete	218	245	269	296	316	331	347
Total	$1,159	$1,333	$1,533	$1,763	$2,006	$2,116	$2,464

Source: DATAQUEST
December 1985

DATAQUEST ANALYSIS

The prognosis for equipment manufacturers operating in this sector is good. The projects are heavily R&D biased and are therefore relatively free from the stop/go purchasing that plagues production equipment today. It makes sense for an equipment manufacturer to invest in this business.

In doing so, VG Semicon has displayed creativity and ingenuity in coming to terms with the basic technical problems associated with the design of an oxygen implanter. To make a commercial success of the project against formidable competition from companies like Eaton, VG Semicon will have to apply to its marketing skills the same entrepreneurial spirit evident in its design.

Jim Beveridge

Nielsen Dataquest

EUROPEAN RESEARCH NEWSLETTER

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BELGIAN INITIATIVE SPAWNS NEW ASIC START-UP

SUMMARY

As part of an overall long-term microelectronics program, a new ASIC focused start-up company, Mietec, was formed in Belgium in March 1983. Located in Oudenaarde near Ghent, Mietec is a joint venture owned 49.5 percent by Bell Telephone Manufacturing Co. (BTM), the ITT-owned Belgium telephone system company; 49 percent by Gewestelijke Investerings Maatschappij voor Vlaanderen (GIMV), the Flanders regional investment company; and 1.5 percent by a private investment bank. As well as conventional NMOS and CMOS technologies, Mietec currently offers a mixed bipolar and CMOS process--BIMOS--offering a 70V breakdown voltage capability, and is developing a HVMOS process capable of operating at up to 400V. The company currently offers a range of gate array and standard cell products as well as full custom and foundry capabilities.

COMPANY BACKGROUND

Mietec's formation was an integral part of the overall Flanders microelectronics plan. This plan encompasses four basic activities:

- Inventive systems
- Interuniversity Microelectronics Centre (IMEC)
- Invomec
- Mietec

The inventive systems activities comprise training support provided directly to small and medium-size companies to encourage the use of microprocessors for existing electromechanical applications. The purpose here is to encourage the replacement of traditional solutions with electronics.

144/146 New Bond Street / London W1Y 9FD England / (01) 409-1427 / Telex 266195

1290 Ridder Park Drive / San Jose, CA 95131 / (408) 971-9000 / Telex 171973

IMEC is a joint program conducted by the universities of Brussels, Ghent, and Leuven, which is headquartered in Leuven under Professor Van Overstraeten. Leuven University has had a long history in microelectronics and semiconductor technology since the early 1970s. The IMEC program is aimed at:

- Developing software for the design of VLSI ICs
- Developing advanced process technologies at the 1.25-micro level and beyond
- Developing software and technology tools for industry

Invomec is a training program covering all the technical engineering schools in Flanders. Effective from 1985, upon completion of their studies, each student will have completed at least one ASIC design as part of their curriculum.

The fourth constituent, Mietec, forms the production arm of the plan. As part of its System 1240 (ITT's digital telephone exchange) design responsibility, BTM had developed substantial expertise in VLSI IC design and technology. This includes a prototype semiconductor facility in Ghent. As an alternative to developing and expanding this in-house production capability in line with the projected System 1240 volume requirements, BTM entered into a joint venture with GIMV to form a new company, the first European start-up dedicated to ASICs. Originally based in Antwerp, close by BTM's headquarters, Mietec relied heavily in the early days on BTM's existing semiconductor capability both in Ghent and Antwerp. Much of the early process development work was carried out by BTM, fueled by the BTM System 1240 ASIC requirements.

Mietec was founded in March 1983, started operations in May 1983, and achieved its first revenues in 1984. The purpose-built facility at Oudenaarde was constructed during 1983 and 1984. Initial equipment deliveries commenced in April 1984 and the first working devices were produced in November. Preproduction and equipment qualification started in February 1985, and in July 1985 the facility reached full production status.

Basically a modern Class 10 facility, the present module can be operated at a 150,000 125mm-per-annum wafer start capability. Currently it is equipped for 100mm wafer processing with a capacity of 6,000 wafer starts per month. Plans to increase this to 8,000 wafer starts per month during 1986 are already under way.

The company's focus is 100 percent ASIC; however, given Mietec's extensive system design experience, we believe that Mietec will plan to offer a series of application-specific standard products in the near future. Mietec will be a major supplier of the ASIC products for the ITT-designed System 1240 digital telephone exchange just entering production. We believe that sales of System 1240 devices will account for more than half Mietec's revenues, at least until 1987. From 1988 onwards, though, we expect this to decrease substantially as revenues from non-ITT products grow and build up in volume. The company anticipates breaking even in 1987 and achieving profitability in 1988.

Mietec's overall marketing thrust is not to remain a captive in-house supplier to BTM (ITT), but to become a viable merchant ASIC semiconductor vendor in its own right. In April 1985, Mietec succeeded in attracting Jean-Pierre Liebaut from Matra-Harris Semiconducteurs, the French start-up, to become Mietec's General Manager. Prior to his previous four years with Matra-Harris Semiconducteurs, Mr. Liebaut spent 15 years at Texas Instruments in Nice. A further key appointment to the Mietec staff was that of Eric Schutz as Director of Marketing and Sales; he was previously with Motorola in Toulouse.

Mietec's board of directors comprises two members from BTM, two members from GIMV, and Mr. Liebaut from Mietec. In this regard, Mr. Liebaut carries the responsibilities of Chief Executive Officer.

The company was formed with an initial capitalization of BFr1.2 billion. In November 1985, this was increased by a further BFr 600 million contributed equally by BTM and GIMV. This decision demonstrates the founders' continuing support for Mietec despite the present severe industry downturn; we believe that it will ensure Mietec's ability to meet its 1986/1987 strategic plan.

PRODUCTS AND MARKETS

As previously mentioned, a substantial part of Mietec's early revenues are expected to be derived from the ASIC requirements of ITT's System 1240 digital exchange. These requirements are potentially very large. Other suppliers known to be in this program are ITT Semiconductors, Sprague, and Texas Instruments.

Mietec is focusing on the automotive, industrial, and telecommunications, plus certain consumer and military application areas. The company is currently in volume production with its CMOS and NMOS processes (2.4- and 3-micron geometries). A BIMOS process developed under a cross licensing agreement with Sprague is presently in a preproduction stage under engineering control, scheduled for full production release during the first quarter of 1986. This will be followed later in 1986 by a fourth process (HVMOS) currently in development. The HVMOS process is targeted to achieve 400V on-chip capability. DATAQUEST believes that much of Mietec's further growth is targeted for applications that require the high-voltage capabilities offered by the BIMOS and HVMOS processes.

The CMOS process is designed to support mixed linear and digital circuitry and is not targeted to address the high gate count, high-speed end of the market. This capability will, we believe, provide Mietec with a strategic advantage over the more traditional ASIC suppliers.

The BIMOS technology combines the features of bipolar and CMOS into a unique process with 70V capability. The process allows the CMOS and bipolar structures to be combined on the same IC to form optimal analog building blocks, for example, operational amplifiers, sample and hold circuits, and multiplexers as well as conventional high-density digital circuitry. Typical application areas include:

- Analog signal processing with logic control
- Microprocessor-driven peripherals with analog and digital functions
- High-voltage drivers
- A/D to D/A convertors with signal processing
- Telecommunications applications, for example, SLIC
- Automotive applications
- Appliance applications

The HVMOS process utilizes dielectrically isolated silicon substrate technology and combines the DMOS device technology with silicon gate CMOS. Initial products feature a 400V capability with planned developments aimed at increasing this to 1,000V. The process will allow high-voltage switches and low-voltage, high-density CMOS logic to be integrated onto a single chip.

The DMOS devices combine high blocking capability with good current-carrying characteristics, or, alternately, the same HVMOS process can be used to construct TRIMOS devices with a lower on-resistance for a given silicon area and a non-linear output conductance characteristic. The resultant device is a bidirectional switch similar to the thyristor effect with a MOS gate input. Several such DMOS and TRIMOS devices can be integrated onto a single substrate while maintaining the high voltage isolation characteristics between them.

Typical applications include:

- Integrated high-voltage DMOS switches
- Integrated high-voltage TRIMOS switches
- Solid state relays
- High-voltage switches with on-chip (TTL-compatible) decoder logic
- Telecommunications applications, for example, crosspoint
- Interface between line voltage (mains) and peripheral electronics (for example, electronic fuses)
- Drivers for flat panels, printers, and video recorders

In addition to selling IC devices, Mietec is also the only European supplier of dielectrically isolated silicon substrates.

The company's initial market thrust is aimed at Europe. An early broadbased U.S. market push was refocused to a key account strategy in July of this year. Sales offices are already established in Bracknell in the United Kingdom and Munich in Germany, as well as in Belgium. We expect sales centers in Frankfurt, Germany, and Paris, France, to be announced shortly. In 1986, Mietec plans to grow all its sales offices into Technical Assistance Centres (TACs) with design and applications support. Mietec currently has two design centers in Belgium, at Leuven and Oudenaarde, with a total design staff of more than 50 engineers to support its ASIC thrust.

DATAQUEST ANALYSIS

Mietec boasts a young and energetic team of international staff whose average age is currently 25.6 years. The staff comprises Belgian, French, German, U.K., and U.S. nationals. The ability to enjoy early revenues from the ITT System 1240 program will, we believe, provide Mietec with an important source of revenue to help establish itself in the marketplace. Its process portfolio, especially the mixed bipolar/CMOS, mixed digital and linear CMOS capability, and its high-voltage processes should give Mietec ample opportunity to establish itself in unique application sockets. This process portfolio will be relatively protected from the increasing competitiveness of the commodity ASIC standard cell and gate array markets. These capabilities represent a leadership position for the company.

We understand that the company has completed over 100 designs to date, including some substantial design wins from major European and U.S. companies. Mietec is aiming for $60 million in revenue in 1988, the bulk of which is planned in the high-technology BIMOS/HVMOS end of the market. We estimate Mietec's revenue to be $5 million in 1985, up from $1 million in 1984. Its plan calls for increasing this to around $25 million in 1986, as several new designs enter production. Given the relatively protected position in which Mietec has established itself, we believe that this goal and its longer-term goals are readily achievable.

Malcolm Penn

Nielsen Dataquest

EUROPEAN RESEARCH NEWSLETTER

ESIS Code: Vol. IV Newsletters

VTI--POSITIONING TECHNOLOGY IN EUROPE

INTRODUCTION

VLSI Technology Inc. (VTI), a six-year-old application specific integrated circuit (ASIC) manufacturer, reported a 1984 operating profit, the first since the company's inception, of $7 million on revenues of $69.5 million, up 94 percent from 1983.

Having consolidated and strengthened its position in the U.S. home market during 1984, VTI also established a base in Europe from which it is now making major inroads into the European ASIC markets.

DATAQUEST believes that the ASIC market in Europe has continued to grow at a rate in excess of 30 percent per annum despite the severe downturn in the consumption of standard semiconductor products. DATAQUEST estimates that the European ASIC market will continue to grow at a compound annual growth rate of 30.4 percent from the 1985 forecast level of $537 million to $2,022 million in 1990, increasing its share of the total European integrated circuit consumption from 15.3 percent to 21.3 percent for the same period.

BACKGROUND

VTI was founded in 1979 by Jack Balletto, Gunnar Wetlesen, and Dan Floyd, all of whom were previously employees of Synertek Corporation. A fourth founder, Douglas G. Fairbairn, formerly with Xerox PARC, joined the company in 1980, and today continues to lead as Vice President of Design Technology, VTI's important ASIC software development effort. After these founders completed the initial development stage of the company, they recruited seasoned semiconductor industry executives to run the company.

In March 1982, Alfred J. Stein joined VTI as Chief Executive Officer and Chairman of the Board, and brought with him 25 years of executive operating experience in the semiconductor industry.

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In September 1983, Henri Jarrat, a 20-year semiconductor veteran, joined VTI as President and Chief Operating Officer, coming from Motorola.

VTI received its initial $10 million venture capital funding in December 1980, and after revenues (derived principally from the sale of ROMs) soared to $21.1 million in 1982, further funding was sought. This was primarily accomplished through a public offering of 4.4 million shares of common stock in February 1983, which raised a further $53 million, and later in January 1984, through the sale of 2.8 million shares to Wang Laboratories for $34 million.

VTI's corporate headquarters, software development, product design, process technology, and manufacturing are located in San Jose, California.

The company has placed a great deal of importance on taking VLSI design technology to the customer. At present, VTI operates five design centers across the United States, and through licensing agreements with independent design companies is involved with another three. VTI's policy of geographical diversification has increased local technical resources, improved customer support, and enhanced VTI's presence in the ASIC marketplace. A similar policy is now being pursued in Europe.

VTI in Europe

In 1983, VTI developed its first presence in Europe through the establishment of a joint design center with Olivetti, the Italian office automation and computer company in Ivrea, Northern Italy. (See the ESIS Research Newsletter entitled "Olivetti opens VLSI design Center," dated August 7, 1984). In July 1984, to accelerate the company's international presence, VTI embarked upon the establishment of its European headquarters in Munich, West Germany, with the appointment of Dieter Mezger as General Manager and Director of European Operations. Mr. Mezger joined VTI after 15 years with Texas Instruments, where his most recent position had been that of European Marketing Manager.

Within the space of six months, VTI located its European operating facility in Munich, opened its first European design center co-sited in Munich, and set up northern and southern European sales/marketing offices in Milton Keynes, United Kingdom, and Paris, France, respectively.

The design center in Munich will be the hub for the satellite design centers in the United Kingdom and France that are planned for the first quarter of 1986. At present the center in Munich is equipped with:

- A VAX 785
- Four Apollo systems
- A Bull SPS 9/60

In addition, there are four offices dedicated for customers to use in the designing of ASIC products.

During 1986, software development activity will commence in Europe, in line with VTI's strategy of local full service for its customers.

In positioning itself in Europe, VTI is pursuing a multipronged strategy. Elements of this strategy include:

- Local geographic presence, with the establishment of the European headquarters in Munich and the proliferation of autonomous design centers across the continent

- Strategic alliances with European semiconductor suppliers, with the objective of standardizing VTI's IC design methodology in Europe and developing local second sources and fast turnaround capability in Europe--an essential ingredient for success in the ASIC business. So far, an alliance has been established with EM Microelectronics-Marin SA (MEM) (a division of Ebauches Electroniques SA, part of ASUAG-SSIH in Switzerland), which provides for the transfer of VTI design software and process technology to MEM in return for European manufacturing support and technology funding. Other alliances are contemplated with other European semiconductor companies

- Strategic alliances with major European ASIC users, exemplified by the joint design center at Olivetti's headquarters in Ivrea, Italy, for training of and use by Olivetti engineers. VTI currently receives engineering revenues from this partnership and anticipates production revenues in 1985

- An additional partnership that has been concluded with the Bull Group in France, a major ASIC user. Bull's SPS 9/60 computer/workstation, a RISC (Reduced Instruction Set Computer) architecture machine running VTI design tools under UNIX, will be Bull's standard in-house workstation. In addition, the agreement provides VTI with the marketing and licensing rights of the SPS 9/60, and access to ASIC designs as well as standard products within the Bull Group

- Other partnerships that are being developed with major European corporations

- University technology relations. VTI is pursuing discussions with several key universities with the prime objective of proliferating and standardizing VTI's IC design methodology and using these establishments as incremental sources of expertise, particularly in the area of applied research. An agreement of this kind has been reached recently with the University of Louvain in Belgium

<u>Revenues</u>

As shown in Table 1, DATAQUEST estimates that VTI's 1984 European revenues were $4 million. Similarly in Table 2, DATAQUEST estimates show VTI's 1984 worldwide revenues to be $69 million.

Table 1

VLSI Technology Inc.
ESTIMATED EUROPEAN SEMICONDUCTOR REVENUES
BY PRODUCT LINE
(Millions of U.S. Dollars)

	1981	1982	1983	1984
Total Semiconductor	0	0	1	4
Total IC	0	0	1	4
Bipolar Digital	0	0	0	0
MOS	0	0	1	4
Linear	0	0	0	0
Total Discrete	0	0	0	0
Transistor	0	0	0	0
Diode	0	0	0	0
Thyristor	0	0	0	0
Other	0	0	0	0
Total Optoelectronic	0	0	0	0

Table 2

VLSI Technology Inc.
ESTIMATED WORLDWIDE SEMICONDUCTOR REVENUES
BY PRODUCT LINE
(Millions of U.S. Dollars)

	1981	1982	1983	1984
Total Semiconductor	1	21	35	69
Total IC	1	21	35	69
Bipolar Digital	0	0	0	0
MOS	1	21	35	69
Linear	0	0	0	0
Total Discrete	0	0	0	0
Transistor	0	0	0	0
Diode	0	0	0	0
Thyristor	0	0	0	0
Other	0	0	0	0
Total Optoelectronic	0	0	0	0

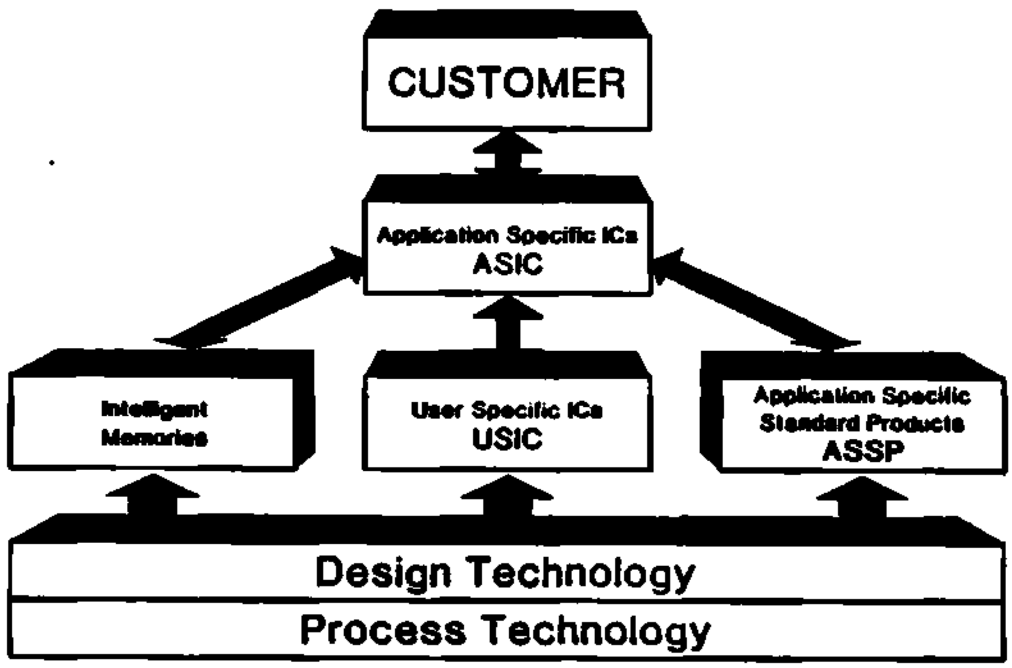
Source: DATAQUEST
October 1985

VTI Product Strategy

Figure 1 shows VTI's overall corporate strategy and illustrates the combination of products and technologies used by the company to provide a total ASIC solution to its customers.

Figure 1

VLSI TECHNOLOGY INC. PRODUCT STRATEGY



Source: VLSI Technology Inc.
DATAQUEST
October 1985

TECHNOLOGIES, PRODUCTS, AND MARKETS

Under the ASIC umbrella, VTI's product portfolio covers:

- User-specific integrated circuits (USICs)
- Application-specific standard products (ASSPs)
- Application-specific memory products (ASMPs)

The driving forces of VTI's product strategy are process and design technology.

Devices can be fabricated by VTI in either 3-micron HMOS or 2-, 2.5- or 3-micron HCMOS. A 1.5-micron HCMOS process is in the final stages of development. VTI offers this full spectrum of process technologies to its customers through products or manufacturing services with dedicated engineering support. The average wafer processing turnround time is 21 days, and complete prototype fabrication from a data base to packaged parts typically requires four to six weeks.

More than $5 million of the $15 million invested in research and development in 1984 went to developing enhancements to CAE/CAD technology, resulting in major additions to VTI's ASIC design tools. Leading-edge products that have been introduced in 1985 include:

- A selection of 2-micron CMOS silicon compilers for RAM, ROM, datapath, N x N multiplier, barrel shifter, and priority encoder

- A library of 250 standard cells (2-micron CMOS) including those with fully automated place and route capability

- The industry's first megacell family

Such megacells as disk and CRT controllers are available as complex building blocks, enabling entire systems to be quickly reduced to a few VLSI devices. Also added in 1985 were HCMOS gate arrays ranging from 500 to 6,000 gates, to provide the fast turnaround and automated design for this segment of the ASIC market. VTI plans to enhance this ASIC capability still further during 1985 with a family of HCMOS electrically programmable logic (EPL) arrays, replicating the functions and speed of popular bipolar programmable logic at CMOS power levels.

As part of its overall strategy, VTI produces high-density, high-performance ASMPs including ROMs, SRAMs, DRAMs, EPROMs, and EEPROMs, providing a profitable revenue stream and a product base to drive the process technology and quality levels to that necessary for the manufacture of advanced ASIC products. At the same time, it has enabled VTI to add the memory technology to both its compiler and megacell libraries.

Complementary to both the ASIC and memory product lines, VTI added some selected standard logic products during 1984, with more planned for 1985.

These enhancements and additions have and will continue to substantially increase the level of integration and flexibility of VTI's ASIC technology, increasing the company's penetration of targeted market segments and enabling expansion into others. At present, VTI is primarily directing its marketing thrust at the EDP and telecommunications markets, but with the addition of selected ASSPs to its product portfolio, it will be diversifying its interests to include the automotive and industrial fields.

DESIGN TOOLS

Crucial to VTI's strategy and success is its advanced ASIC design technology. VTI has a complete set of proprietary integrated circuit design tools. More than 200 circuits have been developed with these tools, which have been proven in production use for three years. VTI has placed more than 350 user systems in place, in more than 70 customer locations. VTI's design tools have a distinctive advantage in their ability to combine silicon compilers, standard cells, and megacells on a single chip. Encompassing system, logic, circuit, and physical design as well as design verification, the tools run on the Apollo, Bull SPS 9/60, Daisy, ELXSI, HP9000 series 300, Mentor, MICROVAX II, RIDGE, and VAX computers. Potential customers can install these software design tools on their existing computer systems or purchase a complete SPS 9/60 or Apollo workstation from VTI. Alternatively, customers can use the tools at VTI's design center.

MORE STRATEGIC ALLIANCES

To accelerate and facilitate the execution of its strategic thrust, VTI has made a number of important and strategic agreements in both products and associated technology.

From a product standpoint, since the beginning of 1984 VTI has entered into the following significant agreements:

- Early in 1984, with Lattice Semiconductor Inc. and VISIC, for high-performance memory products

- In May 1984, with Fairchild Camera and Instrument Corporation (Fairchild), to jointly develop and alternately source 2-micron gate arrays ranging from 600 to 6,000 gates

- In November 1984, with Silicon Compilers, Inc., for manufacturing and exclusive marketing and sublicensing rights to Silicon Compilers' RasterOp advanced graphics processor

- In January 1984, with Sierra Semiconductor Corporation, for the exchange of technical information and the mutual sharing of development in ASIC software, design expertise, and products.

- In April 1985, with Honeywell Inc., for manufacturing and marketing rights to devices previously produced by Honeywell's subsidiary, Synertek Corporation.

- In April 1985, with National Semiconductor Corporation, for manufacturing and marketing rights to a jointly developed CMOS EPROM family ranging from 64K to 512K bits

- In June 1985, with Zilog Inc., a five-year technology cross-licensing agreement for high-performance VLSI products

To extend still further the acceptability of the company's software integrated circuit design tools and silicon compilers, in June 1985 VTI reached agreement with Daisy Systems Corporation, whereby users of Daisy's new concurrent CHIPMASTER and SILICONMASTER can acquire VTI's software. (CHIPMASTER AND SILICONMASTER are registered trademarks of Daisy Systems Corporation.)

DATAQUEST ANALYSIS

DATAQUEST believes that one of the major criteria for success of an ASIC vendor is that the company must have the ability to establish close working relationships with a diverse user community. DATAQUEST also believes that success is further dependent upon service, technology, product offerings, cost effectiveness, and the location of design centers; which in turn must provide user-friendly CAE/CAD tools, technical support, and error minimization, in addition to being conveniently located for easy customer access.

VTI has clearly demonstrated an ability to satisfy these important criteria in the United States and has already made significant moves toward achieving these goals in Europe. The recent alliance with MEM will provide VTI with the ability to provide a quick-turn wafer fabrication facility in Europe. Given the commitment already made, and others that we believe will be announced in the coming months, DATAQUEST believes that VTI is set to become a major player in the European ASIC market.

Peter Savage

Nielsen Dataquest RESEARCH BULLETIN

ESIS Code: Vol. IV Newsletters

PHILIPS ANNOUNCES HIGH-INTEGRATION MICROPROCESSOR

SUMMARY

Philips N.V. and Signetics Corporation recently announced a new member of the 68000 microprocessor family that contains a central processing unit (CPU), a memory management unit (MMU), direct memory access (DMA) control, a serial communications bus (the I^2C bus), an RS-232-C interface and three counters/timers all on the same chip. The device was designed at Philips' International Microcomponent Support Centre (IMSC) in Paris, France, and will be fabricated at the Valvo factory in Hamburg, West Germany. The device will be second-sourced by Matsushita, of Japan.

TREND TOWARD HIGHER INTEGRATION

For a number of years, microcontroller development has followed a higher integration path with the addition of communication ports, LED/LCD drivers, and sophisticated timers around an MCU core. DATAQUEST notes that microprocessors are following this route with the development of highly integrated MPUs. E.g., Intel's 80186 and 80188 microprocessors utilize the 8086/8088 CPU plus DMA and Hitachi's 64180 has a Z80 core plus DMA and an MMU.

The development of this type of device allows system designers to apply immediate cost reductions while still maintaining the integrity of their software bases.

MARKET OPPORTUNITIES

The advantage of high-integration processors is that they cut across consumer and professional system boundaries. They are as equally at home in high-performance, multitasking workstation systems as in lower-cost consumer projects.

DATAQUEST ANALYSIS

DATAQUEST believes that the Philips chip scores over the competition with the addition of an I^2C (inter-IC) bus, which offloads low-speed communications from the high-speed parallel bus, thereby allowing designers to increase throughput and simplify system expansion. The device is fabricated in 2-micron CHMOS. The use of CHMOS technology allows portable versions of existing systems to be easily developed. With the advent of the "digitization" of the consumer industry (digital television and digital audio compact disks) more powerful processors are going to be needed for information processing and control. Philips has produced a processor that is designed to meet these requirements.

The timing of the launch is significant. The new 16-bit home computing standard, MSXIII, is under evaluation, with Philips competing against Intel, National, NEC, and others for the microprocessor socket. A design win in this project would bring Philips' "European" processor worldwide recognition.

Jim Beveridge

Nielsen Dataquest

EUROPEAN RESEARCH NEWSLETTER

ESIS Code: Vol. IV, Newsletters

THE NEW MITSUBISHI SAIJO FACTORY-- A FULLY AUTOMATED FACILITY

INTRODUCTION

DATAQUEST recently had the exceptional opportunity to visit Mitsubishi Electric Corporation's impressive new semiconductor factory located in Saijo on the island of Shikoku, Japan. DATAQUEST was escorted on the factory visit by Dr. Hiroyoshi Komiya, Deputy Manager of the Saijo factory, and Mr. Shigeru Funakawa, Semiconductor Overseas Marketing Manager for Mitsubishi. This factory, the first semiconductor facility on the island of Shikoku, was completed in early 1984 and is a fully automated front- and back-end facility dedicated to the production of DRAMs. The entire production process from bare silicon wafer start to final packaged and tested part is completely automated.

Dr. Komiya spoke on the Saijo facility at DATAQUEST's annual Semiconductor Equipment and Materials Conference held October 14 through 17 in Tucson, Arizona. The theme of the conference was "An Industry in Transition." Dr. Komiya's talk on the Saijo facility at the conference was, indeed, very interesting, as was our visit to the facility.

THE SAIJO FACTORY

Presently, the Saijo factory consists of production buildings B and C, each of which has three floors covering 22,000 square meters of floor space. Building B is dedicated solely to the production of 64K DRAMs and has a capacity of 10 million parts per month. It was constructed at a cost of $127 million, including all capital equipment and automation hardware and software. Volume production of 64K DRAMs on 5-inch wafers began in March of 1984. Building C is dedicated to 256K DRAM production and was constructed at a cost of $190 million. It has a capacity of 7 million parts per month and volume production was scheduled to begin in July 1985. Next to Building C is an empty lot--yes, you guessed it--for a 1-Mbit DRAM facility, which is scheduled to be in production in the near future.

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DATAQUEST visited the Building B 64K DRAM facility and the following discussion pertains to that facility. It is our understanding that the 256K DRAM facility is constructed along similar lines.

Device production occurs on two floors. The wafer fabrication area is located on the first floor and is a Class 10/Class 100 facility designed with a "main street" and "side street" concept. Up and down the wide main street move trackless but optically guided, automatically guided vehicles (AGVs) carrying cassettes of wafers. Branching off from main street at right angles are narrower side streets dedicated to the various wafer fabrication processes. For instance, there is a photolithography side street along which are clustered steppers and photoresist processing equipment. Dry etchers are clustered along another side street.

The AGVs in main street transfer their cassettes of wafers to I/O stations located at the junctions of the main and side streets. Robots moving in the side streets transfer the cassettes from the I/O stations to the various pieces of processing equipment located up and down the side street. The entire wafer fabrication production sequence is entirely automated; at no point in the production sequence do operators handle the wafers. Inspection at various points in the production process is done via CCTV by operators outside the clean room.

The first floor also includes the wafer test area laid out in the same main and side street approach. This area was designed to be Class 1000, but because of the reduction of people present (there appeared to be two) Class 100 levels were actually being reached. DATAQUEST noticed that in the wafer test area there were additional stationary robots transferring cassettes among several pieces of equipment clustered about them.

At the completion of wafer fabrication and probing, the wafers are automatically moved in an elevator up to the second floor where assembly and test occurs. On the second floor, overhead robots running on ceiling tracks transfer the devices among the various types of test equipment. All phases of assembly and test are fully automated including encapsulation and burn-in. Optical pattern recognition systems are used for automatic inspection of the marking step.

Communications and Control

The following is a brief overview of the factory automation system. A central factory computer interfaces with two control computers, one for each floor. For the first floor wafer fabrication and test area, the control computer interfaces to several process control CPUs, each of which interfaces with several individual pieces of process equipment. The first floor control computer also interfaces to another CPU for traffic control of the AGVs in main street. The AGVs communicate to the traffic control CPU through the I/O stations. The AGV receives its instructions from the I/O station. This is in contrast to the U.S.-manufactured Veeco and Flexible Manufacturing Systems AGVs, both of which communicate directly to their control computer via an infrared link. The control computer on the second floor has a similar architecture.

In the factory computer control center, operators sit at a long console and monitor factory status via CRT monitors in the console. In front of the console is a large illuminated electronic board that schematically depicts the entire two-floor production process and the various pieces of equipment. Every bare wafer is marked and, although lots are usually tracked, individual wafers can be called up and located in the factory by the monitoring and tracking system.

Process data are collected by the system and analyzed. Dr. Komiya noted that as the human element has been removed, the process data have tended to exhibit a very tight distribution about the mean. The factory central computer also communicates with Mitsubishi's Kita-Itami Works. For instance, quality control data are sent to Kita-Itami for further analysis, the results of which are fed back to the Saijo factory computer.

Mitsubishi built all robots and AGVs in the factory as well as writing the factory automation software. It took Mitsubishi three years to complete the system.

Results of Automation

DATAQUEST was told that the 64K DRAM facility was obtaining a defect density of 0.1 defects/mask level/cm^2. This should be compared to a world class Class 100 facility that can obtain 0.5 defects/level/cm^2. Mitsubishi has paid much attention to the reduction of particulate levels in the fab. All robotic equipment and AGVs were designed to contribute minimum levels of particulates. Mitsubishi worked closely with the equipment vendors to minimize the equipment particulates and, further, the process equipment was cleaned before it was installed in the clean room.

Cycle time for the wafers for the first floor (wafer fabrication and probing) is about three weeks. This should be compared to the 6 to 10 weeks required for an average U.S. fab cycle, with 6 weeks being a very good cycle time. Cycle time for the second floor (assembly and test) is about one week.

Although Mitsubishi would not disclose its device yields, it indicated that automation resulted in about a 20 percent relative increase in yields. Mitsubishi also believes that the Saijo facility can produce the lowest-cost 64K DRAM in the world. Taking all factors into consideration, DATAQUEST estimates that this facility is obtaining yields of between 85 percent and 90 percent for 64K DRAMs. DATAQUEST also estimates that the factory capacity of 10 million parts per month corresponds to 20,000 wafer starts per month at these yields.

Jim Beveridge
Joseph Grenier

Nielsen Dataquest RESEARCH BULLETIN

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MOTOROLA AND HITACHI ANNOUNCE A 68000 IN CMOS

Hitachi (Tokyo, Japan) and Motorola (Austin, Texas) have announced a second-source agreement for a full CMOS 16-bit microprocessor that is both pin and instruction compatible with the NMOS 68000. Hitachi, which has been a second source for Motorola's M68000, developed this CMOS version and has granted manufacturing and marketing privileges to Motorola. The agreement allows both companies to produce and market the processor worldwide. This agreement does not apply to Motorola's new 32-bit M68020 microprocessor.

CMOS TECHNOLOGY

The new version has the distinction of being fully CMOS. Other processors, such as the 32-bit M68020, are listed as CMOS, but in order to reduce die size, they use NMOS structures internally. The difference between these and fully CMOS processors is apparent in the power consumption; the CMOS version of the 68000 will consume approximately 20mA from a 5-volt supply at 12.5 MHz. This is at least a factor of 15 better than the standard NMOS version, which consumes approximately 300mA under the same conditions. Table 1 shows the range of 16-bit CMOS microprocessors now available to the marketplace.

APPLICATIONS

As depicted in Table 2, DATAQUEST predicts that CMOS microprocessor usage will grow rapidly during the rest of this decade. In addition to the obvious advantages of low power consumption, product designers have recognized the advantages of higher noise immunity, tolerance to temperature extremes, and tolerance to supply voltage variations.

This means that CMOS microprocessors will likely be used in applications such as portable PCs, portable communications equipment, industrial controllers, and sophisticated defense systems.

Jim Beveridge
Janet Rey

Table 1

16-BIT CMOS MICROPROCESSOR MANUFACTURING STATUS

Manufacturer	Product	Status
Harris	80C86	Production
Intel	80C86	Production
Western Design Center	W65SC816	Production
Hitachi	68HC000	Sampling
Motorola	68HC000	Sampling
NEC	V40	Sampling
Oki	80C86	Sampling

Table 2

16-BIT CMOS MICROPROCESSOR WORLD FORECAST
(Millions of U.S. Dollars)

	1984	1985	1986	1987	1988	1989	CAGR 1984-1989
United States	$12	$27	$43	$ 90	$161	$235	81.3%
Europe	2	5	8	12	19	30	71.9%
Japan	1	3	6	17	37	64	129.7%
ROW	0	0	1	2	4	7	-
Total	$15	$35	$58	$121	$221	$336	86.2%

Source: DATAQUEST
September 1985

Nielsen Dataquest RESEARCH BULLETIN

ESIS Code: Newsletters

DIGITAL TO DOUBLE U.K. INVESTMENT AND BUILD SEMICONDUCTORS IN SCOTLAND

SUMMARY

Digital Equipment Corporation has announced that it will double its investment in Britain by building a $110 million silicon chip manufacturing plant in Scotland. By 1988, when the plant is planned to be in production, Digital will be making computers from raw silicon to the finished product. It will be the only manufacturer in Scotland to do so, and the only international company to do this within the United Kingdom.

The company plans to have 400 new jobs available by 1988, and most recruitment will be done in Scotland. The staff will receive extensive training in the latest silicon chip production technology. (The 400 jobs in Scotland are in addition to the 900 jobs that Digital will be creating in the United Kingdom this year.)

The site of the new plant is at Butlaw, near South Queensferry, Edinburgh, where Digital has agreed to purchase 86 acres of land. Planning permission will shortly be sought for a building of 200,000 square feet; construction is expected to begin in spring 1986.

SCOTLAND--AN IDEAL LOCATION

According to Digital, Edinburgh was chosen from several potential locations worldwide because the existing highly developed silicon chip industry in Scotland can supply raw materials, components, and equipment.

In addition, Scotland's educational system is already geared to the needs of the silicon chip industry, and creates high-caliber recruits for training in relevant production techniques. Digital has already established research links with Edinburgh University.

Edinburg has good transport and communications, and is close to Digital's Ayr plant which was established in 1976. The major portion of the new plant's output will go to Ayr for assembly and testing in a new facility in which £10 million has recently been invested. The completed and tested products will be exported to other Digital plants worldwide, or will be built into computers made at Ayr.

ADVANCED CHIPS FOR DIGITAL COMPUTERS

Geoff Shingles, U.K. managing director and vice president of Digital, said, "The new plant will be capable of building our most advanced chip, similar to the one at the heart of our MicroVAX II, one of our best-selling computers.

"Our decision to make this massive investment--coupled with our research and development center already established in Reading--indicates Digital's confidence in the United Kingdom as a creative base, a sound investment, and an expanding market."

OTHER INVESTMENTS IN SCOTLAND

DATAQUEST estimates that including Digital's investment, Scotland has attracted $2.1 billion over the last five years--the majority being in high-technology industries. Companies with manufacturing sites in "Silicon Glen" include General Instrument, IBM, Motorola, National Semiconductor, NEC, Shin-Etsu Handotai, and Wang. With this infrastructure now in place, DATAQUEST believes that Scotland is well-positioned to gain a foothold in the semicomducter market.

Jim Beveridge

Nielsen Dataquest

EUROPEAN RESEARCH NEWSLETTER

ESIS Code: Newsletters

IS IT TIME FOR JUST-IN-TIME?
A EUROPEAN SEMICONDUCTOR INDUSTRY CONFERENCE WORKSHOP

SUMMARY

This newsletter summarizes the just-in-time (JIT) workshop that was conducted at the European Semiconductor Industry Conference. The workshop opened with a 20-minute survey of JIT. The materials used to present this survey are included in the conference notebook.

Three teams discussed and exchanged ideas on three topics relating to JIT:

- Question 1--What are the most important changes that must be made in quality/manufacturing to achieve JIT?

- Question 2--What are the most important changes that must be made in purchasing to achieve JIT?

- Question 3--What are the key service elements that must be addressed to improve operational effectiveness, and how should they be implemented?

All group participants quickly agreed that the semiconductor industry has not reached the point where JIT is a real consideration. The industry has addressed technology, product, and quality issues. Now the critical issue is delivery. According to workshop participants, the industry must first address on-time delivery, then just-in-time delivery.

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1290 Ridder Park Drive / San Jose, CA 95131 / (408) 971-9000 / Telex 171973

TEAM SUMMARIES

Question 1--What are the most important changes that must be made in quality/manufacturing to achieve JIT?

To achieve JIT, manufacturers must think in terms of key customer projects. Manufacturing must be set up in the form of product focus lines that are optimized around common products. This would enable manufacturing people to refine manufacturing methods and improve product quality and service.

Vendor attitudes must change so that vendors consider themselves to be part of their customers' businesses. Related to this, manufacturing people need to meet and understand their customers' programs and needs. Manufacturing people should participate in ongoing bidirectional communications and contacts with customers.

Production lines need to be operated as closed loop systems, where work in process is monitored constantly in terms of quality and volume, and adjustments are made quickly when deviations occur. Customers and manufacturers must set mutually agreed upon quality goals and specifications.

Furthermore, there must be agreement on what constitutes delivery of a product. The team agreed that the customer should consider the product shipped when it left the vendor's shipping dock.

Question 2--What are the most important changes that must be made in purchasing to achieve JIT?

This team determined that the purpose of just-in-time was to reduce raw material inventory to zero. Reasons for carrying raw material inventory were listed first.

- Supplier caused:
  - Lead time fluctuations
  - Yield variations
  - Changes in sales forecasts
  - Cycle time variations
  - Quality variations
  - Processing/mask changes
  - Partial or wrong shipments
  - Incorrect order input

- Minimum economic lot sizes
- Hedges against material shortages/price increases
- Nonstandard products
- Communication delays
- Nonlinearity of shipments
- Frequency of shipments
- Test program changes

- User caused:
  - Sole source/too many suppliers
  - Production changes (volume, product, schedule)
  - Projected material shortages/price increases
  - Nonlinearity of orders
  - Order processing
    - Cycle times
    - Clear product specifications and test programs
    - Changes in specifications
    - Unreliable/inflexible suppliers

The team decided that the following changes in purchasing would help to reduce inventories while maintaining service levels:

- Full participation of purchasing department in the selection of products and suppliers; select suppliers on basis of commercial performance and ability to meet customers' service requirements

- More involvement of the purchasing department in supply management (material management), along with the manufacturing organization

- Select (and limit) the supplier base; the decision should be determined not only by price, but by total cost of ownership, (on-time shipments, quality level, pricing, other considerations)

- Improve communications flow with the supplier:
  - Reduce order processing cycle time
  - Reduce or eliminate specification changes

- Correlate test programs

- Establish common measures of performance; review quarterly

- Communicate specific vendor performance requirements to vendor representatives (e.g., shipments, lead times, production changes)

- Establish a long-term partnership relationship with selected suppliers; consider them assets of the company; limit the highs and lows typical of the business cycle

<u>Question 3--What are the key service elements that must be addressed to improve operational effectiveness, and how should they be implemented?</u>

First, the meaning of JIT and on-time delivery should be established by mutual agreement between customers and vendors. Vendors should take the initiative in providing shipment visibility to the customer. An early warning system for notifying customers when schedules will be missed would assist procurement managers in finding alternative sources for products. Vendors should monitor their performance to a set of criteria defined by both parties. The last point for suppliers was that they should get to know the customers much better. This type of approach will foster closer working relationships with customers, which will result in improved operational effectiveness.

Customers can help by providing vendors with better visibility of their needs. Some companies provide customers with one-year forecasts of their product needs. Customers must also make real commitments to their vendors not only in terms of firm orders for a specified length of time, but also commitments to work with their suppliers over the long haul, developing long-term relationships designed to help each other improve performance and reduce costs.

DATAQUEST CONCLUSIONS

The semiconductor industry is a long way from being able to meet the intent of just-in-time delivery programs. With 14- to 16-week manufacturing throughput and complex logistics, delivery performance today is still poor. The points outlined by the participants in the workshop can go a long way toward improving delivery performance and lowering operational costs.

Since the workshop really focused on on-time delivery rather than just-in-time delivery, we should briefly discuss whether just-in-time delivery is a practical goal for semiconductor devices. The ABC analysis chart from the Hewlett-Packard example in the JIT introductory presentation makes the point that products being purchased on a just-in-time system are either very high dollar volume A category items (3 percent of parts equalling 88 percent of dollars purchased), or high-bulk B category items (3 percent of parts occupying most of the inventory storage space). By buying these just-in-time, Hewlett-Packard either reduces direct spending for material or frees up floor space for increasing productive manufacturing capacity without building additional facilities.

Most semiconductors seem to fit the C category of products, which need to be purchased to a manufacturing service level so that costly shutdowns of production lines are avoided. Therefore, thinking in terms of just-in-time delivery is probably not practical. However, semiconductor manufacturers and their customers can reduce the effect of business cycles on their profit and loss statements and improve overall operation effectiveness. They can take steps to improve delivery performance--such as shortening manufacturing cycles, reducing inventories, working more closely with customers/vendors, and generally developing closer customer/vendor relationships. An example shown from Hewlett-Packard's Greeley, Colorado, plant demonstrated a three-fold increase in output with a 22 percent decrease in floor space over a two-year period. Hewlett-Packard determined that the potential for the same factory is a 25 times increase in output from a 40 percent increase in floor space. Truly impressive results!

Jim Beveridge
Stan Bruederle

Nielsen Dataquest
EUROPEAN RESEARCH NEWSLETTER

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SILICON WAFER FABRICATION TRENDS IN EUROPE

INTRODUCTION

European Semiconductor consumption, at $4,805 million in 1984, represented some 17 percent of worldwide consumption. DATAQUEST estimates that by 1989, European consumption will be close to $11 billion and will represent 18.5 percent of the worldwide market.

This newsletter looks at European wafer production and draws comparisons between regional and technology elements, making reference to European self-sufficiency and position in export markets.

In 1984, DATAQUEST estimates that revenue generated from European wafer fabrication was $3,255 million, compared with $2,412 million in 1983, a growth in revenue of 35 percent. European semiconductor consumption grew by 42 percent in the same period, which indicates that Europe still relied on an increasing level of imported product. DATAQUEST believes that this situation will change over the next five years, to reflect both a higher level of self-sufficiency and increased market penetration outside Europe by the European-owned semiconductor manufacturers. Table 1 shows DATAQUEST silicon consumption estimates by technology in Europe for the years 1983 and 1984. The table is presented in millions of square inches of start material, and it makes basic assumptions for the level of revenue generated for each technology. These assumptions comprehend processing yields and test yields. Optoelectronics production is assumed to be in gallium arsenide or equivalent material.

Table 2 gives estimates of 1984 silicon consumption, split by region, and shows areas of concentration by technology.

Table 3 shows the change between 1983 and 1984 in semiconductor device consumption. Comparison of the data in Tables 1 and 3 would suggest that European manufacturers are making gains in discretes and optoelectronics, while the same group would appear to be losing ground as suppliers of integrated circuits. In fact, during 1984, a significant part of the European integrated circuit market growth was in the area of MOS memories, which grew by over 60 percent to almost $950 million, and

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represented over 26 percent of all integrated circuit revenues. The majority of this memory market was supported by non-European production, and DATAQUEST estimates that some 85 percent of memories were sourced from outside Europe. This means that, memories excepted, European manufacturers did continue to grow with the market, and most increased their levels of investment in MOS processing facilities in an effort to improve their market shares in growth products and technologies in the future.

Table 4 gives DATAQUESTS estimates of the consumption of silicon in Europe out to 1989, split by technology, and indicates the level of output, by product, which may be generated from both existing facilities and known planned or committed new fabrication operations.

The compound annual growth rate (CAGR) for MOS product consumption in Europe between 1983 and 1989 is 32 percent, while the corresponding CAGR for MOS silicon consumption is 33.5 percent. If production increases faster than consumption, European semiconductor makers will, assuming comparable process yields versus competition, by definition, gain market share in MOS products. Current known and planned investment programs in Europe, coupled with the projected market opportunity in MOS custom and standard integrated circuits, worldwide, suggest that European producers of MOS products will make this transition. DATAQUEST believes that in the order of 60 new or totally upgraded wafer fabrication facilities will be operational in Europe by 1989; and to date, 48 of these are already planned, announced, or under construction.

DATAQUEST believes that European production will increase by $6.4 billion over this time frame; this corresponds to a significant reduction in net imports. Table 5 shows European production estimates (at as-sold value) for the years 1984 and 1989, and gives DATAQUEST's prognosis of the split between suppliers of different regional ownership.

Analysis of Table 5 shows that while European consumption has a CAGR of 18.2 percent, European companies are increasing production by 24.8 percent over the same period. This indicates that European companies are setting about the task of both recovering market share in Europe and increasing share in export markets. Certainly, of the 48 new facilities already planned or in progress, 26 are of European ownership, suggesting that current levels of investment are consistent with the planned revenue share growth.

The trend, in Europe as elsewhere, is toward increasing wafer size, and although Europe is behind both Japan and the United States, the new facilities being installed and planned for Europe reflect this trend. In fact, Motorola has recently commissioned the first full 150mm MOS wafer facility in Europe at East Kilbride in Scotland, and most of the known new installations will also have 150mm capability. DATAQUEST does not believe that 200mm wafer processing in any significant volume will be a reality before 1990.

Table 6 gives DATAQUEST's estimates of the wafer consumption trend in Europe, in projected numbers of wafers to be processed by technology to support revenue growth forecasts. This table reconfirms the upward trend in average wafer diameter, shown in Table 7.

DATAQUEST believes that the time delay in introducing new technologies and moving toward larger wafers between the United States and Europe will be reduced over the next five years, as the European market supports more suppliers and moves toward advanced customized circuits, which need a higher level of local support. By 1989, Europe will represent a market that has a comparable value to the U.S. market in 1984, and this situation should result in a comparable product support structure being in place. Historically, levels of investment in Europe for semiconductor production have been significantly below both the United States and Japan; this rate of investment must be increased and sustained if European manufacturers are to recover market share.

Adrian R. Tarr

Table 1

EUROPEAN SILICON CONSUMPTION ESTIMATES BY TECHNOLOGY
(Millions of Square Inches)

	Total S/c	Total IC	Bipolar Digital	MOS	Linear	Discretes	Opto
1983	108.1	65.4	16.0	28.3	21.1	40.1	2.6
1984	140.9	85.8	21.3	39.6	24.9	51.5	3.6
Growth	30.3%	31.2%	33.1%	39.9%	18.0%	28.4%	38.5%

Source: DATAQUEST
July 1985

Table 2

EUROPEAN SILICON CONSUMPTION BY REGION AND TECHNOLOGY--1984
(Millions of Square Inches)

	Total S/c	Total IC	Bipolar Digital	MOS	Linear	Discretes	Opto
Benelux	11.5	4.8	0.0	2.9	1.9	6.7	0.0
France	29.1	15.4	4.7	5.6	5.1	13.2	0.5
Italy	12.5	8.5	1.1	4.5	2.9	4.0	0.0
Scandinavia	1.5	1.1	0.5	0.6	0.0	0.3	0.1
U.K. & Ireland	34.7	25.0	5.8	14.0	5.2	9.5	0.2
W. Germany	46.1	28.3	9.1	9.4	9.8	15.0	2.8
Rest of Europe	5.6	2.7	0.1	2.6	0.0	2.8	0.1
European Total	141.0	85.8	21.3	39.6	24.9	51.5	3.7

Table 3

EUROPEAN SEMICONDUCTOR CONSUMPTION ESTIMATES BY TECHNOLOGY
(Millions of U.S. Dollars)

	Total S/c	Total IC	Bipolar Digital	MOS	Linear	Discretes	Opto
1983	3,370	2,323	483	1,227	613	866	181
1984	4,805	3,634	724	2,092	818	963	208
Growth	42.6%	56.4%	49.9%	70.5%	33.4%	11.2%	14.9%

Source: DATAQUEST
July 1985

Table 4

SILICON CONSUMPTION ESTIMATES BY TECHNOLOGY--EUROPE
(Percent of Square Inches)

	1983	1984	1985	1986	1987	1988	1989
Total Semiconductor	100%	100%	100%	100%	100%	100%	100%
IC	62%	63%	69%	75%	79%	83%	87%
Bipolar Digital	15	15	14	14	13	13	13
MOS	27	30	37	44	49	54	58
Linear	20	18	18	17	17	16	16
Discretes	38%	37%	31%	25%	21%	17%	13%
Total Consumption (M. sq. in.)	105%	137%	161%	191%	240%	307%	341%

Table 5

EUROPEAN SEMICONDUCTOR PRODUCTION ESTIMATES
(Wafer Fabrication--As-Sold Value--Billions of Dollars)

	1984	1989	CAGR 1984-1989
European companies	2.2	6.8	24.8%
U.S. companies	1.0	2.1	16.0%
Japanese companies	0.0	0.7	N/A
Others	0.0	0.0	0.0%
Total	3.2	9.6	24.7%
European consumption	4.8	11.0	18.2%

Source: DATAQUEST
July 1985

Table 6

ESTIMATED EUROPEAN WAFER STARTS BY TECHNOLOGY
(Millions of Wafers)

	1983	1984	1985	1986	1987	1988	1989
Total area (M. sq. in.)	105	137	161	191	240	307	341
Avg. area (sq. in.)	8.5	9.1	10.0	10.6	11.3	12.4	13.4
Total wafers (M)	12.4	15.1	16.1	18.0	21.2	24.8	25.4
IC	7.9	10.1	11.5	13.9	17.2	21.1	22.4
Bipolar Digital	1.9	2.3	2.3	2.5	2.8	3.1	3.3
MOS	3.4	4.9	6.1	8.0	10.6	13.8	14.8
Linear	2.6	2.9	3.1	3.4	3.8	4.2	4.3
Discretes	4.5	5.3	4.6	4.1	4.0	3.7	3.0

Table 7

EUROPEAN WAFER DIAMETER TREND
(Percent)

	1983	1984	1985	1986	1987	1988	1989
2-inch	10%	7%	3%	2%	2%	1%	0
3-inch	38%	31%	27%	21%	19%	16%	13%
100mm	50%	56%	60%	60%	53%	48%	40%
125mm	2%	6%	9%	13%	17%	21%	25%
150mm	0	0	1%	4%	9%	13%	20%
200mm	0	0	0	0	0	1%	2%

Source: DATAQUEST
July 1985

Nielsen Dataquest
EUROPEAN RESEARCH NEWSLETTER

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ONE-TIME-PROGRAMMABLE MICROCONTROLLER

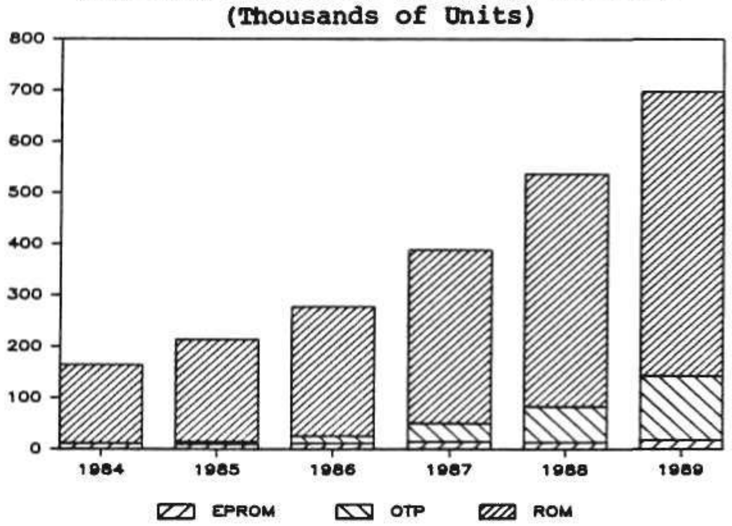
SUMMARY

DATAQUEST estimates that 8-bit microcontroller unit shipments grew from 90,615 million units in 1983 to 164,358 million units in 1984, an 81 percent increase. In spite of this phenomenal increase, many users came to grief and missed production targets due to supply not meeting demand. One way out of the supply problem was to use EPROM micro-controllers as production gap fillers. This was essentially a stop-gap solution because of the high cost of EPROM MCUs--2 to 3 times higher than ROMs. Recognizing a trend, manufacturers have not been slow to respond to the basic demand for a lower-cost user-programmable fast turnaround MCU; earlier this year, Intel and Hitachi announced OTP (one-time-programmable) plastic microcontrollers. DATAQUEST believes that the OTP will replace most EPROM MCU usage in pilot/low-volume production, and will start to eat into the volume ROM MCU marketplace.

Figure 1 shows DATAQUEST's estimates for the worldwide MCU marketplace in thousands of units.

Figure 1

WORLDWIDE 8-BIT MCU SHIPMENTS FORECAST
(Thousands of Units)



Source: DATAQUEST

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PRODUCTS

Intel has announced the P8748H, P8749H, and P8751H versions of the 8748H, 8749H, and 8751H microcontrollers. NEC is producing plastic 8748 and 8749 variants and a proprietary 8741. Hitachi has introduced the 63701XO and 63705VO versions of its 6301 and 6805 microcontroller families. Motorola has versions of the 6801 and 6805 family in EPROM, which it is offering in a low-cost ceramic package. Hitachi and Motorola are the only suppliers offering CMOS-OTP.

Mostek started shipping its 38P7X during the third and fourth quarters of 1984. General Instrument started shipping an EPROM version of Pics in fourth quarter 1984.

MARKETPLACE ANALYSIS

For this newsletter, DATAQUEST has divided the marketplace into three areas.

Prototype Quantities (0-200 pieces per annum)

EPROM parts are used for software debugging and for the prototype runs. OTP usage will only become cost effective once the software has been fully debugged and the end product is considered ready for prototyping.

Pilot Production (200-5,000 pieces per annum)

Devices under this heading are used for customer field trials, quality checks, and low-volume production runs. This market has traditionally used a mixture of EPROM and ROM MCU. DATAQUEST considers this market ideally suited to the cheaper, more flexible OTP alternative.

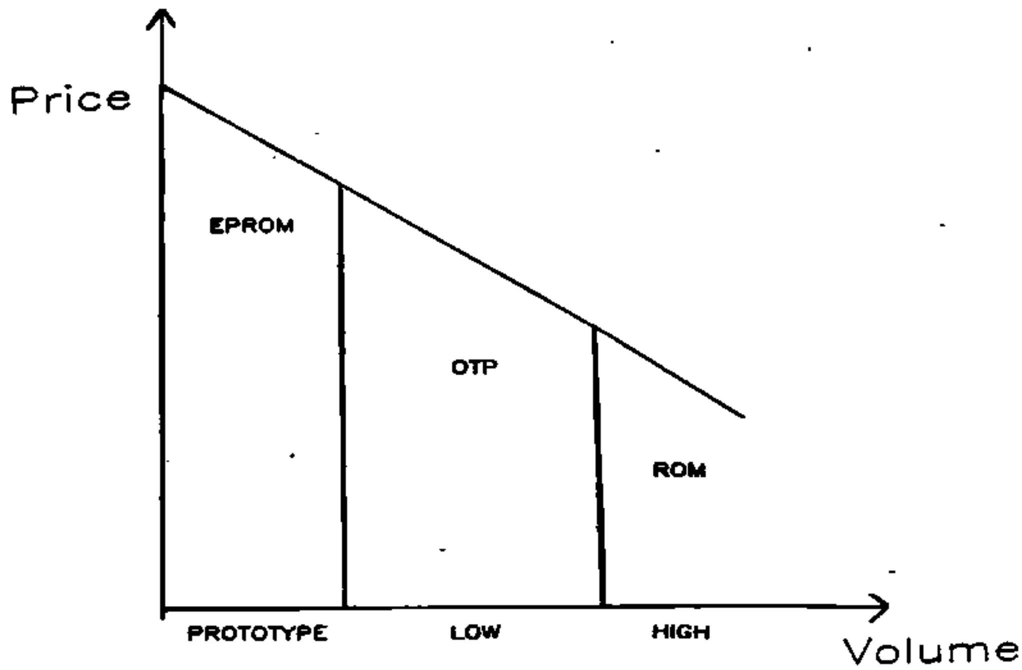
Volume Production (5,000 pieces per annum and upwards)

This is the most price-sensitive sector, using EPROM MCUs only in emergency supply situations. Consequently, the amount of business taken from the ROM MCU is a function of the price relationship between the MCU and OTP. Opinions vary as to what MCU:OTP price ratio is necessary before the OTP starts being considered for high-volume applications. Bearing in mind the undoubted advantages in flexibility, the OTP offers over the ROM equipment, DATAQUEST estimates that users will only consider OTP usage in volumes of up to 50,000 per annum, if price ratios of 1:1 to 1:15 are achieved by the manufacturers.

Figure 2 shows that EPROMS will continue to be used for software development in small quantities. OTP will fill in the area between small production lots and medium-volume production, and the ROM-based version for high-volume production.

Table 1 shows DATAQUEST's estimates for the worldwide MCU marketplace in thousands of units. Expressed as a percentage of total unit shipments, EPROM parts will decrease from approximately 6.8 percent in 1984 to 2.5 percent by 1989. This is consistent with MCU usage being limited to the field of software development.

Figure 2



Source: DATAQUEST

Table 1

ESTIMATED WORLDWIDE 8-BIT MCU SHIPMENTS
(Thousands of Units)

	1984	1985	1985	1987	1988	1989
EPROM MCU	11.1	10.0	11.1	14.4	13.4	17.4
OTP	-	4.3	13.9	35.4	69.8	125.6
ROM MCU	153.3	199.4	252.8	339.1	453.4	554.6
Total	164.4	213.7	277.8	388.9	536.6	697.6

Source: DATAQUEST

ADVANTAGES

Production

From the ROM MCU user's viewpoint, the OTP offers a method of regulating production runs, unforecasted production increases being satisfied with off-the-shelf product. Inventory holdings are reduced/simplified because one OTP part can replace all masked variants of an MCU. An OTP device can also make the logistics of production control/scheduling easier.

A survey of purchasing patterns shows that approximately 70 percent of the patterns account for only 30 percent of the volume. This means that an ever-increasing amount of planning and tracking time goes into managing relatively small product runs through the production areas.

Judicious use of OTPs can simplify planning, ease production flow, and reduce costs associated with inventory holding and obsolete product write-offs.

A final point to be noted is that since OTPs are plastic, they are also suitable for use in automatic PCB placing equipment.

Marketing

Marketing gains due to decreasing the time it takes for new products to bring software changes to market can be implemented overnight. This is a far cry from the three to four months required for a ROM MCU. This flexibility is especially important in the fast-moving consumer segment applications, which are subject to frequent software iterations such as the current automotive ignition/engine control projects.

End Users

Many industries have realized the advantages of OTP MCUs. The following applications show how pervasive the OTP has become:

- Telecommunications: PBXs, Smart Phones, and Digital Switches
- Automotive: Braking Systems (Anti-Skid)
- Office Automation: Disk Drives, Printers, LANs, and Smart Typewriters
- Electronic Instrumentation: Logic Analyzers and Oscilloscopes
- Industrial Control: Numerical Control and Robotic Control

DISADVANTAGES

Reliability

The OTP concept was established through the use of plastic memory EPROM devices in the late 1970s. These devices suffered from long-term reliability problems--a stigma which today's products find difficult to shake off, in spite of improved processing, materials, and packaging techniques.

Cost

Die sizes are larger than the ROM-based product and testing times are longer. This results in a cost premium that dictates against their usage in very high-volume applications.

CONCLUSION

OTP growth will initially be at the expense of the EPROM. However, as user confidence in the parts grows and more manufacturers step into the marketplace, demand will increase. More lower-volume and fast-moving projects will start up on OTPs. DATAQUEST estimates that by 1989, OTPs will account for 156,000 units, or 18 percent of the MCU marketplace.

DATAQUEST believes that the OTP can increase the growth of electronics by encouraging industry entrepreneurs to bring more projects to production. Many good ideas have been killed off by the slow three to four months turnaround time of the ROM MCU, US$3,000 to US$4,000 mask charges, and minimum order requirements of 5,000 pieces.

Jim Beveridge
Janet Rey

Nielsen Dataquest
EUROPEAN RESEARCH NEWSLETTER

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THE GENERATION GAP--
AN UPDATE ON 32-BIT MICROPROCESSORS

SUMMARY

The 32-bit generation of microprocessors is now emerging. Three devices are already on the market, and there are more to come. The decision to move to a new generation of semiconductor devices is complex, and timing can be critical to the company making that decision. This newsletter gives an update on the 32-bit microprocessor, its applications, and its current and future manufacturers.

INTRODUCTION

Users look to the 32-bit microprocessor to provide increased speed and functional enhancements. Engineering and CAD workstations represent the most visible market segment to adopt the 32-bit MPU. Other important design-ins are in robotics, computer-aided manufacturing, and telecommunications.

DATAQUEST anticipates three phases in the adoption of the 32-bit microprocessor:

1. The replacement of 16-bit devices by 32-bit devices will be the first phase as new versions of existing systems are designed. We see this occurring initially with engineering workstations as growing systems complexity demands greater performance from the microprocessor. The important issue in this phase will be upward compatibility. The Motorola 68020 and the National 32032 are expected to be important players here because many of the existing workstations have been designed with the 16-bit predecessors to these 32-bit MPUs. In both cases, the conversion to the new MPU can easily be accomplished. This phase is already beginning.

2. In the second phase of the market development, we will see the use of 32-bit microprocessors in minicomputers and small business systems. Designers will use these products to improve the cost/performance ratio of their machines. A significant factor in this market will be the captive manufacturers of 32-bit devices, such as Data General, Digital Equipment Corporation, Hewlett-Packard, and NCR. The potential exists for any of these companies to offer its devices on the merchant market. NCR's entry into the merchant market marks the beginning of this phase.

3. The third phase of the development of the 32-bit market will occur when the devices are well understood and accepted and become the basic design elements of many microprocessor-based systems. Rapid growth in consumption of 8-bit and 16-bit microprocessors occurred about five years after they were first introduced. We expect 32-bit microprocessors to follow the same trend, with rapid growth beginning in 1989.

MICROPROCESSOR PRODUCT ACCEPTANCE

If 32-bit microprocessors follow the trends we have observed, they will exhibit slow to moderate growth in the first two or three years after introduction, followed by a period of extremely rapid growth in the fourth and fifth years. There are, however, arguments for either faster or slower growth than this experience suggests.

The arguments for slower acceptance revolve to some extent around the fact that the full capabilities of existing 16-bit devices have not yet been exploited. Another argument is that there are more design alternatives than ever before. Many systems designs are being done with multiple 8- or 16-bit microprocessors.

With the evolution of application-specific ICs, we are seeing the development of intelligent microperipherals. A number of coprocessors for 16-bit devices are also coming to the market. All these devices make the design of higher-performance systems possible without resorting to the use of a 32-bit microprocessor.

Faster acceptance of the 32-bit microprocessor could come about simply because the market is much larger than it was when the 8-bit and 16-bit devices were introduced. Some 32-bit microprocessors offer upward compatibility with existing 16-bit devices, making the transition from a 16- to 32-bit device much easier than previous generation switches.

The 32-bit device will appeal to manufacturers of minicomputers and superminicomputers as a means of reducing cost. These manufacturers will not have the same commitment to previous generations of microprocessors as microcomputer manufacturers, so they may accept the devices more readily, thus accelerating the rate of acceptance.

MANUFACTURERS--PRESENT

Motorola

The Motorola 68020 was introduced in the third quarter of 1984. The company is now ramping up to full production. The 12MHz version will be in volume production by mid-1985 and the 16MHz version in the Fall. Motorola has entered into a second-source agreement with Thomson-CSF, contingent upon certain technology exchange agreements. If these agreements are met, Thomson-CSF is expected to start production of the 68020 by the end of 1985. Hitachi, Rockwell International, and Signetics also second-source Motorola's 16-bit devices and may be regarded as potential second sources for the 32-bit family.

National Semiconductor Corporation

National Semiconductor Corporation is currently the leading supplier of 32-bit MPUs with its 32032. The device has been in production for more than a year. Texas Instruments, which is second-sourcing the family, is expected to start sampling around mid-1985.

NCR Corporation

NCR is offering its 32-bit chip set, originally developed for internal use, on the merchant market. The device, which features external microcode, can emulate existing microcomputers. Honeywell, Inc., has signed an agreement with NCR to use the NCR/32 chip set for a future small- to medium-scale computer system.

MANUFACTURERS--FUTURE

This section of the newsletter will cover the announced plans of future participants in the 32-bit microprocessor market. Table 1 lists those companies believed to be currently involved in 32-bit microprocessor development.

Advanced Micro Devices

The Advanced Micro Devices (AMD) 29300 family of bipolar devices includes the Am29323 Multiprecision Multiplier, the Am29325 Floating Point Processor, the Am29332 16-bit Micro-Interruptible Sequencer, the Am29332 32-bit Arithmetic Logic Unit, and the Am29334 Four-Port Dual-Access Register File. Each device can function alone or act as a building block for a 32-bit system. The products are intended for use in high-performance applications, for intelligent peripherals control, and in digital-signal and array processors. The 29325 arithmetic unit will be sampling within two months, and all five devices will be sampled by the end of 1985.

AT&T Technologies

AT&T's WE32100 is a CMOS microprocessor originally developed for in-house use. The company recently announced commercial availability of the family. The WE32100 is now in production, together with the WE32101 memory management unit and the WE32105 system interface unit. The 32106 math acceleration unit is now being sampled, and the 32103 DRAM access controller and the 32104 DMA controller will complete the chip-set early next year.

Hitachi Ltd.

Hitachi Ltd. announced the development of a CMOS 32-bit microprocessor at the end of 1984. Sample quantities are expected at the end of 1986, with full production beginning in mid-1987. The device is expected to be upwardly compatible with Motorola's 68000 family. Hitachi had been regarded as a potential second source for the Motorola 68020 and it is not yet clear what effect the announcement of a proprietary 32-bit device will have on the situation.

Inmos

Inmos is in the final development stages of a family of devices based on its unique, high-performance architecture. The family includes both a 16-bit and a 32-bit transputer as well as some intelligent microperipherals. Inmos will begin sampling the first parts of this family by the end of 1985 or early 1986.

Intel

Intel announced early this month that it plans to ship samples of its 80386 32-bit microprocessor in about six months. The device will be offered in 12- and 16-MHz versions, and Intel will also offer a 32-MHz clock generator and a floating-point coprocessor chip.

NEC

NEC's V series family of microprocessors will include 32-bit devices. The V-60 is scheduled for introduction in 1986 and the V-70, described by NEC as a second-generation 32-bit device, is planned for 1987. NEC has licensed both Sony Corporation and Zilog, Inc., as second sources. NEC is also licensed as a second source for Zilog's Z80,000.

Zilog

The Zilog Z80,000 is now expected to be sampled by the end of 1985. NEC is a licensed second source for the part.

Other Manufacturers

Data General, Digital Equipment Corporation, and Hewlett-Packard have all introduced 32-bit microprocessors for internal use, but it is not yet known whether they will offer these devices on the merchant market. The other companies listed in Table 1 are believed to be developing 32-bit devices for the merchant market.

SELECTING A 32-BIT MICROPROCESSOR

As Table 1 shows, 17 companies already produce or are planning to produce 32-bit microprocessors. How do you pick a winner from such a range of alternatives? The market is still too young to predict who the big winners will be, but there are several points worth considering.

For the first time, the computing power of a minicomputer will be available in a microprocessor. This means that the 32-bit device can be approached from two directions: it can provide an upward migration path for current users of 16-bit devices, and it can offer a lower-cost option to manufacturers of mini- and superminicomputers. These two categories of users make different demands on 32-bit devices. Those taking the upward migration path are looking for upward compatibility from existing 16-bit devices so that they can continue to exploit the existing software base. Those taking the downward path from the minicomputer environment are more concerned with getting the architectural capabilities available with advanced technology. In the long term, this diversity could set the stage for a larger number of suppliers to enter the market.

There are two new factors in the 32-bit market that could change the market pattern. The first is the presence of the captive manufacturers. Captive manufacturers were ahead of the merchants in their development of the 32-bit device. There has been an increasing trend for captive semiconductor manufacturers to offer their products on the merchant market. NCR's device, the NCR/32, is the first of such products to be offered, but others could follow. Such a development could herald the growth of a 32-bit niche market for those users who are looking for minicomputer capability in a microprocessor. Captive manufacturers have the advantage of a protected internal market to help them weather the vicissitudes of market introduction. However, the ability of captive manufacturers to market their products effectively will obviously be an important factor in the growth of this niche market.

The second factor to be considered in the 32-bit market is the development of proprietary devices by Japanese companies. In previous generations, Japanese manufacturers have second-sourced U.S. products.

The most important issue to consider in selecting a 32-bit microprocessor is whether you really need the added capabilities that the device can offer. Have you fully exploited the 16-bit options available? If your application requires 32-bit capability, then the next areas of consideration are similar to those for any microprocessor:

- Does the device match your application?
- Will it be available in sufficient quantities when you need it?
- Are the appropriate microperipherals and coprocessors also available?
- Are there adequate development tools?
- Is there a viable second source?

The point of divergence that you reach when selecting a 32-bit device is the decision about which category of 32-bit devices you should be considering. Is upward compatibility an issue? If so, you should be considering those devices that offer a migration path from earlier generations. Are you looking for minicomputer-like architecture? Devices developed initially for captive use will fit into this category. National Semiconductor's 32032 offers a VAX-like architecture, and Fairchild is promising to take a minicomputer-like approach to its 32-bit offering. Japanese companies will also be entering the market with devices that are not upwardly compatible with existing products. There is yet another segment, represented by AMD's 29300 family and also, perhaps, by the Inmos transputer. These devices offer alternatives for high-performance applications that do not fit into either of the other categories.

The ultimate success of 32-bit microprocessors may rest on the rate at which the market develops. If market acceptance of the 32-bit device is delayed, the winners could be those companies that gained an early share of the market, those companies with upward compatibility to a substantial installed base of 16-bit devices, or those companies with protected internal markets. Early acceptance of the 32-bit devices, on the other hand, may permit market growth adequate to support a wider range of successful products than we have seen in any previous generation.

Future newsletters on the 32-bit microprocessor will examine the growth of the market and the development of new devices. This information will help you to implement a selection strategy that will satisfy your product's requirements.

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Jim Beveridge
Jean Page
Mel Thomsen

Table 1

COMPANIES INVOLVED IN 32-BIT MICROPROCESSOR DEVELOPMENT

Advanced Micro Devices (Bipolar)	Matsushita
AT&T Technologies	Motorola
Data General	National Semiconductor
Digital Equipment Corporation	NCR
Fairchild Semiconductor	NEC
Hewlett-Packard	Texas Instruments
Hitachi	Toshiba
Inmos	Zilog
Intel	

Source: DATAQUEST
May 1985

Nielsen Dataquest

EUROPEAN RESEARCH NEWSLETTER

ESIS Code: Vol. IV Newsletters

RECORD YEAR FOR MEMEC--DESPITE INDUSTRY SLOWDOWN

INTRODUCTION

With its market continuing to expand rapidly over the 12 months ending December 31, 1984, Memec (Memory and Electronic Components) plc, an international electronics distributor, saw its pre-tax profits rise from £2.8 million in 1983 to a record £4.5 million in 1984. At the same time, turnover for 1984 surged by 91 percent, from £18.0 million to £34.4 million. Furthermore, despite the general semiconductor downturn, incoming orders for the first quarter of 1985 remain on target, and overall, Memec foresees a further satisfactory growth year in 1985.

Memec is typical of the narrow-line, high-technology European distributor. European distributors tend to offer a more complete service to their customers in terms of technical assistance and design support, aiming their sales efforts toward the engineering force, where design-ins occur, rather than concentrating on the buying activity, which tends to be the case in the United States. (See the ESIS service notebook, Volume II, Section 1.5, "Channels of Distribution").

The Memec Group now comprises 14 European subsidiaries distributing a comprehensive range of products that includes active components, OEM systems, disk products, peripherals, and microcomputers, in the United Kingdom and West Germany. In addition, an American subsidiary, Insight Electronics of San Diego, California, is a specialist distributor of high-technology electronic components.

BACKGROUND

Memec was launched by R.T. Skipworth, in April 1974. The company's objective was to provide an independent source of the latest available integrated circuits in the United Kingdom. Previously, Mr. Skipworth was Sales Manager of Transitron Ltd. In April 1974, Memec negotiated a distribution arrangement to sell products manufactured by Harris Corporation in the United Kingdom. Memec provided stocks of IC components and a PROM programming service for U.K. customers. Memec moved on to expand its product range by making distribution arrangements with other manufacturers.

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In 1977, the Group began selling microcomputer equipment, development systems, and powerful microcomputer systems.

Memec's management team is headed by Mr. Skipworth who is Managing Director, Chairman, and Chief Executive. Ed Sturmer, who joined the company in 1974, is Group Technical Director, and Colin Stevens is Financial Director. The company has some 300 employees.

Table 1 lists Memec's subsidiaries:

Table 1

MEMEC SUBSIDIARY COMPANIES

Ambar Components Ltd.
Ambar Systems Ltd.
Cascom Microelectronics Ltd.
Computer Repair Centre Ltd.
Electronica GmbH
Insight Electronics Inc.
IST Sales and Trading GmbH
Kudos Electronics Ltd.
Metronik GmbH
Micro Call Ltd.
Midwich Computer Company Ltd.
Technology Warehouse Ltd.
Thame Components Ltd.
Thame Properties Ltd.
Thame Systems Ltd.

Source: Memec plc
DATAQUEST
April 1985

The main categories of components marketed by Memec are microprocessors, interface circuits, power supplies, and various (specialized) semiconductor memories. Memec has supply arrangements with several integrated circuit manufacturers, including Advanced Micro Devices, Fujitsu, Harris, and Mostek. The company markets a range of microcomputers and peripheral equipment, such as printers, visual display units, and floppy disk controllers, and a range of standard software operating systems.

Memec's recent expansion activities have included the formation of Cascom Microelectronics in the United Kingdom, a company specifically formed to address the application-specific IC (ASIC) market; further expansion into West Germany with the acquisition of Metronik; and the opening of its first U.S. subsidiary, Insight Electronics.

ASIC DEVELOPMENTS

In February 1985, Memec set up a new division called Cascom (Customer Application-Specific Components) Microelectronics, which will concentrate entirely on ASICs. Cascom will initially offer all British CAE tools for silicon compilation: UV-erasable PALs from Atera Semiconductor, a range of linear and mixed linear/digital ASICs from Microlinear, and the Whitechapel Computer Works' MG-1 workstation running a variety of design software, including the Lattice Logic Chipsmith package. Gamil Hadad is Cascom's managing director.

Several U.K. distributors are now approaching the ASIC market. Berkshire-based Macro Marketing has opened a semicustom design center to offer its customers semicustom device design capabilities. The new facility claims that it can turn around sample standard cell and gate array products in 10 weeks.

Gothic Crellon has just opened a semicustom design center at Slough. The move into this area is an extension of a franchise agreement between Gothic Crellon and Mullard, in which designs produced for customers will be manufactured by Philips, in Eindhoven.

Power Technology Ltd. of Reading, a U.K. distributor of power components and supplies, recently launched a linear ASIC capability through its exclusive franchise agreement with Silicon General.

DATAQUEST ANALYSIS

DATAQUEST believes that Memec is fulfilling a valuable role in the overall European electronics industry. The role of the specialist distributor is one for which we feel there will be an increasing need as products, both ICs and systems, become more technical. In pursuing a strategy of balancing its activities, Memec has so far been able to maintain profitable growth in its expanding markets without being significantly affected by fluctuations in any one particular product area. Its minimal exposure to the highly variable memory, microprocessor, electronic games, and personal computer markets, together with its successful penetration of other market sectors that are less cyclical in nature, have resulted in a healthier and more stable order book than similar companies in both Europe and the United States.

The European distributor scene is generally more technically oriented than its U.S. counterpart. We believe that this bodes well for the European electronics companies and can provide an overall advantage in helping them to apply advanced electronics technologies to their products.

Jennifer G. Berg
Malcolm G. Penn

Nielsen Dataquest

EUROPEAN RESEARCH NEWSLETTER

ESIS Code: Volume II Newsletters

THE CAMBRIDGE HIGH-TECH BOOM TOWN PHENOMENON

OVERVIEW

The university city of Cambridge, United Kingdom, traditionally has been a backwater, in industrial terms. Since 1975, however, it has become the focus of Britain's high-technology expansion. More than 4,000 new jobs have been created in the last five years, mainly in small, science-based companies. Of these jobs, around 90 percent were created in enterprises that were less than ten years old.

Over the last decade, Cambridge has spawned new companies in disciplines such as biotechnology, computers, electronics, and instrumentation. Recently this trend has accelerated--since 1981, Cambridge has formed around 30 such enterprises each year. A recent analysis of around 260 technology-based companies in Cambridge revealed the following:

- 60 percent are less than six years old
- Collectively, they employ 13,700 people (out of a total 100,000-person work force)
- Collectively, they generated 1984 revenues of £890 million (US$1.2 billion)
- One in three employ fewer than six employees
- Three quarters employ fewer than 30 employees

Most of the employees are engineers, scientists, or clerical workers. The Cambridge companies currently do little of their own manufacturing, preferring to subcontract this function to other businesses.

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BACKGROUND

The emergence of small science-oriented companies in Cambridge is very similar to what occurred with the Boston Route 128 companies and with California's Silicon Valley companies in the United States. Though these latter phenomena are longer established and much larger, both have strong connections to developments at their nearby academic institutions, the Massachusetts Institute of Technology and Stanford University, respectively. Similarly, DATAQUEST believes that one reason behind the growth of Cambridge's high-technology companies is the small, lively, special nature of the city dominated by its university. Cambridge University itself was instrumental in persuading its academics either to start their own businesses or to form business relationships with the industrial community.

The core of people skilled in the technology disciplines associated with Cambridge University has reached critical mass--sufficient to greatly influence the city's life and destiny. Perhaps the most famous of these is Sir Clive Sinclair--one of the United Kingdom's earliest high-technology entrepreneurs--whose early days in electronics saw him reclaiming saleable products from manufacturers' reject transistors. Currently, Sinclair Radionics is one of the world's largest home computer manufacturers.

Another significant factor in the Cambridge success story is the ease with which people can leave existing companies to form new ones. The virtual lack of heavy industry has resulted in a very flexible work force and a general psychological attitude in which flexibility and individualism have never been suppressed.

A further factor was the 1960s formation of Cambridge Consultants, which was to become instrumental in setting the tone for Cambridge's future industrial activities. Many of the founders of Cambridge Consultants subsequently left to start new high-technology enterprises--a phenomenon that has repeated itself several times. As the critical mass of such people gained momentum, so the informal social and communications networks flourished, thereby creating the environment to further encourage people to change jobs and start up new companies.

All these factors, however, would have come to nothing had it not been for the sympathetically disposed attitudes of the financial community, which took the trouble to learn and understand the needs of the new companies.

Thus, coincidental with the period of rapid advances in technology, the close proximity of this new generation of people and companies to the university where such advances were taking place proved an ideal spawning ground. The Cambridge phenomenon was born.

As with other entrepreneurial high-technology centers, the Cambridge phenomenon is not without its own set of traumas. In the mid-1970s, Mr. Sinclair suffered a major setback when his once-booming pocket calculator company failed as a result of his ill-fated digital watch venture. In true Silicon Valley tradition, Mr. Sinclair subsequently rose to become one of the world's largest and most successful manufacturers of home computers. More recently, however, Acorn Computers, the Cambridge-based Sinclair spinoff company, has run afoul of the vicious home computer price war currently under way in the United Kingdom (see ESIS newsletter "U.K. Home Computer Bubble Bursts," dated February 28, 1985).

DATAQUEST ANALYSIS

In addition to Cambridge, there are currently two other high-technology boom areas in the United Kingdom--the M4 Motorway Corridor between Bristol and Berkshire in Southern England, and Silicon Glen in the Scottish lowlands. There are substantial differences between these and the Cambridge Silicon Fen area.

Cambridge comprises mainly small companies emphasizing research and development. By contrast, the predominant influence in the M4 Corridor comes from companies involved in high-technology production, distribution, and marketing, while the Silicon Glen area is typified by the U.K. subsidiaries of multinational electronics and semiconductor companies.

DATAQUEST believes that the following factors contributed substantially to the Cambridge phenomenon:

- Strong university support
- Highly flexible work force
- 1960s formation of Cambridge consultants
- Informal communications networks
- Supportive financial community
- Strength in technological innovation

Cambridge's technology-based community is currently dominated by small companies. Recently, however, big companies such as IBM and Schlumberger have started to set up shop there. We believe that this trend will continue as large corporations seek to benefit from the phenomenon.

There is no reason to suppose that either the flow of good ideas from the university or the existing companies will cease--on the contrary, DATAQUEST believes that the Cambridge phenomenon has barely reached its infancy and is poised to embark as a new area of technology-based growth. We believe that the Cambridge phenomenon is one further example of the winds of change in Europe.

Malcolm G. Penn

Nielsen Dataquest

EUROPEAN RESEARCH NEWSLETTER

ESIS Code: Vol. II Newsletters

SGS ON TRACK FOR CORPORATE MISSION

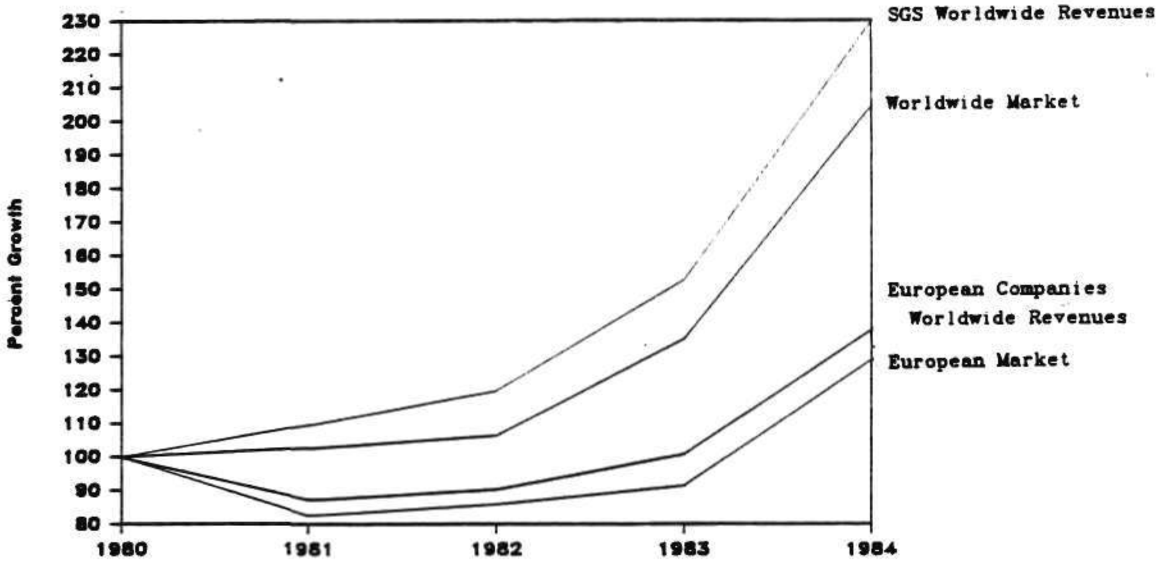
MANAGEMENT OVERVIEW

SGS had another successful year in 1984. Worldwide sales increased by just over 50 percent to US$335 million and European revenues by about the same amount to $181 million. This compares to overall worldwide and European market growth of 47 percent, and 41 percent, respectively.

Since 1980, SGS has consistently outperformed both the European and world semiconductor markets (see Figure 1).

Figure 1

RELATIVE GROWTH IN SEMICONDUCTOR MARKET
(U.S. dollars, Base 1980 = 100)



Source: DATAQUEST
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The company has successfully undergone a radical and substantial transition. The once engineering-oriented, predominantly nationalistic company has become an aggressive, quality-driven, broad-range supplier to the world semiconductor markets. DATAQUEST believes that this transition has been effected through a combination of technological leadership in certain key products and technologies, license agreements, and joint ventures, directed by President and Chief Executive Officer, Pasquale Pistorio. Perhaps the ultimate measure of success was achieved in 1983 when the company became profitable for the first time in its then-11-year history as a joint SGS-Ates company.

BACKGROUND

The company's semiconductor experience dates back to the late 1950s when SGS was formed by Olivetti and Telettra. The present company was the result of the 1972 merger of SGS and Ates. At that time, the company shareholders included STET (60 percent), Olivetti (20 percent), and Fiat (20 percent). Subsequently SGS became wholly owned by STET, a $7 billion conglomerate operating in the telecommunications and electronics fields, which in turn is part of the state-controlled IRI group (see ESIS Volume III, "SGS Group of Companies" company profile dated August 7, 1984, for further details).

SGS was the first European company to master the silicon planar technology, and over the years has become a world leader in high-voltage, high-current, linear technologies as well as in power transistor technologies. In the late 1960s, SGS was the first European company to start research and development of MOS technologies, and was the first in Europe to produce microprocessors.

Despite this history of innovation, SGS until recently, has never enjoyed a substantial world semiconductor market position. In part, this was due to the original brief given to the company by its owners--that SGS's role was to fulfill Italy's strategic and technological needs rather than to be a major international force. By 1980, both STET and IRI changed their philosophies radically, with the growing realization that semiconductor competence could only be achieved as a result of achieving world success. The message was becoming clear--unless SGS became a successful international semiconductor force, it would fail in its broader role of fulfilling Italy's technological needs. With this in mind, the owners set about finding an internationally experienced management team to effectively implement the necessary changes.

The stage was thus set for the return to Italy of the Italian-born semiconductor veteran, Pasquale Pistorio. After much persuasion from STET, Mr. Pistorio quit his position as general manager of Motorola's International Semiconductor Division in Phoenix, Arizona, and agreed to accept the challenge, but on three conditions. These conditions were:

- That he could run the company as a free enterprise without political, social, and economic interference

- That he could run the company as a fully international operation, from design through manufacturing and marketing

- That the resources would be made available for him to take the company where he (and STET) wanted

These conditions were readily accepted by STET, and in July 1980, Mr. Pistorio arrived at SGS headquarters in Agrate, near Milan, Italy.

PERIOD OF TRANSITION

The effects of Mr. Pistorio's arrival were immediate. Within two months, he fired 15 people who were singled out for their staggering absenteeism record of more than 50 percent during the previous three-year period. What made this even more profound was that just one month previously, the Italian Minister for Industry had publicly stated that no one would ever be fired from a state-owned industry. Pasquale Pistorio did just that. The reaction was equally profound. Apart from some token strikes and demonstrations, productivity and morale immediately improved.

Mr. Pistorio's next visible action was a major reorganization of the company, in terms of both its structure and its key management.

Previously, the company had operated on a centralized (vertical) design, manufacturing, and marketing structure. Mr. Pistorio changed that to a matrix organization, with four product areas matrixed across three regional areas (see Figure 2).

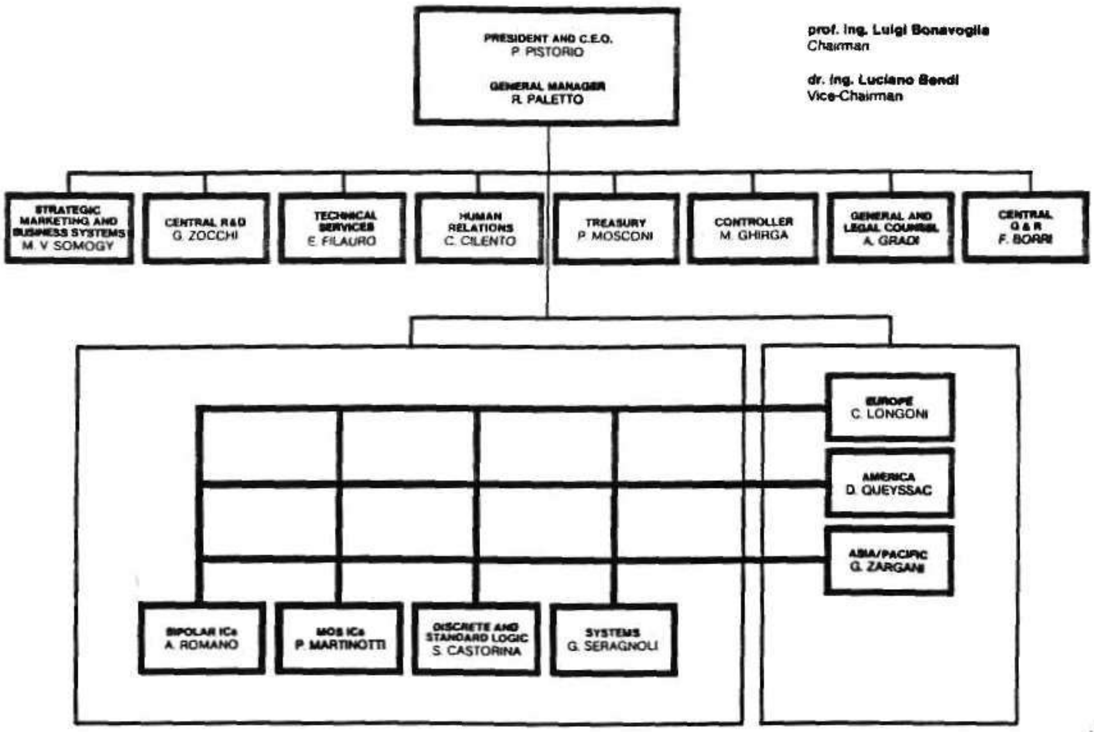
Under this new structure, the heads of each of the four product areas (divisions) assumed full profit and loss accountability and control of all the activities, design, manufacturing, and product marketing in their areas. The regional directors also assumed an increasingly responsible role for sales and marketing as well as for local design centers, administration of local factories, and margin contribution. Several key personnel were imported into SGS, notably Daniel Queyssac (ex-Motorola, United States), Carlo Longoni (ex-AMD, Europe), Piero Martinotti (ex-Motorola, Europe; ex-Fiat, Italy), Salvatore Castorina (ex-Motorola, Europe), Maurizo Ghirga (ex-Exxon, Italy); and Milivoy von Somogy (ex-Motorola, Europe). Raimondo Paletto, one of the joint general managers, became the sole general manager.

All of these people were veterans of the semiconductor industry and brought a substantial amount of cumulative energy and experience to SGS. For example, Mr. Queyssac had spearheaded Motorola's introduction of the 68000 microprocessor to the marketplace.

By the end of September 1980, after three months in office, Mr. Pistorio had completed SGS's first five-year plan. By November, this plan had been formally approved by both STET and IRI and had been publicly presented to the then-suspicious outside world. In the same time period, all the organizational changes had been announced and some of the new management was already in place.

Figure 2

SGS ORGANIZATION STRUCTURE



Source: SGS
DATAQUEST
February 1985

One of the positive aspects of Mr. Pistorio's management style is his openness both to his staff and to the world at large. Simultaneous with the publication of his plan, Mr. Pistorio informed each of his staff of their new corporate goals--"We at SGS have 1 mission, 3 objectives, 6 strategies." Subtly hidden within this statement was the message "1 + 3 + 6 = 10--an indication that Mr. Pistorio ultimately aims for SGS to be among the top 10 world semiconductor suppliers.

Mr. Pistorio declared that the new mission of SGS was to be a broad-range semiconductor manufacturer operating on a multinational basis. Within this plan, three objectives were defined. The first was technological--to guarantee access to advanced semiconductor technologies for the European electronics industry; the second was social--to contribute to the social development of all the countries in which SGS operated with the view to creating real jobs in the future; and the third was economic--to reach economic breakeven by the end of 1984 and to operate financially in accordance with world standards for the semiconductor industry. Mr. Pistorio clearly emphasized that the realization of the third objective was a fundamental and mandatory requirement for achieving the other two objectives.

The six strategies defined to realize the objectives, and thus the corporate mission, were listed as follows:

- Rationalization of the product portfolio
- Optimization of the market portfolio
- Technological attack of the European market
- Attacking extra-European markets
- Productivity
- Service and quality

Under the revised company logo, and with a new corporate slogan, "Technology and Service," by March 1981, SGS had begun its world offensive.

PRODUCTS AND STRATEGIES

SGS picked six product areas, together with a defined market objective, in which to concentrate its resources. These product areas and their corresponding market objectives included:

- Linear ICs--World leadership
- Power transistors--World leadership
- N-channel MOS--Strong microprocessor, ROM, EPROM, and nonvolatile memory presence together with other dedicated circuits, for example, telecommuhications ICs
- Si-gate CMOS--Strong presence in innovative fast logic families (4000 series and 74HC), microprocessors, gate arrays, and other dedicated circuits, again telecommunications-focused
- Bipolar and CMOS logic--Participation in the world markets for LS TTL and CMOS standard logic families
- Small-signal metal can transistors--Commercial supremacy in a mature family with high returns

In linear ICs, SGS presently enjoys world leadership in high- (several hundred) voltage devices--for example, subscriber line interface ICs (SLICs), RGB driver ICs, motor drive ICs, and a 200W switching power converter IC. In addition, developments are under way to combine CMOS, DMOS, I^2L, and linear power devices onto a single IC. In power transistors, SGS is particularly strong in epi- and multiepi-technologies, and a range of DMOS power devices.

The three market segments prioritized were:

- Telecommunications/informatics
- Industrial
- Automotive

By concentrating its resources in this way, SGS aimed to exploit its existing strengths as the vehicle for immediate growth in sales dollars to embark on its corporate mission.

Among the first programs to be eliminated from its product portfolio were the company's meager efforts in DRAMs. With sales of 4K and 16K DRAMs totaling only around $12 million worldwide, losses were mounting. Even though this represented writing off access to a major market segment, Mr. Pistorio decided that the costs (and risks) were too high to stake his company's future on such a gamble at that time.

Also to be put on ice was the company's LS TTL activity, which at that time comprised a limited range of somewhat old designs, and had limited sales.

Important to SGS's successes has been its strategy to enter into product and technology agreements, leveraging its own strengths wherever possible. Several earlier agreements already existed, for example with Fairchild and Zilog, and by the end of 1984, these has been complemented by deals with Toshiba (CMOS technology, 74HC joint development program, CMOS telecommunications ICs), Rifa (high-voltage bipolar telephone ICs), LSI Logic (3000 and 5000 series CMOS gate arrays), National Semiconductor, Silicon General, Unitrode (mutual linear IC second sourcing), and Semikron (joint development of high-power discretes). In addition, SGS has pioneered several world standards in power IC packaging.

FUTURE OUTLOOK

Since 1981, SGS has committed substantially to investment, both in capital expenditures and R&D. For example, in 1984, $145 million or 43 percent of revenues was spent on new capital. Similarly, since 1980, more than 13 percent of revenues per annum has been invested in R&D. By the end of 1984, five 125mm front-end facilities were fully operational, the first (linear ICs) having been commissioned in Agrate in December 1982. Since then, two lines have been commissioned in Catania, Sicily (LS TTL and power transistors), two in Singapore (linear and power transistors), and one in Rennes, France (linear ICs). By April of this year, SGS's first 150mm (NMOS) front end will be operational in Agrate, and by the first quarter of 1986, the second 150mm (CMOS) front end will be operational in Phoenix, Arizona. This represents SGS's first wafer fabrication facility in the United States.

The opening of the 125mm lines in Catania also signaled SGS's re-entry into the standard bipolar LS TTL market. The Catania TTL facility utilizes ion-implant and projection align techniques, making it one of the most efficient such plants worldwide. Fully equipped, the plant is capable of running at 25,000 wafers per month capacity--equivalent to more than $200 million per annum output. A second such facility is scheduled for installation in Singapore when required. While DATAQUEST believes that SGS does not aim for world leadership in the TTL marketplace, we believe that it does aim to rank among the top five or six world suppliers.

DATAQUEST CONCLUSIONS

Table 1 gives DATAQUEST's estimates for SGS's worldwide semiconductor revenues for 1979 through 1984. Since 1980, SGS has consistently outperformed the world semiconductor market growth. During that period, the world semiconductor market grew at an 18 percent CAGR while SGS's sales grew 23 percent--five percentage points higher than the world norm. By comparison, the European market grew 7 percent in dollars and SGS's Italian home-base market, 6 percent. It is significant that this growth was achieved during a period of the worst semiconductor recession the industry has ever known. In 1980, SGS was number 24 in the world rankings; in 1984 it advanced to the 21st slot. Among the other world semiconductor companies with revenues in 1980, only AMD, Analog Devices, Ferranti, Monolithic Memories, Zilog, and the major Japanese companies (Fujitsu, Hitachi, Matsushita, Mitsubishi, NEC, Oki, and Toshiba) equaled or bettered this performance.

Table 1

ESTIMATED SGS WORLDWIDE SEMICONDUCTOR REVENUES
(Millions of U.S. Dollars)

	1979	1980	1981	1982	1983	1984
Total Semiconductor	$120	$146	$160	$175	$223	$335
Integrated Circuits	$ 71	$ 88	$110	$126	$177	$264
Bipolar Digital	$ 7	$ 9	$ 14	$ 5	$ 9	$ 22
MOS	$ 14	$ 24	$ 33	$ 45	$ 68	$106
Linear	$ 50	$ 55	$ 63	$ 76	$ 94	$136
Discretes	$ 49	$ 58	$ 50	$ 49	$ 51	$ 71
Optoelectronics	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0

Source: DATAQUEST
February 1985

It is important to remember that the high growth of the Japanese companies can be attributed to their substantial presence in the DRAM marketplace--an area which, currently, SGS has deliberately chosen to ignore.

In 1983 SGS achieved profitability--one year ahead of its strategic plan. In 1980, with a worldwide staff of approximately 8,800, SGS achieved $146 million in sales, around $16,600 per employee. By 1984 this ratio had doubled to $33,000. While perhaps not yet ranking with the best in the industry, it does represent a substantial improvement in productivity and indicates to DATAQUEST that the company is well on the way to a more secure financial footing.

Under Pasquale Pistorio's leadership, through a combination of drive, commitment, and sound business strategy, SGS has achieved some dramatic results. DATAQUEST believes that SGS has come of age and remains firmly on course to achieving its corporate mission--to be among the top 15 worldwide suppliers by 1988.

Malcolm G. Penn