DATAQUEST
A Subsidiary of A.C. Nielsen Company
INCORPORATED

SEMICONDUCTOR SUPPLY STUDY

for

DIGITAL EQUIPMENT CORPORATION

August 1979

by

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INTRODUCTION

The purpose of this study is to highlight the crucial strategic questions which DEC must consider in developing a procurement strategy for the next five years. In addition, a data base is developed to support the conclusions drawn.

The proposal, work statement and amendment to it are attached at the end of this section.

Summary

This report has five sections. Section 1 on wafer fabrication suppliers characterizes the types of vendors who make a business of processing customer masks. Section 2 on capital equipment suppliers gives some of the key forces at work in this market and provides 31 documented vendor interviews. Section 3 discusses materials, principally silicon and poly silicon. Section 4 discusses major merchant suppliers and provides an overview of the industry, delineating critical changes such as increasing capital intensity, higher design costs, the tendency towards merger and acquisition, and the diminishing number of viable competitors in each product line. Section 5 summarizes the other sections and presents strategic recommendations.

Conclusions

The data presented in this report leads to the conclusion that the number of semiconductor companies competing in each component product category is shrinking. In addition, many semiconductor companies are becoming less competitive either because their stock is being purchased by their customers or because they have made long-term commitments to certain customers.

European suppliers do not offer a supply alternative because they are generally not technology leaders. Japanese suppliers have successfully developed advanced technology; however, they are probably not a viable long-term supply source because it appears that they will use this technology to give their own computer industry a competitive advantage. In spite of this, the Japanese can usually be depended upon to meet contractural commitments--the uncertainty comes when the contract is to be renewed.

As the semiconductor industry becomes more oligopolistic and less competitive, it is necessary to revise procurement strategies. Total corporate requirements need to be combined if one is to get the attention of semiconductor companies and it is important to control the types of parts to be used in new designs to those that can be acquired. Vendor relationships need to be developed that have a higher degree of trust--semiconductor firms have to have confidence that a customer will be there in 3-5 years; otherwise, they will not provide capacity for that account. Procurement should be stratified into different component categories; such a mix might include high technology parts, external wafer fabrication, captive manufacture, and obsolescent components designed into older products.

The material in this report includes all the raw data on which our conclusions are based--in some cases even transcripts of personal interviews. In reviewing this material, the reader can trace conclusions to their source and is free to adopt or modify them as appropriate.

PROPOSAL

SEMICONDUCTOR SUPPLY STUDY

for

DIGITAL EQUIPMENT CORPORATION

Objective:

Digital Equipment Corporation (DEC) expects significant increases in its requirements for semiconductor components in the next five years--total purchases may increase to $500 million at present growth rates. The objective of this study is to develop a factual data base and to highlight the crucial strategic questions which DEC must consider in developing a procurement policy for the next five years.

Proposal:

DATAQUEST submits, on Attachment I, a Work Statement to fulfill the objective set forth above.

Methodology:

The study proposed will be accomplished through field interviews with appropriate semiconductor firms and suppliers to the semiconductor firms, as well as through reference to DATAQUEST's data base. Periodic session among members of the DATAQUEST team will be used to develop strategic questions. The project leader will be Howard Z. Bogert. Team members will include James F. Riley and Frederick L. Zieber.

Price:

--Fifty percent (50%) upon award, and fifty percent (50%) upon completion.

Completion:

A presentation will be made at DEC's offices in Maynard, Massachusetts at the end of July if award occurs before June 15, 1979 (6 weeks). A written report will follow within four (4) weeks.

Respectfully submitted,

DATAQUEST, INC.

Accepted:

DIGITAL EQUIPMENT CORP.

By: _____

Date: _____

By: _____

Date: _____

ATTACHMENT I

Work Statement

1. Wafer Fabrication Suppliers. Conduct interviews with 10-15 wafer fabrication suppliers offering technologies of interest to DEC. Profile each company in the following areas:

   Customer interface
   Processes available
   Process compatibility with other firms
   Facilities
   Staff
   Design capability
   Ownership and financing
   Viability--ability to stay competitive

2. Capital Equipment Suppliers. Conduct interviews with the top 2-3 suppliers in each significant capital equipment group. In particular, assess the capability of each firm to deal with a possible doubling of the capital equipment market due to purchases by captive suppliers. Firms representing the following equipment markets will be interviewed:

   Diffusion
   Alignment
   Photoresist processing
   Plasma etching
   Ion implant
   Epi reactors
   Chemical vapor deposition
   Plasma deposition
   Metal deposition

3. Material Suppliers, with emphasis on Silicon and Poly Silicon. Interview suppliers to develop industry capacity versus expected semiconductor industry needs. Spot check other materials areas, including photoresist, chemicals, gasses, and packaging materials.

4. Analysis of Major Merchant Vendors. (Confidential to DEC) What will their position be in five years? What is their susceptibility to merger? How would diversion of capacity to DEC effect other business? What is the demand for expected merger candidates and how will it affect stock prices?

5. Crucial Strategic Questions. DATAQUEST team members will engage in several discussion sessions to develop alternative scenarios for DEC to follow in developing sources of supply. It is expected that the choice among these scenarios will require DEC to answer a number of strategic questions.

MODIFICATION OF WORK STATEMENT

DIGITAL EQUIPMENT CORPORATION

Comments on Work Statement

General: DEC would like some consideration of international effects on supply of semiconductors. What changes will take place in Europe and Japan to change supply?

Would like a detailed analysis of merchant supplier wafer fabrication capacity in wafer starts per year. Divide ion bipolar and MOS.

Would like to know how other people in the computer industry plan to meet their volume demands.

Want to know who the major component buyers are in each major consumption category.

Interim Report: A telephone report is to be made half way through the project.

Additions to Work Statement

1. Wafer Fabrication Suppliers. Consider also:

Prime Mission - wafer fabrication or merchant supplier capacity (wafers per month).

Likely growth.

Customer Base - merchant suppliers or systems companies. Merchant vendors with whom compatible.

How is process controlled to maintain compatability?

Equipment inventory.

Test equipment and probe equipment.

Average wafer selling cost.

Availability for acquisition.

1. Capital Equipment Suppliers. Add:

Plasma etching (already listed).

High pressure oxidation.

Mask and maskmaking equipment.

Consider important equipment growth markets.

3. Major Merchant Vendors. Additional questions:

Could pieces of a vendor be acquired?
Would Fairchild sell the Portland, Maine Plant?

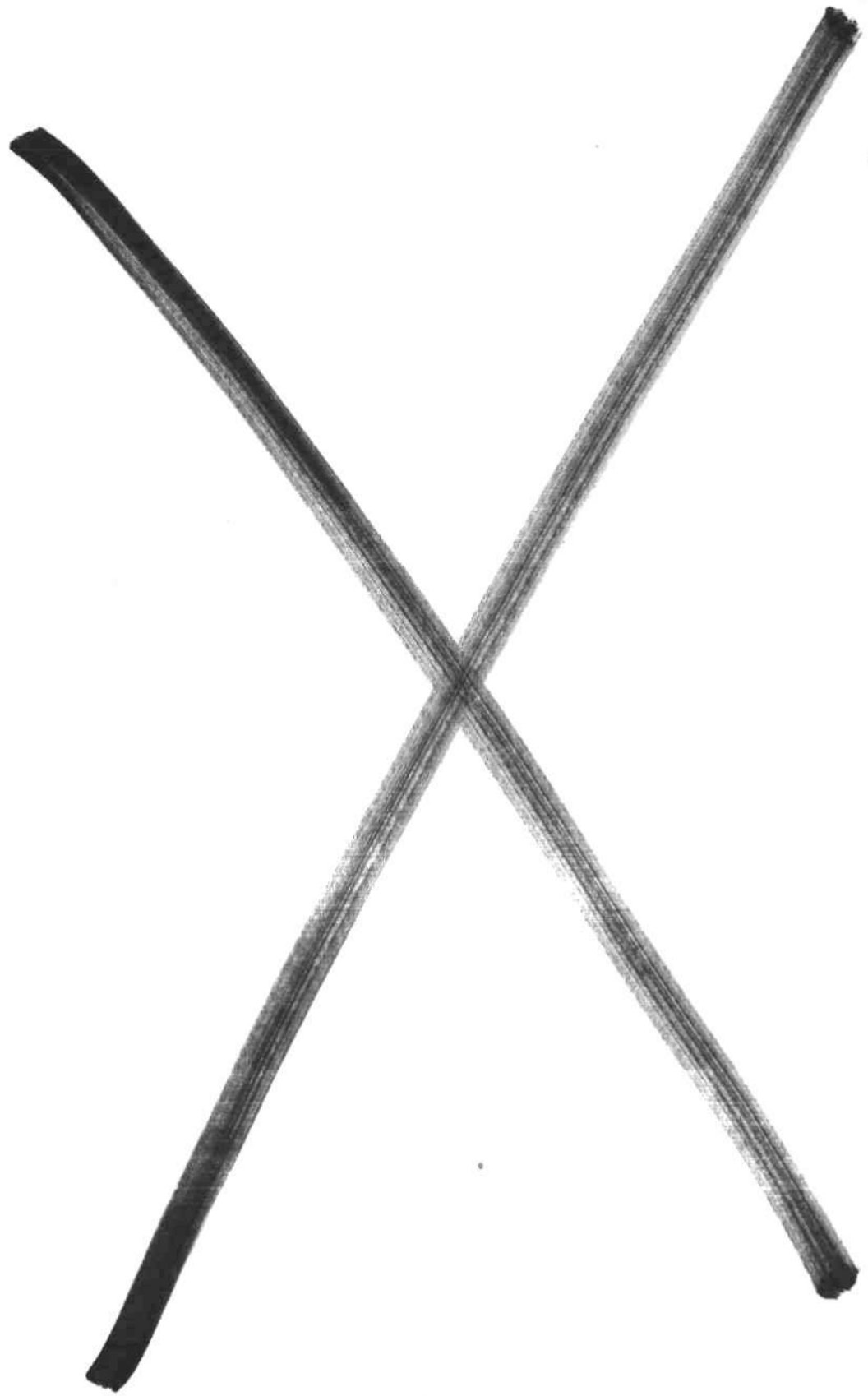
Likely future criteria for accepting customer tooled designs?

Is there a limit on custom production as a percent of total production?
As an amount from one customer?

What are the merchant vendor's perception of growth limits?
People, capital, space, or what?

PEOPLE AT DEC TO WHOM FINAL PRESENTATION
WILL BE MADE

Jim Coggmore	-	Group Manager LSI Manufacturing & Engineering
Dan Hamil	-	Purchasing Manager LSI
Bill Greene	-	Planning Manager LSI
Russ Doane	-	(works for Jim Coggmore)
Gene Jones	-	Future Planning (works for H. Crouse)
Jack Batten	-	Corporate Purchasing



1. WAFER FABRICATION SUPPLIER SUMMARY

Wafer fabrication suppliers will accept either masks or computer tapes generated by their customers. They supply prototype wafers which customers can use to verify designs. Universally, these are paid for on a per-wafer basis (usually 10 wafers minimum). In production, some vendors sell by wafer, some reach a price based on yield, and some prefer packaged products.

Basic conclusions of this section are as follows:

- Wafer fabrication suppliers lag the "state-of-the-art" in technology.
- $10 a layer is a good "ballpark" price for wafers from these suppliers.
- High technology wafers, e.g., HMOS or ECL, may cost twice as much as those from wafer fab suppliers since they can only be obtained from major merchant vendors.
- The major merchant vendors expect as much revenue from their customer-tooled wafers as from their most profitable products.
- Major merchant vendors are not anxious to sell wafers.

A company is considered a wafer fabrication supplier only if it has an individual in marketing assigned to this responsibility. Thus, it is possible to deal with wafer fab suppliers without involving the highest levels of management at the customer company. Most merchant semiconductor companies do not have such marketing and, therefore, must be dealt with on a corporate basis. The end of this section gives a list of wafer fabrication suppliers and provides a profile of each company.

WAFER FABRICATION SUPPLIERS

Overview

Vendor Interface

Incremental and Fixed Pricing

Merchant and Wafer Pricing

Source: DATAQUEST, Inc.
July 1979

WAFER FABRICATION OVERVIEW

- Vendors prefer to work with designs to their rules.
- Process "tweaking" only possible for very high volumes (above 2,000 wafers per month per design).
- Companies only include those perceived to be receptive to wafer fabrication business.
- "Spot" capacity available from time to time.
- "Spot" capacity cheaper and less predictable.
- Majors (Intel, Motorola) may consider wafer fab business in special situations:
    a. "Lease a line"
    b. "Take or buy"
- Wafer fabrication procurement requires a relationship of high trust.
- Wafer fabrication suppliers demand technically qualified customers.

Source: DATAQUEST, Inc.
July 1979

TECHNOLOGY EVOLUTION

Advanced - Proprietary product and process

Intermediate - Custom product

Low - Wafer fabrication service

Source: DATAQUEST, Inc.
July 1979

STEPS TO WAFER PRODUCTION (IDEAL)

1. Obtain design rules and process parameters.
2. Create "Worst Case" rules for selected vendors.
3. Create proprietary test pattern.
4. Design acceptable multi-vendor alignment keys.
5. Design circuit.
6. Run prototype wafers:
   a. To establish circuit functionality
   b. To establish circuit yield
   c. To establish process integrity (new vendors).
7. Run production wafers, dice or parts.

Separate mask sets may be required for separate vendors.

Source: DATAQUEST, Inc.
July 1979

CONTRACT INTERFACE

Prototype: Customer buys the wafer if test device and optical inspection good.

Production: Options

1. As in prototype phase
2. Yield incentive
   a. Vendor test
   b. Customer test
3. Packaged units

Comment: Keep in mind vendor's incentive to get low yields on prototype runs.

Source: DATAQUEST, Inc.
July 1979

INCREMENTAL WAFERS COST LESS THAN "FIXED CAPACITY" WAFERS

- Incremental costing is used for excess capacity.
- Firms reluctant to add staff for wafer buyer; will sell wafers to keep current staff.
- Reluctance to sell significant portion of output to single customer.
- Opportunity cost: maybe unused capacity can be sold later for more money.

Source: DATAQUEST, Inc.
July 1979

INCREMENTAL WAFER SUPPLY IS UNDEPENDABLE: THE LOWEST PRICED WAFERS ARE ALWAYS SHIPPED LAST.

Source: DATAQUEST, Inc.
July 1979

FINANCIAL ANALYSIS OF

INCREMENTAL AND FIXED

CAPAICTY WAFERS.

Source: DATAQUEST, Inc.
July 1979

ASSUMPTIONS

"Fixed" Costs per month	$122,464
Variable costs per wafer	$30.23
Wafer out capacity per month	20,000
Actual wafers out per month	10,000

Source: DATAQUEST, Inc.
July 1979

WAFER PRICING

"Fixed Capacity Wafers:

$122,464/10,000 + $30.23 = $42.50

Selling price at 60% gross margin = $106.25

Incremental Wafers:

Selling price	$80.00
Incremental cost =	30.23
Margin Contribution per wafer =	$49.77

Source: DATAQUEST, Inc.
July 1979

TYPICAL WAFER PRICES

12,000 CMOS wafers per month (3")	$ 80 - $10 per layer.
100 up N-channel (4")	$300 - $21 per (3") layer.
100 up ECL wafers (4")	$400 - $20 per (3") layer

Source: DATAQUEST, Inc.
July 1979

MERCHANT MARKET NET REVENUE PER WAFER

To figure part price:

	Wafer Cost
+	Assembly and Test Cost
=	Total Cost
+	60 - 100% Gross Markup
=	Selling Price

To figure equivalent wafer price:

	Part Price
-	Assembly Cost
=	Net Part Price
x	Parts Shipped per Wafer
=	Equivalent Revenue per Wafer

Source: DATAQUEST, Inc.
July 1979

PROPRIETARY PRODUCT REVENUE PER WAFER

(Net of Assembly Costs)

16K Dynamic RAM ($5.75 ASP)	(4")	$143 - $10 per (3") Layer
4K Fast Static RAM ($12.00 ASP)	(4")	$431 - $22 per (3") Layer
MOS Average	(3")	$115 - $14 per (3") Layer
Bipolar IC Average	(3")	$253 - $23 per (3") Layer

Source: DATAQUEST, Inc.
July 1979

WAFER FAB SUPPLIER OVERVIEW

Company	Customer Fab. Capability Rating	Production Interface (P=Parts YW=Yielded Wafers W=Wafers	Current Customer Base % Parts	% Custom	% Fab	Estimated Potential Customer Fab Starts (x 000/yr.)	Technology
AMI	+++	P	20%	60%	20%	132	MOS
ADV. LSI	+++	YW	-	-	100%	96	MOS
Burroughs	+(?)	W	-	100%	-	48, 48	BIP, MOS
Commodore	+	W	-	88%	12%	60	MOS
Electronic Arrays	-	P	95%	5%	-	-	MOS
EM&M Semi	-	YW	87%	-	13%	144	MOS
EPI, Inc.	-	W	-	-	100%	12	BIP, MOS
Hughes	-	YW	67%	20%	13%	24	MOS
Maruman	++	P	60%	10%	30%	36	MOS
Micropower	+	YW	40%	30%	30%	48	MOS
Mitel	++	YW	30%	30%	30%	36	MOS
Monosil	++	YW	10%	-	90%	84	BIP, MOS
National[1]	++	P	20%	60%	20%	216	MOS
Nitron	++	YW	65%	10%	25%	192	MOS
Polycore	+	YW	-	-	100%	36, 36	BIP, MOS

[1]Accounts only for six of National's Modules

WAFER FAB SUPPLIER OVERVIEW (Continued)

Company	Customer Fab. Capability Rating	Production Interface (P=Parts YW=Yielded Wafers W=Wafers	Current Customer Base % Parts	% Custom	% Fab	Estimated Potential Customer Fab Starts (x 000/yr.)	Technology
Samsung	-	W	15%	80%	5%	13	BIP, MOS
Semi Process Inc.	+	YW	-	-	100%	12	MOS
Standard Micro.Sys.	+	P	85%	10%	5%	12	MOS
Supertex	+++	YW	20%	20%	60%	96	MOS
Synertek	++	P	65%	15%	20%	67	MOS
Teledyne	+	YW	95%	-	5%	36	MOS
United Semi	+	YW	-	-	100%	48	MOS

Total Potential Fab Starts	1,532
Equivalent Product Revenue	$162 million
IC Production by U.S. Companies (1978)	$3,433 million
MOS Production by U.S. Companies (1978)	$1,640 million

Source: DATAQUEST, Inc.
July 1979

AVAILABLE FOR ACQUISITION

AMI - (Bosch, Borg Warner Interest) Public

ADV. LSI - Siemens Captive

Maruman - Several interested parties closely held

Micropower - Closely Held

Mitel - Captive of telecom firm

Monosil - Several interested parties closely held

National - Public

Nitron - Interst in partial acquisition

Polycore - Interest in partial acquisition

Semi Process, Inc. - Might sell 25%

Standard Microsystems - Many offers, lukewarm

Supertex - Finalizing agreement with EXXON

Synertek - Honeywell captive

United Semi - Offering joint venture wafer fab setup

Source: DATAQUEST, Inc.
July 1979

WAFER FAB SUPPLIERS

Company:

AMI

Prime Mission:

Custom MOS-LSI and standard products.

Customer Base:

20% standard product, 60% custom LSI, 20% customer tooling.

Estimated Wafer Starts:

Estimate a total of 150,000 to 200,000 wafer starts per year.

Likely Growth:

Expect firm to continue in custom MOS and to experience growth at about the industry average rate.

Ownership and Financing:

Public company 25% owned by Bosch and Borg-Warner.

Availability for Acquisition:

Substantial holdings by foreign firms makes acquisition unlikely.

Ability to Stay Competitive:

Expect that AMI will be technologically at the top of the second tier companies. In other words, they should be one of the most technologically competitive firm offering custom design services.

Customer Interface:

Will work with logic or system diagrams for custom LSI. Prefer Calma tapes or equivalent for customer tooling. Work with many design houses. See customer tooling as high growth area.

Processes:

28 process variants available. In addition to standard N & P channel MOS & CMOS, plan HMOS, VMOS and oxide isolated CMOS.

Process Compatibility With Other Firms:

Should be compatible with Synertek, Maruman and possibly National.

Equipment:

Four manufacturing modules in Santa Clara and additional capacity in Pocotello, Idaho.

Company:

Advanced LSI Technology (Subsidiary of Litronix and Siemens).

Prime Mission:

Wafer fabrication to customer masks.

Customer Base:

All customer tooling. About 30% of business from semiconductor houses at present. Some wafer fabrication for Litronix.

Estimated Wafer Starts:

8,000 3 inch wafer starts a month.

Likely Growth:

Expansion plans not firm at present.

Ownership and Financing:

Owned by Siemens through Litronix.

Availability for Acquisition:

Very unlikely.

Ability to Stay Competitive:

Company is five (5) years out of date technologically. Think they can maintain this position and also find a market for their wafers. 6% of sales goes to R&D. Well managed and have excellent understanding of what the wafer fab business really is. Probably have low yields on large die.

Customer Interface:

Masks - working plates.

Processes:

N-channel silicon gate, P-channel metal gate, P-channel silicon gate, CMOS metal gate.

Process Compatibility With Other Firms:

Broad compatibility since all masks come from other firms.

Employees:

75-80

Equipment:

30 diffusion tubes
7 aligners
2 implanters

Company:

Burroughs Corporation

Prime Mission:

Captive

Customer Base:

Burroughs Corporate

Estimated Wafer Starts:

4,000 Bipolar, 4,000 MOS. Excess capacity available.

Likely Growth:

As required by corporation. Some expansion plans.

Ownership and Financing:

Burroughs Corporation

Availability for Acquisition:

Nil.

Ability to Stay Competitive:

Believe processes and yields are quite competitive, especially bipolar.

Customer Interface:

Probably at the Calma tape level, if a decision is made to take outside business.

Processes:

High voltage N & P channel, ECL.

Process Compatibility With Other Firms:

Bipolar processes compatible with Motorola. MOS processes with at least AMI.

Company:

Commodore

Prime Mission:

To support Commodore Corporation. Some work has been done for outside customers; 2,000 to 4,000 wafers per month.

Customer Base:

Internal plus one outside customer.

Estimated Wafer Starts:

5,000 wafers per month available for sale. Two modules available at the Frontier facility, two at the MOS Technology facility. Estimate 30,000 to 40,000 wafers per month total.

Likely Growth:

As required by Commodore

Ownership and Financing:

Commodore Corporate

Availability for Acquisition:

Very unlikely.

Ability to Stay Competitive:

Current CMOS yields are known to be excellent, (7 micron rules). Expect firm to remain technologically competitive 3-5 years behind leading merchant firms.

Customer Interface:

Masks.

Processes:

CMOS and NMOS

Process Compatibility With Other Firms:

CMOS process known to be reasonably compatible.

Company:

Electronic Arrays.

Prime Mission:

Standard Products.

Customer Base:

100% Standard Products.

Estimated Wafer Starts:

Estimate EA currently starts 15,000 to 25,000 wafers per month.

Likely Growth:

Growth is likely to be better than industry average. Plant expansion currently underway.

Ownership and Financing:

100% owned by NEC.

Ability To Stay Competitive:

NEC technology should keep Electronic Arrays in the front ranks technologically.

Processes:

N&P channel MOS, CMOS.

Process Compatibility with Other Firms:

Low compatibility except NEC.

Employees:

300-400.

Equipment:

48 diffusion tubes; 22 aligners; 2 implanters.

Company:

EM&M Semi - Phoenix, Arizona.

Prime Mission:

Standard product. Some customer tooled product. Do not like to run wafers for other semiconductor companies.

Customer Base:

Mostly EM&M corporate. Presently 5% outside masks.

Estimated Wafer Starts:

New module has equipment for 5000 wafer starts, floor-space for 10,000 starts a month.

Likely Growth:

Expect no expansion plans for several years.

Ownership and Financing:

EM&M corporate.

Availability for Acquisition:

Questionable.

Ability To Stay Competitive:

Current processes are quite competitive. Expect firm to remain 1-2 years behind industry leaders.

Customer Interface:

Masks or Calma tapes.

Processes:

N channel Si gate; CMOS.

Process Compatibility with Other Firms:

Low. Prefer to have customer design to EM&M process.

Company:

Epitaxy Inc.

Prime Mission:

Supplier of epitaxial wafers; custom wafer processing to supplement major merchant firms.

Customer Base:

Mostly semiconductor firms. 70% of epi work on own substrates, 30% on customer substrates.

Estimated Wafer Starts:

Highly variable. Possibly 1000 wafers per month.

Likely Growth:

Expect wafer processing business to show moderate growth.

Ownership and Financing:

100% private and self-financed.

Availability for Acquisition:

Not known.

Ability To Stay Competitive:

One of the two major suppliers of epitaxial deposition services.

Customer Interface:

Masks.

Processes:

As specified by customer. Usually do only one process step--e.g., subepitaxial diffusion.

Process Compatibility with Other Firms:

As required by customer.

Employees:

Over 800.

Equipment:

Only two aligners available for custom processing.

Company:

Hughes - Newport Beach.

Prime Mission:

Merchant supplier, captive producer. Interested in custom wafer processing only as a filler. Want no more than 5% to 15% wafer processing.

Customer Base:

Mostly standard product.

Estimated Wafer Starts:

12,000 wafer outs is current plant capacity.

Likely Growth:

Plant expansion underway.

Ownership and Financing:

100% by Hughes Aircraft.

Ability To Stay Competitive:

Hughes Aircraft has excellent semiconductor technology and can keep the Newport Beach facility competitive if the desire is there. Expect Hughes to favor high-performance, low-volume technologies like SOS and oxide isolated ECL. Hughes is a bidder on the VHSI program.

Customer Interface:

Masks, Calma tapes.

Processes:

CMOS. Hughes is an ex-watch module manufacturer.

Process Compatibility with Other Firms:

Moderate compatibility on CMOS.

WAFER FAB SUPPLIERS

Company:

Marumann.

Prime Mission:

Standard parts. Some custom design and customer tooling.

Customer Base:

60% parts, 10% custom designed, 30% customer tooling.

Estimated Wafer Starts:

Currently 11,000 to 12,000 per month. $200 to $500 for prototype wafers.

Likely Growth:

Second wafer fab area will start first wafers in January.

Availability for Acquisition:

Currently, 5 different parties have expressed interest.

Ability To Stay Competitive:

Processes have been 1-3 years out of date. Some yield problems occurred last year.

Customer Interface:

Masks.

Processes:

N channel Si gate including surface planar and double poly.

Process Compatibility with Other Firms:

Good with AMI and Synertek.

Employees:

210 currently.

Equipment:

6 cobilt aligners.

WAFER FAB SUPPLIERS

Company:

Micropower.

Prime Mission:

Standard product, custom design, some customer tooling but very selective on this.

Customer Base:

40% standard product, 30% custom design; 30% customer tooled.

Estimated Wafer Starts:

Present capacity 12,000 wafers per month.

Likely Growth:

New building under construction. Should begin processing late 1979.

Ownership and Financing:

Privately held.

Availability for Acquisition:

Some potential.

Ability To Stay Competitive:

Micropower has been a leader in high technology processes for narrow markets. Not a mainstream company.

Customer Interface:

Masks, Calma tapes.

Processes:

Bipolar, linear and digital CMOS.

Process Compatibility with Other Firms:

Low.

Employees:

Not available.

Equipment:

Not available.

WAFER FAB SUPPLIERS

Company:

Mitel Semiconductor.

Prime Mission:

Merchant, captive, customer tooling.

Customer Base:

30% parts, 40% custom design, 30% customer tooled.

Estimated Wafer Starts:

Capacity 8000 wafers per month.

Likely Growth:

No known expansion plans.

Ownership and Financing:

Owned by Mitel Corporation, a manufacturer of telecommunications equipment.

Availability for Acquisition:

Low.

Ability To Stay Competitive:

Reasonably competitive. Have pioneered short-channel oxide isolated CMOS. Canadian location offers a good reservoir of technical talent.

Customer Interface:

Mask.

Processes:

CMOS metal gate; CMOS silicon gate; CMOS oxide isolated.

Process Compatibility with Other Firms:

Low.

Employees:

Over 100.

Company:

Monosil.

Prime Mission:

Wafer fabrication, specializing in custom processing.

Customer Base:

90% customer masks, 10% products of own design. Less than half the masks from the semi industry.

Estimated Wafer Starts:

8,000 starts per month.

Likely Growth:

Expect capacity to grow to 10,000 starts a month. Sales growth has been 85% in last two years.

Ownership and Financing:

Private. Hong Kong financing and majority interest.

Availability for Acquisition:

Ultimately, management desires to sell the company. Not actively seeking acquisition at present, but offers have been received. 8 inquiries.

Ability To Stay Competitive:

Expect Monosil to lag state of the art 3-5 years.

Customer Interface:

Masks.

Processes:

Over 250 process variations have been run.

Process Compatibility with Other Firms:

As required.

Employees:

100 approximately.

Equipment:

8 diffusion tubes; Lp CVD equipment; evaporator; new epi reactor; To be delivered in August.

Company:

National Semiconductor

Prime Mission:

Standard product. However, a separate marketing group exists for custom LSI. This group has a good feel for the custom business. Expect customer tooling to grow.

Customer Base:

Within the custom group; 20% parts, 60% custom LSI, 20% fab.

Estimated Wafer Starts:

Marketing claims they can schedule production on four lines in Santa Clara, one in Danbury and one in Salt Lake City.

Likely Growth:

Expect National to remain competitive in custom LSI.

Ownership and Financing:

National Semiconductor

Availability for Acquisition:

Public company.

Ability to Stay Competitive:

Expect National to remain 0-2 years behind leaders depending on product line. Custom LSI wafer fab areas are probably less competitive; 3 to 5 years behind the leaders.

Customer Interface:

Prefer Calma tape.

Processes:

N & P channel MOS, CMOS

Process Compatibility With Other Firms:

Should be good with AMI, Synertek, Maruman

Company:

Nitron

Prime Mission:

Alternate interest is in standard products. Wafer fabrication business is undertaken for cash flow business, but will always be important.

Customer Base:

65% catalog items, 10% custom design, 25% customer masks. Willing to commit up to 25% of capacity to one customer.

Estimated Wafer Starts:

Currently there are 4 modules. EAch has a capacity of 8,000 wafer starts. One module on 2 1/2 shifts, one on 2 shifts, one on 1 1/2 shifts and the fourth unused and lacking equipment.

Likely Growth:

Current objective is to fully load all modules.

Ownership and Financing:

A subsidiary of Nannon, but believe this activity to be essentially a holding company.

Availability for Acquisition:

Interested in 10 to 25% equity investment to provide capital and business for the fourth module.

Ability to Stay Competitive:

Should be state of the art in MNOS for non-volatile memories. Company has a license from NCR/General Instrument. Will lag industry 2-5 years technologically otherwise.

Customer Interface:

Masks, Calma tapes.

Processes:

N-channel isoplanar metal gate. P-channel metal gate. CMOS metal gate. MNOS.

Process Compatibility With Other Firms:

Company processes material for Maruman. Should be compatible with AMI, Synertek.

Employees:

Estimate 200

Equipment:

One (1) Perkin-Elmer aligner has been delivered for 4th module; 14 other aligners, 48 diffusion tubes, 3 Fairchild testers, Maskmaking capability.

WAFER FAB SUPPLIERS

Company:

Polycore

Prime Mission:

Wafer fabrication.

Customer Base:

100% customer tooled wafers, Over half of these are linear bipolar made for another semiconductor company.

Estimated Wafer Starts:

3,000 bipolar wafer starts. 3,000 MOS wafer starts.

Likely Growth:

Growth may be a problem since most of business comes from another semiconductor firm and is likely to be short lived.

Ownership and Financing:

Private capital from Singapore.

Availability for Acquisition:

Available. No offers have been made because company is little known, We believe management to be technically competent, but somewhat inexperienced in business.

Ability to Stay Competitive:

Firm should be able to stay 3 to 6 years behind industry leaders. Most of technical talent has been trained at Polycore since the area offers no resevoir of trained people.

Customer Interface:

Masks, Calma tapes.

Processes:

Full range of linear ICs. Gold doped digital circuits. Metal gate PMOS. Metal gate CMOS.

Process Compatibility With Other Firms:

Linear IC process should be compatible with Exar, Monosil.

Employees:

Approximately 35-45.

Equipment:

15 tubes; 3 contact aligners; 2 Epi reactors; 1 sputtering equipment; 1 E-beam reactor; 1 Ion implatner; 2 tracks resist application; 2 tracks resist develop.

WAFER FAB SUPPLIERS

Company:

Samsung.

Prime Mission:

Support to Samsung--A $1.3 billion Korean conglomerate. Most of the parts made are used in Samsung's products.

Customer Base:

15% standard parts, 80% custom parts, 5% customer tooled. Company has small custom MOS capability in the United States.

Estimated Wafer Starts:

Estimate total capability of 20,000 wafer starts per month in Korea.

Likely Growth:

Sales doubled between 1978 and 1979.

Ownership and Financing:

Samsung.

Availability for Acquisition:

Not available.

Ability To Stay Competitive:

Believe company will maintain adequate technology to support Samsung's basic businesses.

Customer Interface:

Masks.

Processes:

Bipolar, CMOS.

Process Compatibility with Other Firms:

Believe CMOS process reasonably compatible.

Employees:

Estimate 1,000.

WAFER FAB SUPPLIERS

Company:

Semi Processes Inc.

Prime Mission:

Wafer fabrication.

Customer Base:

100% customer tooled. Estimate 25-50% from semi industry.

Estimated Wafer Starts:

1,200 per month.

Likely Growth:

Add 1,800 wafers per month in 1980, 8,000 wafers per month in 1981-82.

Ownership and Financing:

Privately held. Funding from well-to-do Silicon Valley individuals (Bob Freund, Jean Hoerni).

Availability for Acquisition:

Partial acquisition is possible.

Ability To Stay Competitive:

Expect company to be 2-5 years behind industry leaders.

Customer Interface:

Masks.

Processes:

P-channel, N-channel MOS. Working on oxide isolated CMOS.

Process Compatibility with Other Firms:

Should be reasonably good.

Employees:

20 people.

Equipment:

Currently 9 tubes, 2 aligners.

Company:

Standard Micro Systems.

Prime Mission:

Supplier of merchant parts. Want to keep customer tooling business below 10% of wafer starts.

Customer Base:

85% standard product, 10% custom designed, 5% customer tooled.

Estimated Wafer Starts:

Estimate 10-12,000 starts per month.

Likely Growth:

Growth has exceeded industry average. A new 80,000 square foot facility will be started in two months.

Ownership and Financing:

Public company.

Availability for Acquisition:

Many offers have been made.

Ability To Stay Competitive:

Company has been excellent in technology for a small company. Holds patents on coplamos process. Expect firm to stay 1-3 years behind industry leaders.

Customer Interface:

Masks, Calma tapes.

Processes:

N channel coplamos metal gate; p-channel metal gate.

Process Compatibility with Other Firms:

Believe to be reasonably compatible.

Employees:

275 employees.

Equipment:

30 tubes; 9 aligners; 1 implanter.

Company:

Supertex.

Prime Mission:

Working toward increased volume in proprietary products. Still predominantly customer tooled wafers.

Customer Base:

20% catalog items, 20% custom parts, 60% customer tooled.

Estimated Wafer Starts:

Estimate 6,000-8,000 starts per month.

Likely Growth:

Second fab area went on stream this year. A third fab area is planned for next year.

Ownership and Financing:

Far Eastern interests.

Availability for Acquisition:

Currently negotiating with Exxon. Additional minority interests possible.

Ability To Stay Competitive:

Believe company has some of the best technology available in a small company. Should be 1/2 to 2 years behind selected industry leaders.

Customer Interface:

Masks, Calma tapes.

Processes:

CMOS metal gate (100% of the capacity of the 4-inch line); VMOS power transistors; N channel silicon gate.

Process Compatibility with Other Firms:

Should be good. Cross license with AMI.

Employees:

Estimate over 100.

Equipment:

Two fabrication modules.

Company:

Synertek.

Prime Mission:

Standard products. View customer tooled business as a growth opportunity.

Customer Base:

65% standard product, 15% custom product, 20% customer tooled.

Estimated Wafer Starts:

28,000 per month.

Likely Growth:

Growth should exceed industry average.

Ownership and Financing:

100% owned by Honeywell.

Availability for Acquisition:

Not available.

Ability To Stay Competitive:

Company should be 1-2 years behind industry leaders. HMOS process currently being transferred to production.

Customer Interface:

Masks, Calma tapes.

Processes:

N-channel silicon gate, p-channel silicon gate, CMOS silicon gate.

Process Compatibility with Other Firms:

Good compatibility with AMI, Marunan.

Company:

Teledyne Semiconductor.

Prime Mission:

Standard product, customer tooling. Company would be good to do business with.

Customer Base:

95% standard product, 5% customer tooled.

Estimated Wafer Starts:

Current wafer starts are approximately 3,000-4,000 per month.

Likely Growth:

Little growth expected until company regains profitability. Formerly was managed as a "cash cow."

Ownership and Financing:

100% owned by Teledyne.

Availability for Acquisition:

Not available.

Ability To Stay Competitive:

Firm is currently 4-6 years behind industry, but expect this to improve.

Customer Interface:

Masks, Calma tapes.

Processes:

Junction FETs, high voltage bipolar IC's, CMOS metal gate, bipolar-CMOS combined.

Process Compatibility with Other Firms:

Low, except for Motorola CMOS.

Employees:

Estimate 100-200.

Equipment:

3-4 aligners; 80 tubes; 1 photoresist applicator track; 1 develop track; Calma digitizing equipment.

Company:

United Semiconductor.

Prime Mission:

Wafer fabrication.

Customer Base:

100% customer tooled.

Estimated Wafer Starts:

4,000 wafers per month is total capacity for sale (manufactured by Analog Devices and made available to United Semiconductor.

Likely Growth:

Unpredictable.

Ownership and Financing:

100% privately held.

Availability for Acquisition:

Company is seeking a joint venture to set up a U.S. wafer fabrication facility.

Ability To Stay Competitive:

Estimate firm is 4-6 years behind industry leaders.

Customer Interface:

Masks, Calma tapes.

Processes:

P and N channel MOS and CMOS.

Process Compatibility with Other Firms:

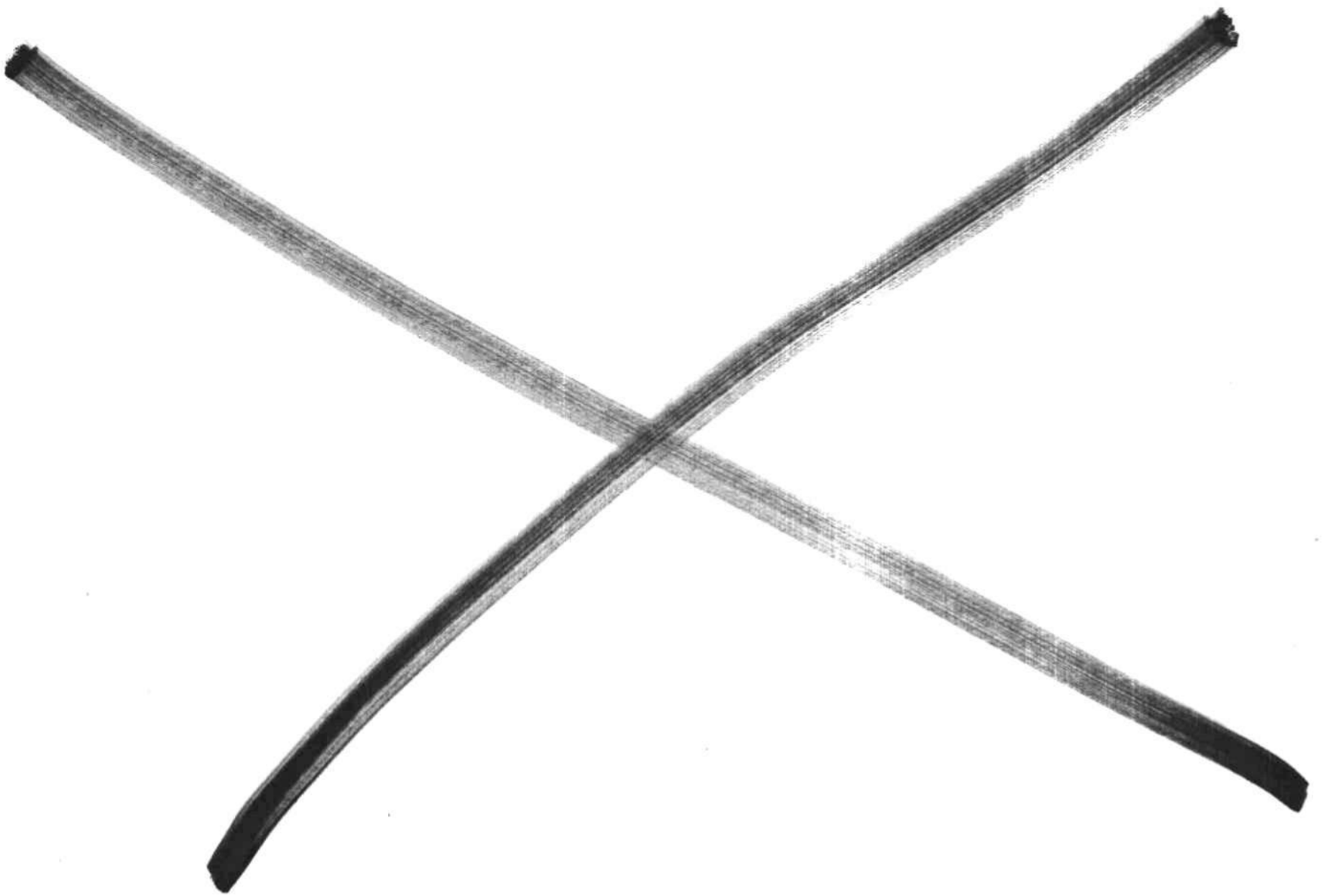
Should be good.

Employees:

67 (wafers are manufactured by Analog Devices).

Equipment:

Presently, no manufacturing equipment is owned by United Semiconductor.



2. CAPITAL EQUIPMENT SUPPLIER SUMMARY

Capital equipment suppliers provide the equipment that is used to manufacture semiconductor components. This section examines suppliers of wafer fabrication equipment in detail. While there are over 100 such companies, the top eight represent over 50 percent of the dollar revenues. DATAQUEST believes that a consolidation process is underway; through a process of acquisition and merger, firms are beginning to supply a larger and larger portion of the wafer fabrication market.

Major conclusions of this section are as follows:

- Captive semiconductor manufacturers account for 17 percent of the wafer starts and 26 percent of capital equipment purchases.
- Captive manufacturers will be hard pressed to account for more than 22 percent of wafer starts by 1983.
- Total capital equipment demanded by merchant and captive semiconductor manufacturers will not exceed available supply.
- Lead times for capital equipment increase as the equipment becomes more expensive.

CAPITAL EQUIPMENT SUPPLIERS

Aggregate Supply/Demand

Impact of Captive Supplier Purchases

Industry Problems

Leading Companies

Technology Trends

Source: DATAQUEST, Inc.
July 1979

ESTIMATED CAPITAL EXPENDITURES

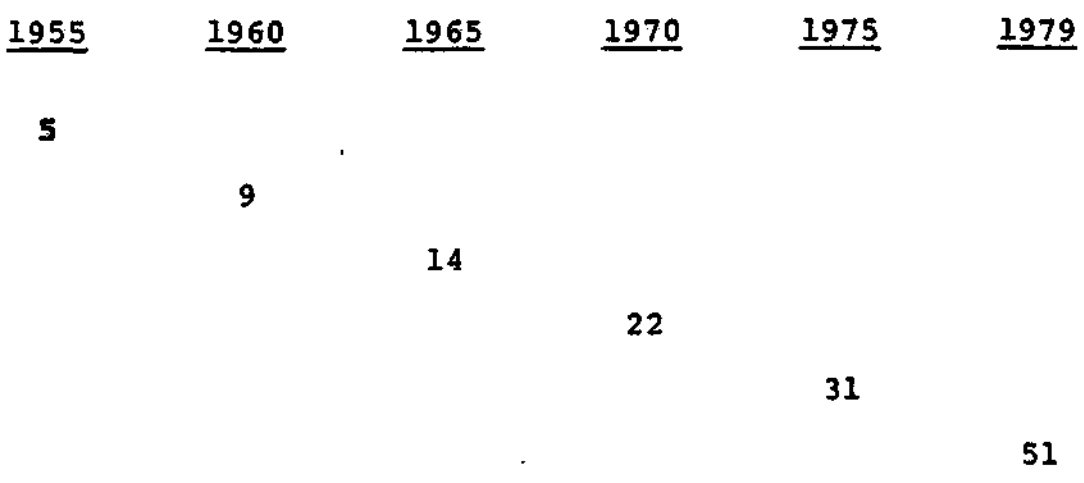
BY MERCHANT SEMICONDUCTOR COMPANIES

($ in Millions)

	Semiconductor Production U.S. Companies	% Capital Expenditures	Capital Expenditures
1974	$ 3,358	12.5%	$ 420
1975	$ 2,783	7.0%	$ 195
1976	$ 3,502	10.2%	$ 357
1977	$ 4,043	10.5%	$ 425
1978	$ 5,172	13.1%	$ 677
1979	$ 6,147	14.0%	$ 860
1980	$ 6,750	10.0%	$ 675
1981	$ 7,877	12.0%	$ 945
1982	$ 9,070	13.0%	$1.179
1983	$10,462	13.0%	$1,360

Source: DATAQUEST, Inc.
July 1979

CAPTIVE SEMICONDUCTOR MANURACTURERS VS. TIME



Source: DATAQUEST, Inc.
July 1979

CAPITAL EXPENDITURES OF SELECTED COMPUTER EQUIPMENT MANUFACTURERS

(Dollars in Millions)

Company/Fiscal Year	Sales	Capital Expenditures (Property, Plant & Equipment)	Capital % of Sales
Burroughs (1976)	$ 1,870	$ 228	12.2%
Control Data (1977)	1,493	97	6.5%
Data General (1977)	255	15	5.9%
Digital Equipment (1978)	1,436	170	11.8%
Four Phase Systems (1977)	88	25	28.4%
Hewlett Packard (1977)	1,360	111	8.2%
IBM (1976)	16,304	2,016	12.4%
Perkin-Elmer	432	14	3.2%
Prime Computer (1977)	50	5	10.0%
Texas Instruments (1976)	1,658	136	8.2%
Total	$24,946	$2,817	11.2%
Total U.S. Electronic Equipment Manufacturers	$53,350		

Source: DATAQUEST, Inc.
July 1979

ESTIMATED IMPACT OF LSI ON MANUFACTURING COSTS OF ELECTRONIC EQUIPMENT

	COMPLEXITY OF LSI DEVICE			
	40 Transistors	400 Transistors	2000 Transistors	8000 Transistors
Relative Equipment Manufacturing Costs	100%	45%	21%	23%
Component Costs (Share of Total Cost)	11%	25%	53%	86%

Source: DATAQUEST, Inc.
July 1979

CONCLUSIONS

- Electronic euipment makers need custom wafer processing.

- The semiconductor industry is not supplying the need.

- AND the electronic equipment makers have the capital to fund captive semiconductor manufacturing.

Conclusion: Purchases of semiconductor equipment by captive manufacturers could significantly impact the equipment market.

Source: DATAQUEST, Inc.
July 1979

CAPTIVE SEMICONDUCTOR MANUFACTURERS WILL USE MORE CAPITAL EQUIPMENT PER WAFER START

	Semiconductor Manufacturing Module	Captive Manufacturing Module
Capital Investment (Property, Plant & Equipment)	$33 million	$10 million
Wafer Start Capacity	40,000/month	5,000/month
Depreciation per wafer (straight line)	$13.75 (5 years)	$23.80 (7 years)

Source: DATAQUEST, Inc.
July 1979

ESTIMATED CAPTIVE MANUFACTURING CAPACITY

(From 1978 Silicon Usage)

	Merchant Suppliers	Captive Suppliers	Total
Silicon Usage (Million Sq. Inches)	345	70	415
Percent Silicon Usage	83%	17%	100%
Equivalent Production ($ in Millions)	$5,172	$1,050	$6,222
Capital Expenditures ($ in Millions)	$ 677	$ 235	$ 912
Capital Expenditure Per Wafer (Equivalent 3 inch)	$13.90	$23.80	

Source: DATAQUEST, Inc.
July 1979

ESTIMATED SEMICONDUCTOR CAPITAL

EXPENDITURES BY MERCHANT AND CAPTIVE SUPPLIERS

($ in Millions)

	1978	1979	1983	Compound Annual Growth
Merchant Suppliers	$677	$ 860	$1,360	15%
Captive Suppliers				
Percent of Silicon Processed	17%	18%	22%	-
Capital Expenditures	$235	$ 277	$ 656	23%
Total Capital Expenditure	$912	$1,137	$2,016	17%

Source: DATAQUEST, Inc.
July 1979

ESTIMATED SEMICONDUCTOR EQUIPMENT

SUPPLY VS. DEMAND

($ in Millions)

	1978	1979	1983
Total Capital Expenditures	$912	$1,137	$2,016
Less Facilities Costs	319	398	645
Net Equipment Demand	$593	$ 739	$1,371
Planned Industry Supply	$593	$ 789	$2,729
Annual Sales of Average Sized Equipment Manufacturer	$ 13	$ 17	$ 58

Source: DATAQUEST, Inc.
July 1979

INDUSTRY PROBLEMS

(As Stated in Survey)

Technology Selection	-	26%	
Wafer Handling Technology	-	6%	
Personnel Recruiting	-	74%	(Mostly engineers)
Financial Situation:			
- Backed by large firm	-	42%	
- Use retained earnings	-	32	
- Funds problem	-	26	
		100%	
Facilities	-	32%	(Trend out of Silicon Valley)
Supplier Problems:			
- Support from job shops	-	23%	
- Semiconductors	-	19	
- Flow controllers	-	10	
- General problems	-	19	
- No problems	-	29	
		100%	
OSHA/EPA Problems	-	6%	(Many think this is a user problem!)
Energy	-	6%	

Source: DATAQUEST, Inc.
July 1979

EQUIPMENT LEAD TIMES

Purchase Price	Current Lead Time	Desired Lead Time
Less than $50,000	2-4 Months	2-3 Months
$50,000-$100,000	3-8 Months	3-5 Months
$100,000-$300,000	7-18 Months	5-8 Months
$300,000 Up	10-20 Months	8-12 Months

Source: DATAQUEST, Inc.
July 1979

LEADING COMPANIES

($ in Millions)

Equipment companies are moving towards providing a total capability in wafer fabrication.

	1979 Estimated Semi.Equip. Sales		1979 Estimated Corporate Sales
First Rank			
Cutler-Hammer (Semi Equipment Div.)	$ 40		$ 650
Perkin-Elmer	134		650
Varian Associates	100		443
Second Rank			
Applied Materials	34		34
Computervision/Cobilt	30		90
Tempress/General Signal	31		1,052
Thermco/Sunbeam	30		2,500
GCA	43		80
Total	$442	(56%)	
Total Industry	$789		

Source: DATAQUEST, Inc.
July 1979

EATON SALES - (MILLIONS)

	1979	1980
KASPER -	$ 19.0	$ 30.0
CONTACT / PROXIMITY	14	
WAFER TRACKS	5	
D&W -	3.0	9.0
PLANAR PLASMA		
OPTIMETRIX -	1.5	2.4
WAFER STEPPERS		
NOVA / ELTEK -	3.6	11.3
MACRODATA -	11.5	10.0
PRICE PERIPHERALS	3.0	4.0
	$ 41.6	66.7
		72.5 (AMT EST)

Top 10 (1980)
Semiconductor Equipment Manufacturers

Company	Sales (in millions)	Equipment
P-E	133.7	Microalign
Fairchild	105.7	Sentry testers
GCA	100.8	David Mann steppers
Varian	89.9	Extrion implanter
General Signal	78.2	
Teradyne	77.7	J series testers
Eaton	72.5	
Applied Materials	69.5	Radiantly headed epitaxial reactor
Kulicke & Soffa	49.8	
Tektronix	40.9	3260/70/80 testers

Source—Applied Materials

EATON SALES - (MILLIONS)

	1979	1980	
KASPER -	$ 19.2	$ 20.0	(?)
CONTACT / PROXIMITY.			
WAFER TRACKS			
D&W -	3.0	9.0	
PLANAR PLASMA.			
OPTIMETRIY -	1.5	2.4	
WAFER STEPPERS.			
NOVA / ELTEK -	3.6	11.3	
MACRODATA -	11.5	10.0	
PACIFIC RELIABILITY.	7.0		
	$ 45.8		

CUTLER-HAMMER - SEMICONDUCTOR EQUIPMENT DIVISION
($ in Millions)

	1979 Sales (Estimated)
Kasper	$19.2
- Controlled Wafer Environment - 2 Defects/Sq.In.	
- Automatic Etch in 2 Years	
- Contact Aligners	
- New Proximity Machine in Development	
-	
D&W	$ 0.7
- Plasma Etch	
- Recent Acquisition	
- Shipment Problems	
Optimetrix	$ 1.5
- Direct Step on Wafer Aligners	
- Prototype Deliveries	
Nova Associates	$ 1.6
- High Current Implant (10 ma)	
- New MBE Machine (82/83)	
- E-beam Anneal (1981)	
ELTEK	$ 2.0
- Mid Current Implant	
Macrodata	$ 8.0
- Test Equipment	
Pacific Reliability	$ 7.0
- Environmental Testing	
	$40.0

Source: DATAQUEST, Inc.
July 1979

PERKIN-ELMER

($ in Millions)

	1979 Sales (Estimated)
Micro Align	$ 90.0
- Scanning Projection Aligners	
- Upgrade 1979	
- Deep U.V. Mid-1981	
ETEC	$ 27.5
- E-beam Maskmaking Equipment (80% Share)	
- Direct Write E-beam (1981)	
- Direct Write 20 Wafers/Hour (1984)	
ULTEK	$ 16.5
- Sputter Deposition	
- Reactive Ion/Plasma Etch - Especially Oxide	
- SiO_2,SiN3 Deposition (1980, 1981)	
- Cassette to Cassette Planned	
Physical Electronics re MBE	$134.0

Perkin-Elmer also makes computers (Interdata), terminals, and peripherals (Wang Co.). Company has a $2.5 million design center in Santa Cruz, California.

Microalign and ETEC presently dominate their markets (over 50%).

Source: DATAQUEST, Inc.
July 1979

VARIAN ASSOCIATES

($ in Millions)

		1979 Sales (Estimated)
Varian, Palo Alto		$ 75M
- E-beam Maskmaking ✓	7	65
- Direct Write (1982) ✓		16
- Sputtering ✓		99
- RIE-Cassette to Cassette (1980)	1	
- Gas Analysis Instruments	5	
- MBE (for SOS) ✓		
- Crystal Growers	3	
Varian Extrion		$ 25M
- Mid Current Implant (to 500 μA)		
- High Current Implant (500 μA to Several μA)		
- E-beam or Optical Anneal (1981)		
		$100M

Source: DATAQUEST, Inc.
July 1979

APPLIED MATERIALS

($ in Millions)

	Sales (Estimated)
High Pressure Oxidation (Gasonics)	
Plasma Etch, Using Plasma Deposition Equipment	
Epitaxial Deposition	
- Radiant Heated	
- Low Pressure	
Mid Temperature Deposition (600-1000° C)	
- Poly Silicon	
- Silicon Dioxide	
- Silicon Nitride	
Low Temperature Deposition/500°-500°C)	
- Silox	
Plasma Nitride (Silicon Dioxide Also Possible)	
Film Thickness Measurement	
- Elippsometer	
- Reflectometer	
- Epi Thickness (1980)	
Plasma Etch (1980)	
Continuous Metal (1980)	
Ion Implant	
Estill.	
Dry Etch.	
	$34

Company dominates epitaxial deposition market. Does not have the development funds to broadly enter the total market. Has had many acquisition offers.

Source: DATAQUEST, Inc.
July 1979

COMPUTERVISION/COBILT

($ in Millions)

	1979 Sales (Estimated)
Projection Aligners	
- Only Second Source to Perkin/Elmer	
- Shipping 11 per Quarter vs. 120 per Quarter	
- Better Mechanics and Automation, Larger Lens.	
Contact and Proximity Aligners New Proximity Aligner in Development	
X-ray Aligner (1980)	
Photoresist Application/Development	
Inspection Stations	
	$30

Computervision is a major supplier of computer aided design equipment.

Source: DATAQUEST, Inc.
July 1979

TEMPRESS, GENERAL SIGNAL
($ in Millions)

	1979 Sales (Estimated)
Oxidation/Diffusion	
- Poor Second to Termco	
Chemical Vapor Deposition	
- Third or Fourth Position	
Etch/Clean (Corotek)	
- Being Surpassed by Fluoroware	
Dicing Saws, Bonders, Small Tools	
	$31M

Source: DATAQUEST, Inc.
July 1979

General Signal

18 Tempres.

Tempres – Diamondscribe
Sola Basic – Furnaces
Unitek – CVD, Epi.
Convotek – Rinser/dryers.

30 Xynetics – X-Y plotting tables.
Electroglas – Wafer saws
blades.
~~EBM~~ III (?) – Tracks.

20 Kayex/Hamco – Crystal Pullers

8 ~~EBM~~ – E-Beam.

876m

Ultratech(?) Leo de Bose

General Signal Developing lead bonder.
DDC Furnace —

8m Acquired Micro-Automation Late 80, early 81

84m

17 Nov 80
HZB.

THERMCO-SUNBEAM

($ in Millions)

	1979 Sales (Estimated)
Oxidation/Diffusion	
- Leaders in Direct Digital Control	
High Pressure Oxidation (August)	
Chemical Vapor Deposition	
Liquid Phase Epitaxy	
(For Bubble Memory)	
	$30

Plan to expand product line through acquisition.

Source: DATAQUEST, Inc.
July 1979

GCA

($ in Millions)

	1979 Sales (Estimated)
Sunnyvale Division	$18
Wafer Tracks Using Air Movement	
- Tie on to DSW (1980)	
- "Wafer Local" Clean Air	
Looking for Plasma Etch Acquisition	
Ion Implant	
- Mid Current	
- High Current (50 ma - 1981)	
Burlington Division (David Mann)	$25
Maskmaking	
Direct Step on Wafer Aligners (DSW)	
Direct Write E-beam (1981)	
	$43

David Mann products dominate their markets and provide high profits and cash flow.

Source: DATAQUEST, Inc.
July 1979

TECHNICAL TRENDS

Dry Etch

- Barrel Etch - Nitride, Resist Strip
- Reactive Ion Etch -Oxides, Metal
- Parallel Plate Etch - Oxides, Metal
- Ion Mill - Non-Selective
- Sputter Etch - Non-selective
- Market in Transition. Large, well managed and financed companies (Perkin/Elmer, Varian, Applied Materials), Will Dominate the VLSI Equipment Market.

High Pressure Oxidation

- Two Suppliers - Thermco, Applied Materials
- Insignificant (20 tubes per year) fraction of diffusion market (1000-2000 tubes per year)
- Little concern about global shift in wafer processing?

Maskmaking Equipment

- Definite Transition to Electron Beam

Source: DATAQUEST, Inc.
July 1979

TECHNICAL TRENDS (Continued)

Alignment Equipment

Above 2 microns

- Scanning projection systems well established.
- Strong move to reconsider proximity alignment

Below 2 microns - Direct Step

- Direct wafer step entering R&D applications
- Many direct step competitors
  - Ultratech
  - Censor
  - Electromask
  - GCA
  - Cutler Hammer/Optimetrix
  - Canon

Below 2 microns - Other

- Deep U.V. - Global wafer shift?
- X-ray - Throughput?
- E-beam - Will be used for prototype applications, particularly among captives. At least four suppliers planning product: GCA, Varian, ETEC, EBM.

Source: DATAQUEST, Inc.
July 1979

TECHNICAL TRENDS (Continued)

Ion Implant

- New high current product for direct junction implant
- New anneal techniques - E=beam, Laser
- Will eventually impact diffusion market

Epi Reactors

- Molecular beam epi for SOS

Plasma Deposition

- Oxide deposition coming. Should be important for interlayer dielectrics

Metal Deposition

- One supplier (Applied Materials) working on in-line system
- Sputtering becoming much more popular

Source: DATAQUEST, Inc.
July 1979

IMPORTANT EQUIPMENT GROWTH MARKETS

High Current Ion Implant and Anneal

Below 2 Micron Aligners

- Estimate 400 units per year in early 1980s
- Total market 400x500K = $200 million
- Growth problem for current suppliers
- Lens supply a problem for Direct Step Suppliers

Prototype Aligners - E-beam

- Could be 50-100 units/year
- Current production 10-15 units/year

Dry Etch

- Market expected to grow 50 percent per year for next 3-4 years
- Current (1979) market $27.4 million
- Well-known suppliers have growth pains - Tegal, Dionics, D&W, LFE

Source: DATAQUEST, Inc.
July 1979

INTERVIEW GUIDE

Semiconductor Manufacturing Suppliers

DATE 7/3/79

Company/Location ADE - Boston, MA area

Contact/Position V.P. - Small inst. maker, capacitive techniques measuring, diverse industrial sales (auto, wire, computer heads, etc.) - Non contact sensing

The interviews will be conducted in two segments. We will first discuss the company's current and future potential in supplying products for Semiconductor Wafer Fabrication. Major current and anticipated problem areas will then be reviewed.

Wafer Fabrication Products

Wafer Incoming Q.C. (Inst./Inspect) - Resistivity, flatness, warp, thickness
- Back reference fixture similar to GCA
- Wafer scan multiple point fixed sensors
- 2-6/minute throughput (2-5" wafers)

- Cassette to cassette transfer system slated for early 1980; introduction at ~$110K

In-Process flatness & Warp - Model 6032 at $10K prior to P-E or GCA aligners

N or P Gauge will be out early 1980 at $2K. Small unit will be used to find mistakes

Note: Vacuum variation, chuck design doesn't seem to make major flatness difference. See Bob Walsh report (Monsanto) given SIA (June 1979).

General Business

Current Delivery 2-3 months. Action on backlog problem if applicable: Will hold steady

---

Semi Related Products/Approx. Annual Sales:

1978: $2M 1979: $5M 1983/84: ~$25M New Products:

Other industry sales:

Major Problem Areas

Technology - No

Personnel - Looking for market/sales types now

Financial - Always looking for more cash

Facilities - Moving into new plant in September 1979

Suppliers - Delivery (A/D chip quality, high technology memories, service industry delivery) Major

Others

Note: Firm actively looking for wafer handling capability. Will develop internally at this time.

INTERVIEW GUIDE

Semiconductor Manufacturing Suppliers

DATE 7/2/79

Company/Location GCA - Burlington, VT

Contact/Position Dir. Mktg. - Optical group has Mann and government contract primarily.

Moved into step and repeat on wafer in last two years.

The interviews will be conducted in two segments. We will first discuss the company's current and future potential in supplying products for Semiconductor Wafer Fabrication. Major current and anticipated problem areas will then be reviewed.

Wafer Fabrication Products

Mask Making - 3696 leads field, mid 1981 delivery; ~25/yr. capacity. Also provide pattern generator and 9400 VLSI CAD systems.

Alignment - DSW 4800 at $500K (over 100 on order/shipped to date). Wafer handling option started to ship (~$50K), auto-align TV joy stick and reticle exchange early 1980. Registration on machine ± 0.15 microns (3 std. dev.), machine to machine/time/operator ±0.3 microns (2 std. dev.).

E-beam next major product in 1981.

Note: Feels projection (P-E) has 5 more years life, stepper intermediate, then E-beam comes on in 1983-1985 for 1985-1990 production use.

General Business

Current Delivery 12-18 months. Action on backlog problem if applicable: Will probably remain

---

Semi Related Products/Approx. Annual Sales: (Burlington only)

1978: $13M 1979: $25M 1983/84: $100M New Products:

Other industry sales:

Major Problem Areas

Technology - No

Personnel - No

Financial - GCA all right (some long-term debt)

Facilities - Expanding rapidly (time required)

Suppliers - Always some

Others

INTERVIEW GUIDE

Semiconductor Manufacturing Suppliers

DATE 7/2/79

Company/Location Varian - Palo Alto, CA

Contact/Position Industrial Equipment Group Manager (14% of total corporate sales)

The interviews will be conducted in two segments. We will first discuss the company's current and future potential in supplying products for Semiconductor Wafer Fabrication. Major current and anticipated problem areas will then be reviewed.

Wafer Fabrication Products

Mask Making & Alignment - E-beam (40 MHz rate, big speed feature)
1982 announce of direct write planned (await resist sensitivity improvement). Realistically, believe economies will limit to few layers only.

PVD & Etch/Clean - E-beam, magnetic enhanced sputtering (confine plasma to reduce charge damage). 1980 announcement of RIE product (cassette to cassette).

Ion Implant - Complete broadest line, 1980-81 announcement of elec. or photon localized anneal.

Instrumentation - Helium and gas analysis (smart guage - atomic florescience, closed loop control gas inject)

CVD - MBE for high freq. III-V compounds prime use. Growing interest by silicon on sapphire people. Cost/throughput tradeoff poor for Si on Si.

Wafer making - Crystal growers only (dropped lappers & cutting)

General Business

(least expensive) (most expensive)
Current Delivery 3-15 months. Action on backlog problem if applicable: Probably won't change even with expansion.

Semi Related Products/Approx. Annual Sales:

1978: $67M 1979: $100M 1983/84: $500M New Products:

Other industry sales: Always so outside. Government R&D, etc.

Major Problem Areas

Technology - Varian's strongest point.

Personnel - Always

Financial - Cash flow problem in big equipment. Can't get customers to advance payments because of their cash problems.

Facilities - Here 6-7000 employed in Mexico. Plan to move much of system to So. Calif. with Mexico supplying subassembly. Extrion has 55K sq. ft. in 1977; will be at 250K sq. ft. in early 1980.

Suppliers - Can't get it, then we make it. Unfair advantage!

Others - Note: Have increased service force to 150 in U.S.

INTERVIEW GUIDE

Semiconductor Manufacturing Suppliers

DATE 7/2/79

Company/Location Tencor Instruments - Mt. View, CA

Contact/Position President

The interviews will be conducted in two segments. We will first discuss the company's current and future potential in supplying products for Semiconductor Wafer Fabrication. Major current and anticipated problem areas will then be reviewed.

Wafer Fabrication Products

Inspection/Inst. - Ex-founder of Rondex who sold to P-E (now Ultek Div.)

Wafer Inspection - Resistivity, thickness & flatness (sonogages)

Aluminum Thickness - non-destructive

Film Thickness - Alpha-step (improved version of Dektac)

NOTE: Unique advantages are: modular wafer handling cassette system for each instrument; semi-intelligent terminal for sorting to user limits.

New Products Planned - Laser defect detector (mid-1980); looks at surface and locates defects or particles. Also have backroom effort in plasma deposition (introduction unclear).

General Business

Current Delivery 3 months. Action on backlog problem if applicable: Build to forecast not order. Will hold at that lead time.

Semi Related Products/Approx. Annual Sales:

1978: $2M 1979: $4M 1983/84: $20M New Products: Question as to impact of plasma system.

Other industry sales:

Major Problem Areas

Technology - No, although choice of which to exploit is difficult.

Personnel - No, small company advantage

Financial - Well done with private funds, in C/D position with banks

Facilities - No

Suppliers - Have cultivated machine shops and strong inventory position. Some IC quality has been problematic.

Others

INTERVIEW GUIDE

Semiconductor Manufacturing Suppliers

DATE 7/2/79

Company/Location Bruce Ind. - Boston, MA

Contact/Position Mktg. Mgr. - BTU parent company in negotiations with Holec (~$300M sales).

Will be acquired by European firm in few months. Their business - gas generation/glass furnaces.

The interviews will be conducted in two segments. We will first discuss the company's current and future potential in supplying products for Semiconductor Wafer Fabrication. Major current and anticipated problem areas will then be reviewed.

Wafer Fabrication Products

Ox/Diffusion - Computer controller prime emphasis. Furnace (BDF-4) equal to Thermco (heavier built but less tested)-4"-5" wafers. Computer controller (7351) is direct digital control of temperature with:

- Four modes of operation:
  1) proportional/reset normal
  2) proportional nodch-quicker temp. response
  3) auto profile-8 thermocouples (3 controlling) for gas flow change temperature profile holding
  4) combined 2 & 3
- 20ma closure current loop
- Each tube (up to 8) independent-ramping, drive flow controls, etc.

Auto Flow Control (std. on systems)

- Prec. flow devices standard
- Will put in whatever customer wants

CVD - Low pressure - mid-temperature; working with ACS and Applied Materials

NOTE: Suggest "T" bar configuration for best space/ops tradeoff. 8 units (64 tubes) of this sold to date.

General Business

Current Delivery 10 months. Action on backlog problem if applicable: Have 140 sq. ft. facility for BTU/ Bruce ops, but production people availability & custom product restrains growth. Will go to 30 weeks if slowdown comes in 1980.

Semi Related Products/Approx. Annual Sales: (Semi sales only)

1978: $5M 1979: $6M 1983/84: $20M New Products:

Other industry sales: BTU parent is conveyer furnace house (~ equal sales of semi) - Markets include nuclear, powder metals, temperature curing

Major Problem Areas

Technology - No

Personnel - Trained production people

Financial - In negotiation for purchase by $300M company

Facilities - No

Suppliers - About same as always.

Others - Look at safety as customer problem. Will do whatever customer specifies in this area. (WECO a prime customer is very demanding in this area)

INTERVIEW GUIDE

Semiconductor Manufacturing Suppliers

DATE 7/2/79

Company/Location Varian/Extrion - Boston area

Contact/Position General Manager - Have 70% of market and intend to maintain leadership--recent increase in field service.

The interviews will be conducted in two segments. We will first discuss the company's current and future potential in supplying products for Semiconductor Wafer Fabrication. Major current and anticipated problem areas will then be reviewed.

Wafer Fabrication Products

Implantation -

Mid-Current (200 DF4) most popular system in field (~$200K each)
- o Steady growth
- o Well known performance
- o Double and triple charge species (deeper drive) of major interest

High-Current (400-1,000)
- o Coming into its own (source-chain applications)

NOTE: Contact claims average implants/wafer has increased from 1.4 (1978) to 4 (1980). Varian has increased field service crew by factor of 3 over four year period (all products).

General Business

Current Delivery 8 months. Action on backlog problem if applicable: Investing $4M in new facilities this year on top of $4M last year.

Semi Related Products/Approx. Annual Sales:

1978: $18M 1979: $25M 1983/84: $65M New Products: E-beam or optical anneal by early 1981

Other industry sales: Some diversion into metal treatment will occur.

Major Problem Areas

Technology - No.

Personnel - All kinds because of rapid growth

Financial - Varian financing OK

Facilities - Time to build, must plan thoroughly

Suppliers - Stretching vendor capacities, processing & parts services

Others - No

INTERVIEW GUIDE

Semiconductor Manufacturing Suppliers

DATE 6/29/79

Company/Location ETEC - Hayward, CA

Contact/Position Ind. Product Mktg. - Tech oriented. This firm recently acquired by Perkin-Elmer (May 1979); 330 employees, 70K sq. ft., 7 leased buildings

The interviews will be conducted in two segments. We will first discuss the company's current and future potential in supplying products for Semiconductor Wafer Fabrication. Major current and anticipated problem areas will then be reviewed.

Wafer Fabrication Products

Mask Making - E-beam mask generator to 5" mask - ~$2M each ASP
- One hour/mask in Raster scan mode typical
- 0.5 micron resolution (½ micron spot) in positive resist
- Data handling rate and memory major concern

Alignment - Direct write on wafer (lab units now)
- Commercial production unit 2 yrs. away (late 1981)
- Throughput of 20/hr. (4" wafers) 3-5 years off
- Hybrid version most likely (both vector & raster scan)
  - Shaped beam for repetitive patterns (memories)
  - Raster scan for peripheral circuits
  - Price will remain about constant at $2M

General Business

Current Delivery 12-14 months. Action on backlog problem if applicable: Will not change, system to exotic/ custom/costly scale-up. Stand in line.

Semi Related Products/Approx. Annual Sales:

1978: $20M 1979: $25-30M 1983/84: $3.5X projected New Products:

Other industry sales:

Major Problem Areas

Technology - No

Personnel - Good engineers

Financial - Perkin-Elmer unbrella, had some difficulties in past

Facilities - Yes, suitability and time to acquire

Suppliers - Yes, machine parts

Others - No

INTERVIEW GUIDE

Semiconductor Manufacturing Suppliers

DATE 6/29/79

Company/Location Signatone Inc.

Contact/Position Small inst. mfg.; does sales/design/and directs mfg.

The interviews will be conducted in two segments. We will first discuss the company's current and future potential in supplying products for Semiconductor Wafer Fabrication. Major current and anticipated problem areas will then be reviewed.

Wafer Fabrication Products

Instrumentation/Inspection -

V/I measurement

- Probe with 500x Nikon can get to 0.1 micron diameters
- Engineering analysis system with X-Y 4" movement at $11K; manual feed, vacuum chuck for load/unloads, built 30 to date
- Micropositioner built in 100 pc. lots at $250-$500; will have automatic resistivity unit (similar to ASM) early 1980 at $6K (~ half price)
- Probe card prober 4x8 stage, panographic vac. arm
- Auto angle lap used by Japanese to determine boron drive depth after diffusion ($50K/yr. in sales)

General Business

Current Delivery 2 months. Action on backlog problem if applicable: Will maintain this sort of delivery

Semi Related Products/Approx. Annual Sales:

1978: $1.2M 1979: $1.8M 1983/84: $5M New Products: More automation

Other industry sales:

Major Problem Areas

Technology - No

Personnel - Willing to do several things

Financial - Always in small, privately held firm

Facilities - No

Suppliers - Make much of their own, some machine parts

Others - No

INTERVIEW GUIDE

Semiconductor Manufacturing Suppliers

DATE 6/21/79

Company/Location Tylan Corp. - Torrance, CA

Contact/Position V.P./Gen. Mgr. - Overall daily mgr. and planning. Major stockholder (Drexel majority).

The interviews will be conducted in two segments. We will first discuss the company's current and future potential in supplying products for Semiconductor Wafer Fabrication. Major current and anticipated problem areas will then be reviewed.

Wafer Fabrication Products

Oxidation/Diffusion - Panels and handling systems (200 tubes/yr. - 3rd Pl. mkt. supplier.)
Purchase furnaces from Thermco for system supply. Provide pullers, laminar flow, source cabinets. Major mass flow supplier (1200/mo. at $500 ea.).
Future - CC6 (their sequel to DDC) - first delivery 9/79.

CVD - Retrofit nitride/oxide/poly mid-temp RP units (4th place supplier)-60 tubes/yr.; some epi panels (IBM)

General Business

Current Delivery 5-6 months. Action on backlog problem if applicable: Up mass flow output to accomodate systems. 16-18 weeks shortest after first of 1980.

Semi Related Products/Approx. Annual Sales:

1978: $6M (actual) 1979: $10-15M ($8M backlog going in) 1983/84: $30M New Products: More automatic process systems

Other industry sales: 10% fiber optics for communications - 30% various specific gas-related applications)

Major Problem Areas

Technology - None

Personnel - Engineers shortage (production available)

Financial - Will go to banks (since profits can't finance growth), good credit and funds available, but don't like risk

Facilities - OK to $15M sales then moving to So. Orange County (1980-81)

Suppliers - Parts (316 S.S. tabing special sizes (3/8 to 3/16) went 4-20 weeks, I.C. for microprocessors 8-20 weeks, pots (Bourns & Beckman) 26 weeks)

Others - Light mfg. presents no environmental or governmental regulation problems

INTERVIEW GUIDE

Semiconductor Manufacturing Suppliers

DATE 6/21/79

Company/Location Cutler-Hammer (Semi Equipment Div.) - Sunnyvale, CA

Contact/Position Controller/Dir. Planning reports to V.P. & G.M. group. Acts as staff for president. Experience in mfg. from FSC and AMI; 20+ yrs. in industry.

The interviews will be conducted in two segments. We will first discuss the company's current and future potential in supplying products for Semiconductor Wafer Fabrication. Major current and anticipated problem areas will then be reviewed.

Wafer Fabrication Products

Oxidation/Diffusion - Not active (looking to acquire), no current ideas.

Photoresist Application/Develop - Complete line. Belt movement, MPU controlled. Building strategy (concern about defects) to control wafer envirnment. Plan to have pattern deliniation (apply/expose/develop/etch) in 2 yrs. Target defect level 2/sq. microns vs. 30 today. System must have own environment rather than facilities (airconditioning, wet waste, etc.)

Alignment - Contact now. Optometrics will join SED in next few months with step and repeat. Feels old rule $100/wafer cost still real and direct write e-beam or projection UV/x-ray for 1-2 microns in production will win. Must be at 2 microns in production 1982 (4-6 microns now).

Etch - D&W plasma only entrant current. Future Nova development ion mill 1981-82. Scrubbers high pressure & brush (leader in this area).

Ion Implant - Mid current product now ($2M annual-10 units) with late 1980 Nova high dose production unit in final design ($450K, 100+ wafer throughput). Anneal on backburner (ion beam) Eltek (Austin, TX) is mfg. now, but marginal.

CVD - This is obvious problem (tried to acquire AMT). Looking for answer here.

PVD - D&W vac. system good, but not widely accepted or sold ($2M 1979 sales) - 30-40% to optical coating.

Inspection-Withdrew product. Trying to develop reasonable unit. Planned new intro for Q3 1980. One-third labor in inspection wafer fab area. Looking for chip
to detect defect.

General Business

Current Delivery 6 months. Action on backlog problem if applicable: Adding capacity but will hold 5 months backlog through end of 1979. 3-month delivery target (will never get better).

Semi Related Products/Approx. Annual Sales:

1978: $32M 1979: $40M 1983/84: $100+M New Products: Acquire to serve entire semi mfg. needs.

Other industry sales: Subsidiary of Eaton Industries $4B, SED group includes: Eltak (I^2), Nova (C-H funded), Kasper/III, D&W, Pacific Reliability (envir. testing devices), Macrodata (elect. device test)

Major Problem Areas

Technology - 1) Choice of lithographic winning technology; 2) Availability of CVD technology

Personnel - Technical people (moving future ops to Austin, TX and others for this reason).

Financial - No problem (Eaton looks to C-H SED for glamour and added stock value)

Facilities - No.

Suppliers - Elec. components (7400 series Schottky in particular), lead times way out.
Elec. enclosures and services in short supply.

Others - Worried about safety specs on equipment in future. "We have gotten away with major dangerous items (hazardous gas, pinch points, elect. shock), but coming to end.

INTERVIEW GUIDE

Semiconductor Manufacturing Suppliers

DATE 6/26/79

Company/Location Tegal - Novato, CA

Contact/Position President - Firm majority owner Motorola with strategy to serve MSC needs for dry processing equipment then sell into merchant market.

The interviews will be conducted in two segments. We will first discuss the company's current and future potential in supplying products for Semiconductor Wafer Fabrication. Major current and anticipated problem areas will then be reviewed.

Wafer Fabrication Products

Photoresist Application/Develop - Have major interest in Micro-Air (Vytek wafer movement) through MSC. Laminar flow and some spin, develop. Also working with Hunt Chemical through MSC to supply units (plasma) for development of photoresist (PDP). Hunt will sell chemicals on royalty basis to MSC. Shows continued emphasis of MSC on dry processing.

Etch/Clean/Strip - Total plasma line (barrell and planar) with manual and automatic control. Announced in-line, single wafer (30 wafer/hr.) unit. Have orders for over one dozen. Two units at MSC for 2 months. Prime emphasis on improving plasma process prediction/production ops. Believes RIE may not be long term answer to fine line (conventional plasma can be made to work). Selling Micro Air and Vac. etch

CVD - Si_3N_4 with plasma dep only. Plasma dep having problems (12 in field). Japanese only reorder indicating they are making it work. SiO_2 deposition low priority because of problem.

General Business

Current Delivery 2-3 months. Action on backlog problem if applicable: Building to forecast rather than orders (mostly std. equipment). Increasing capacity 30K sq. ft. to 50 in next year (120K sq. ft. by 1983).

Semi Related Products/Approx. Annual Sales:

1978: $3M/90% semi 10% W.F. matls/assy 1979: $7M/90% semi W.F. 1983/84: $25M/75% semi W.F.

New Products: In-line plasma; looking for wafer handling acquire

Other industry sales:
Various industrial uses of plasma being investigated (wafer purification through fabric coatings)

Major Problem Areas

Technology - Gathering vacuum, wafer handling and microprocessing capability to play in the "big game" (Maintain competitive with P-E, Varian, etc.)

Personnel - Experienced chemical/electronic eng. rare

Financial - MSC backing more than adequate

Facilities - No difficulty in Novato

Suppliers - Deliveries stretching but 2nd order difficulty

Others - Technical secrecy of customers makes it difficult to communicate. MSC and others worried about information transfer through vendors.

NOTE: EPA and OSHA help plasma trend. Chemical waste disposal difficulties increasing rapidly.

INTERVIEW GUIDE

Semiconductor Manufacturing Suppliers

DATE 6/26/79

Company/Location GCA - Sunnyvale Division

Contact/Position General Management - Inputs will be negative with respect to others because of character of interviewee. May be too realistic.

The interviews will be conducted in two segments. We will first discuss the company's current and future potential in supplying products for Semiconductor Wafer Fabrication. Major current and anticipated problem areas will then be reviewed.

Wafer Fabrication Products

Mask Making - See Burlington

Oxidation/Diffusion - No (dying technology)

Photoresist Application/Develop - Complete line (air/nitrogen movement). Wafer trak modular concept. Integrating DSW for April 1980 shipment (line deliniation system). "Wafer local" - clean area around wafer to decrease defects (IBM, TI, Intel already have).

Alignment - See Burlington

Etch - Looking to acquire for more line integration (plasma technology)

Ion Implant - Mid-current unit at $2M annual. Plans for source/drain 50ma unit for 1981 introduction. Also looking at double/triple species in interim.

CVD - May have acquisition close at hand.

PVD - See Vac. Products Div.

Inspection - Look for high resolution CRT approach for defects, etc. Timing unsure.

General Business

Current Delivery 9 months. Action on backlog problem if applicable: Waiting for down cycle.

Semi Related Products/Approx. Annual Sales:

1978: $9M 1979: $18M 1983/84: $35-$40M New Products: Line delineation prime emphasis

Other industry sales: Multiple division operation (Burlington/Mann, vacuum (indust.) scientific products)

Major Problem Areas

Technology - Strategy to take advantage of opportunities

Personnel - Labor turnover 70%/yr. in body-bidding war in this area (Santa Clara)

Financial - Currently strong internal cash supply

Facilities - Singular big buildings at reasonable price/sq. ft. not available

Suppliers - Materials management really basic problem

Others - Top management successor

INTERVIEW GUIDE

Semiconductor Manufacturing Suppliers

DATE 6/27/79

Company/Location Ultek (P-E subsidiary)

Contact/Position Product Mgr. - Plasma equipment

The interviews will be conducted in two segments. We will first discuss the company's current and future potential in supplying products for Semiconductor Wafer Fabrication. Major current and anticipated problem areas will then be reviewed.

Wafer Fabrication Products

Photoresist Application/Develop - Micralign trying to integrate etch/clean with alignment 1982/83

Alignment - See Micralign from Stamford

Etch - Plasma/diode and RIE--less than 2 microns geometry requirement

CVD - Future development of Si_2N_4 and SiO_2 - 1980/81

PVD - Sputter deposition Al/alloys and metals

} 4400 Series platen loaded; microprocessor is basis for all products/processes.

General Business

Current Delivery 6 months. Action on backlog problem if applicable: Will maintain about constant in future.

Semi Related Products/Approx. Annual Sales:

1978: $8M 1979: $16.5M 1983/84: $40+M New Products: Total etch/clean and deposit-cassette/cassette-Smart machines

Other industry sales:

Major Problem Areas

Technology - No

Personnel - Some in technical

Financial - P-E backer

Facilities - Expanding to 3 facilities with option on 3 more

Suppliers - Slow

Others - Conservative management not attuned to pace of semi industry.

INTERVIEW GUIDE

Semiconductor Manufacturing Suppliers

DATE 6/27/79

Company/Location Electromask, Van Nuys, CA

Contact/Position Vice President Engineering

The interviews will be conducted in two segments. We will first discuss the company's current and future potential in supplying products for Semiconductor Wafer Fabrication. Major current and anticipated problem areas will then be reviewed.

Wafer Fabrication Products

Mask Making - Step & Repeat
Pattern Generator
Criss-Cross (Combines both for greater throughput)
Will set up mask shop for client, approximately $750K, 4K sq. ft. includes machines, enclosure, sinks & inspection tools. Includes training.

Aligner - Step and Repeat on wafer (thru lens for direct/offset capability.)

General Business

Current Delivery 6 to 8 months. Action on backlog problem if applicable: Increasing production by 2x, scheduled completion facilities mid-'80 - 4 to 6 mo. long-term average - (40K sq. ft.)

Semi Related Products/Approx. Annual Sales:

1978:	1979:	1983/84:	New Products:
$10M	$15M	$60M	

Other industry sales:

All semiconductor above ⇒ subsidiary of TRE $110M Firm

Major Problem Areas

Technology - Determining real customer needs

Personnel - Engineers and high grade technicians

Financial

Facilities

Suppliers - Planning of Matl's critical, Services (Cabinets, Metal lap/polish, etc., cabinets in short supply, Lens could be problem (Ziess).

Others - Government restrictions on export.

INTERVIEW GUIDE

Semiconductor Manufacturing Suppliers

DATE 6/16/79

Company/Location Tempress - Los Gatos, Sunnyvale, Watertown and Corotek, So. California

Contact/Position President Reports to Group President of Sola Basic - a Subsidiary of General Signal (~$4-5B Sales)

The interviews will be conducted in two segments. We will first discuss the company's current and future potential in supplying products for Semiconductor Wafer Fabrication. Major current and anticipated problem areas will then be reviewed.

Wafer Fabrication Products

- In Wafer Processing & Assembly areas of Semi. Mfg. Vending

  Oxidation/Diffusion - Poor second to Thermco. Working on digital rather than former analog furnace control.

  CVD - Reduced pressure retrofit and furnace package (was leader, now #3 to 4). Pyro Oxide (Pyrox) major seller. Horizontal epi (Unipac) was largest selling 1973-1975, now down to ~ 10/yr overseas.

  Etch/Clean - Automated etch sinks, etc. now turned profitable but no new product innovation (Flouroware Systems will surpass),

  Back-end Products - Dicing saws, bonders, small tools - $6M/yr.

General Business

Current/Delivery Equipment 3 months. Action on backlog problem if applicable: Nothing
6 Months for furnaces.

Semi Related Products/Approx. Annual Sales: Total worldwide (Sub Mfg. Japan & Europe ≃ 40%)

1978:	1979:	1983/84:	New Products:	Plasma Syst. - 198?
$25M	$31M	$62M		Auto Bonders, Dir. Hdl. Equipt.
Other industry sales:				Tape Syst. ⇨ Assy. Emphasis

Major Problem Areas

Technology

Personnel - Engineers (can't spend budget in development) TSR - Known for tightness. Turnover rate in this area very high. Elect/Design especially difficult.

Financial - As sub of General Signal no problem.

Facilities

Suppliers - Parts in short supply, Automatic Flow Controls.

Others

INTERVIEW GUIDE

Semiconductor Manufacturing Suppliers

DATE 6/27/79

Company/Location Floroware, Wisconsin

Contact/Position Wafer Containers & Equipment

The interviews will be conducted in two segments. We will first discuss the company's current and future potential in supplying products for Semiconductor Wafer Fabrication. Major current and anticipated problem areas will then be reviewed.

Wafer Fabrication Products

Masking - mask cleaner.

Etch/Clean - Chemical in situ, single chamber, recirculating automated system.
Very popular in Europe and Eastern U.S. Niche is that others have bypass concept.
General Systems sell for $30-40K. Specials for TI, IBM, RCA, BTL/WECO at $60-80K.

General Business

Current Delivery 9 months. Action on backlog problem if applicable: Will increase capacity on line in 4 months. Will get to 4-6 mo.

Semi Related Products/Approx. Annual Sales:

1978:	1979:	1983/84:	New Products:
	$2-3M (Est.)	$8M (Est.)	

Other industry sales:
50% Equipment/50% Containers

Major Problem Areas

Technology	No
Personnel	No
Financial	No - TSR - I really doubt this with projected growth
Facilities	No
Suppliers	Stainless Steel and machine parts
Others	Projects '81 slowdown thru mid-1982.

INTERVIEW GUIDE

Semiconductor Manufacturing Suppliers

DATE 6/17/79

Company/Location Nova Assoc. - Boston, MA

Contact/Position Joint Venture of Cutler-Hammer (owner of Kasper/ III

Initially slated as development firm for Kasper, now on its own.

The interviews will be conducted in two segments. We will first discuss the company's current and future potential in supplying products for Semiconductor Wafer Fabrication. Major current and anticipated problem areas will then be reviewed.

Wafer Fabrication Products

High Current (10ma) Ion Implanter ⇒ Auto Hdl. (probably best in industry)

CVD - New Concept MBE looking at for 1982/83.

E Beam anneal for Ion Implant - 1981 mid-year planned.

INTERVIEW GUIDE

Semiconductor Manufacturing Suppliers

DATE 6/27/79

Company/Location ASM America, Phoenix, AZ

Contact/Position Originally European based - Mfg/Rep. organization. Came to U.S. 2 years ago. Tended to copy U.S. equipment, now becoming innovative.

The interviews will be conducted in two segments. We will first discuss the company's current and future potential in supplying products for Semiconductor Wafer Fabrication. Major current and anticipated problem areas will then be reviewed.

2-18

Wafer Fabrication Products

Oxide Diffusion - Full System but short in versatility and computer control.

Etch/Clean - Working on parallel plate plasma.

CVD - Radiant Horizontal Epi, Reduce Pressure Mid and Low Temperature Deposition.

Inspection - Wafer particle counter (laser optical)
V/I Resistivity System.

General Business

Current Delivery 3-4 months. Action on backlog problem if applicable: Instituting proper mfg. plan will maintain lead times at about same levels.

Semi Related Products/Approx. Annual Sales:

1978:	1979:	1980:	1981	1983/84:
$2M	$5M	$10M	$20M	$40M

Other industry sales:

New Products: Parallel Plate Plasma for deposition (CVD) and etch, will be announced in July for Nov. 1979 delivery.

Major Problem Areas

Technology - No

Personnel - Soft/Hardware oriented Engineers, CVD knowledgable people.

Financial - Tough to get growth in low profits business

Facilities - No

Suppliers - Inventory Planning Absolutely necessary. Flow controllers, IC most problematic.

Others
- Safety requirements for equipment will be tough and expensive.
- Environmental problems for users.
- Cash flow in Capital Equipment business requires up-front payment but competition will not go along.

General Business

Current Delivery 6 months. Action on backlog problem if applicable: Will hold

Semi Related Products/Approx. Annual Sales:

1978:	1979:	1980	1983/84:	New Products:
-	$1.6M	$5	$8	~ $15 (Est.)

Other industry sales:

Major Problem Areas

Technology	No
Personnel	Trained of all types plus salary demands caused by inflation
Financial	Cutler-Hammer reasonable (Subsidiary of Eaton)
Facilities	Poor, but adequate (build for $30/sq.ft., $210/K acre property.
Suppliers	No
Others	Varian Suit - will be settled within 30 days after 10 weeks hassle. Energy Availability - electricity, heating oil, gas for transport. Holding back information on bogus secrecy.

INTERVIEW GUIDE

Semiconductor Manufacturing Suppliers

DATE 6/27/79

Company/Location MRC (Corp. Headquarters)

Contact/Position Materials and Equipment Market - Intends to be factor in both for industry.

The interviews will be conducted in two segments. We will first discuss the company's current and future potential in supplying products for Semiconductor Wafer Fabrication. Major current and anticipated problem areas will then be reviewed.

Wafer Fabrication Products

PVD - Platen Loading Sputtering, 900 Series (near top popularity for MOS Mfg.), 600 Series (900 turned on side) for Bipolar (thicker metals to reduce flakes, etc.). Advantage is vertical integration (materials supply targets) felt big advantage. MOS moving to Schottky for high speed so 600 may enter that market - also sputter etch (via opening) popular.
R.F. power control key to operation (P.E. felt to be only equal source).
Micro-processor, interactive terminal big feature.

Etch/Clean - MH 100 Plasma is first generation. Cassette to Cassette planned for '81 introduction. RIE in process now on 100 with recipesand special versions available in early 1980.

TSR - Firm not really used to process guarantees.

General Business

Current Delivery 6-8 months. Action on backlog problem if applicable: Order entry slope dependent

May get to 4 months general products (equipment).

Semi Related Products/Approx. Annual Sales: SEMI Wafer Fab. Equipment only ⇒ Sputtering

40% Annual Growth Projected

1978:	1979:	1983/84:	New Products: More automated
40% Sales $14M	$20M	3.8x	

Other industry sales:

40% in Elect. General (Hybrids)
20% Industrial (Razor Blades, etc.) - Expected to maintain.

Major Problem Areas

Technology - No

(3) Personnel - Engineers

(2) Financial - Fund Allocation Choice. Borrowing at 18% effective. Equipment business tough because of cash flow. Instituted payment (40%) with P.O. for smaller customers.

(1) Facilities - Can't build fast enough.

(4) Suppliers - Late deliveries.

Others - MRC has good patent position. Challenge anyone to "back-engineer" product.

- Safety for employees in ceramic operation.

INTERVIEW GUIDE

Semiconductor Manufacturing Suppliers

DATE 6/29/79

Company/Location Applied Materials, Santa Clara, CA

Contact/Position VP - Marketing - Define business as Semiconductor Mfg. Equipment. Supplier to Wafer Fab Area.

The interviews will be conducted in two segments. We will first discuss the company's current and future potential in supplying products for Semiconductor Wafer Fabrication. Major current and anticipated problem areas will then be reviewed.

Wafer Fabrication Products

Oxidation/Diffusion - Sell for Gasonics - includes gas jungles (fixed oriface) and High Pressure OX (HiPox) to 25 ATM. Purchase or retrofit to customer supplied furnaces for atmospheric applications.

Etch/Clean - Plasma II used by some customers as parallel plate etches.

CVD - Epi king with radiant heated 76-7800 Leader (approaching 10/Mo output). Reduced pressure Epi (7800 RP @ $325K) slated for 3/mo output starting 9/79 with all major customers in place by 1/80. Benefit is reduced autodoping, sharper junctions. Available to general customers starting 4/80. Well characterized.
LP/RP mid-temp (600-1000°C) in 2nd or 3rd place (poly, nitride, oxide) and looking at silicides and TEOS (lower resistivity than poly). Microprocessor interactive terminal.
LP/Deposited Oxides (low temperature 300-500°C) entrant is 2100 continuous plate loaded Silox. Works well and good for doped oxide, high throughput needs.
Plasma Deposited Nitride (Passivation) with Plasma II much better. Package available to reduce cleaning needs in works ($5K cost). SiO_2 depo also available. (See Phillips paper by Van De Ven). Conformal, compressive film for multiple lay metal.

Inspection - Ellipometer (manual) and Reflectometer (thickness) available. Epi thickness 6-12 mo. off.

General Business

Current Delivery 4 months. Action on backlog problem if applicable: Will hold at this level.

Semi Related Products/Approx. Annual Sales: All Semi Wafer Fab

1978:	1979:	1983/84:	New Products:
$27M	$34M Projected	$80-100M Planned	Plasma Etch and Continues Metal Syst. Planned for early 1980 intro.

Other industry sales:

Have tried without success to diversify

Major Problem Areas

Technology - No but focus effort problematic

Personnel - Engineers

Financial - No. Have $1-2M in C/D with investors clammering.

Facilities - 1-2 year expansion plan in process. Will expand to 5 year plan in few months.

Suppliers - MRP recently working effectively (started 3 years ago). Many materials in short supply. Vendor response time poor. Planning critical.

Others

INTERVIEW GUIDE

Semiconductor Manufacturing Suppliers

DATE 6/29/79

Company/Location Siltec - Mt. View, CA

Contact/Position President - Diversify on opportunity. Wafers, wafer making equipment, processing equipment (CVD of interest) and Solar Energy Markets.

The interviews will be conducted in two segments. We will first discuss the company's current and future potential in supplying products for Semiconductor Wafer Fabrication. Major current and anticipated problem areas will then be reviewed.

Wafer Fabrication Products

Wafer Making Equipment	- Pullers/Slicers, etc.
Cassette Transfer	- Supply to mfg. for integration on line and into OEM equipment (~ $2.5K each)
Inspection	- Visual Syst. planned for mid-1980 intro. Sorting for other characteristi potential (see Rick Stevens for further). See niche. TV option for training.
Etch/Clean	- Have wet etcher for wafer final etch now. Could adopt to in-line wafer etch in processing. No current plan.

General Business

Current Delivery 6 months. Action on backlog problem if applicable: Expanding to 3 mo. target

---

Semi Related Products/Approx. Annual Sales:

1978:	1979:	1983/84:	New Products:	1979 Sales
$28M	$45M	$150M Planned		Siltec

Other industry sales:

Major Problem Areas		Wafers (70%)	Wafer Making Equip. (15%)	Ceramic Package (10%)	Wafer Fab Equipment (5%)
Technology	- No				
Personnel	- Qualified microprocessor applications engineers (elec/ mech hybrid)				
Financial	- May go public late 1979 to finance growth.				
Facilities	- Outside Si Valley OK (building 3 stories in Bohanan Park next year).				
Suppliers	- Electric motors, all service suppliers (cabinets, machine parts, etc.)				
Others	- Building large Si mfg. (wafers) in Oregon				

INTERVIEW GUIDE

Semiconductor Manufacturing Suppliers

DATE 6/29/79

Company/Location Ultratech (subsidiary of Xynetics), Santa Clara, CA

Contact/Position General Manager - Equipment Div.

The interviews will be conducted in two segments. We will first discuss the company's current and future potential in supplying products for Semiconductor Wafer Fabrication. Major current and anticipated problem areas will then be reviewed.

Wafer Fabrication Products

Aligners	-	Step and Repeat (on wafer), auto focus and register, multiple reticles @ $200K. Delivery first production unit to Intel with first year production committed to them (~12 units) if it works. Will have commercially available units for general sales 9/81 if unit is good.*
Cleaning	-	Mask Scrubber combines spray/brush, disperse with microprocessors and vacuum chuck (~$8K)
Photo Dev.	-	Automatic System for Intel. Filter, temperature control, rinse/tank combination with spray. Not commercially available yet but contemplate announcement early 1980.

*Note - Ultratech approached P-E to linear design. Still open but doubtful.

General Business

Current Delivery 4 months. Action on backlog problem if applicable: Steady

---

Semi Related Products/Approx. Annual Sales:

1978:	1979:	1983/84:	New Products:
$2M	$3M	? (Depends on S&R)	
		(Aligner)	
		(Assume $20M -TSR)	

Other industry sales:

Major Problem Areas

Technology - No

Personnel - No

Financial - Availability versus other opportunities

Facilities - No

Suppliers - lens (forced to mfg. their own)

Others

INTERVIEW GUIDE

Semiconductor Manufacturing Suppliers

DATE July 3, 1979

Company/Location Süss - Takuda - Ryohosha U.S., Representative, Pasadena, California

Contact/Position Specializes in Sales/Service for foreign manufacturing (5 services - 3 in Santa Clara, 1 each in Mid West and East)

The interviews will be conducted in two segments. We will first discuss the company's current and future potential in supplying products for Semiconductor Wafer Fabrication. Major current and anticipated problem areas will then be reviewed.

Wafer Fabrication Products

Alignment - Süss (Germany): Proximity (MJB-55, 2 to 5" capability at $100K)
- Ops Modes - Vacuum ("O"-ring lip around wafer for sub-micron close contact, hard or soft contact and proximity to 10 mils (2-3 microns resolution)
- Shallow U.V. Ops - lamp/filter peak @ 300 nm for conventional resist process use with 30% reduction resolution (vs 460 nm) - MSC getting unit by 8/79
- Full deep U.V. (250 nm) in early 1980

Etch/Clean - Takuda (Toshiba Sub) CDE4, $175K, Si_3N_4 and Poly, Microwave, + 1% uniformity Cassette to cassette, in-line, single wafer Did 0.75 micron line and space
- Saturated Japanese market (?-TSR) at TRW oxide (400 ^{O}A) over Poly (4K ^{O}A)

Inst./Inspect - Ryokosha (Hitachi Sub): Telecomputer for C/D measure
- Precision to > 0.5 micron, repeat 0.8 micro inch

General Business

Current Delivery Align - 3-6 months
Etch - 3 months
~~Inst. - 1~~ months. Action on backlog problem if applicable: Target to remain at 3 months

---

Semi Related Products/Approx. Annual Sales: Est.

1978: $1M 1979: $2M 1983/84: $12M New Products:

Other industry sales:

Major Problem Areas

Not applicable

Technology

Personnel

Financial

Facilities

Suppliers

Others

INTERVIEW GUIDE

Semiconductor Manufacturing Suppliers

DATE July 5, 1979

Company/Location Machine Technology Inc. - New York

Contact/Position President - Defines needs, ideas to solve, make it cost effective

(Note TSR - generally thought of as lab operation equipment - limited scale)

The interviews will be conducted in two segments. We will first discuss the company's current and future potential in supplying products for Semiconductor Wafer Fabrication. Major current and anticipated problem areas will then be reviewed.

Wafer Fabrication Products

Photoresist App/Dev. - Omni Chuck Concept Cost/Floor Space/Defect Reduction - Cassette to chuck transfer with multiple heads perform operations of spin, apply hard and/or soft bake. Rotate wafer in places 20% less cost then GCA for same through-put with 30-40% less floor space. Microwave baking with 10 second de-hydrate or 6 second soft bake. Couples to polar molecule (photo). Includes IR lamp for negative or hot plate chuck for positive photoresist. Can't use over aluminum and prime design use in MOS (Bipolar marginal) 1st units shipping in 8/79 with production starting in 10/79. ASP - $40K with 15/month output slated 1/80 capable. Marry to aligners 1980.

Clean - Double sided vertical scrubber at $30K (1 or 2 cassette), air cylinder load

Inspection - Looking for inst. such as Kaptec defect counter.

General Business

Current Delivery 3 months. Action on backlog problem if applicable: Maintain even with growth by increasing capacity (3.2K$^{O'}$ to 10K$^{O'}$ by 1/80)

Semi Related Products/Approx. Annual Sales:

1978: $1M 1979: $3M 1983/84: $15M New Products:

Other industry sales:

Major Problem Areas

Technology	Ideas, use consultants
Personnel	Always (good), draftsman
Financial	Always when in growth made, 2 years away from going public
Facilities	No
Suppliers	Upgrade capacity (double source peculiar parts), work close with vendors
Others	Microwave cert. - OSHA Radiation (50 mw/cm^2 maximum allowed) - Now meet at 1 mw/cm^2

INTERVIEW GUIDE

Semiconductor Manufacturing Suppliers

DATE July 5, 1979

Company/Location Pacific Western - Mountain View

Contact/Position President - Innovative, production oriented, diverse experienced people, tend to stay in small-dedicated equipments. Production in Nevada, microprocessor in Seattle

The interviews will be conducted in two segments. We will first discuss the company's current and future potential in supplying products for Semiconductor Wafer Fabrication. Major current and anticipated problem areas will then be reviewed.

Wafer Fabrication Products

CVD - Low temperature oxide (Models 2000-5000) - manual deposited O_2/SiH_4 hot plate approach. Operational/Maintenance/Cost Effective ($20K/unit) Have 3-400 installed base worldwide.

- New Plasma Depo (Nitride Process Defined, Oxide and Poly coming) using diffusion furnace at 300+°C with vertical mounting plates. About 50 - 3-4" wafers/run at $60-80K/tube dual configuration. First unit to Intel, now working with NSC and AMD. Could revolutionize plasma depo.

Etch - Will go into etch mid-1980.

General Business

Current Delivery 3 months. Action on backlog problem if applicable: Will hold steady 3 months

---

Semi Related Products/Approx. Annual Sales: CVD equipment only

1978: $2M 1979: $3M 1983/84: $15M New Products:

Other industry sales:
Prober Sales (50% corp.) - $4M 1978, $6M 1979
Tester Sales (25% corp.) - $3M 1978, $4M 1979 "will grow fastest"

Major Problem Areas

Technology	No
Personnel	Always
Financial	Control Growth
Facilities	O.K. in Nevada
Suppliers	Make most of own parts
Others	

INTERVIEW GUIDE

Semiconductor Manufacturing Suppliers

DATE July 3, 1979

Company/Location Airco - Timeseal

Contact/Position V.P. Marketing - Old line vacuum firm acquired by Airco several years ago. Airco management now infiltrating. Bus. defined - Vac. Tech.

The interviews will be conducted in two segments. We will first discuss the company's current and future potential in supplying products for Semiconductor Wafer Fabrication. Major current and anticipated problem areas will then be reviewed.

Wafer Fabrication Products

PVD - Stress Cost Effective/Depo. Quality - FCE (Fast Cycle Evaporator), FCS (Fast Cycle Sputter) with filament/e-beam evap. or plasma magnetion sputtering -

- Load back system 40% more cost at 2X through-put MRC-602 or ultec 4400
- High Al/alloy reflectivity, water vapor pump down, step cover etc.
- Microprocessor control (4400 isn't there yet)
- 20-30 min air to air cycle at at 50-4" wafer loads (multiple process(s))
- Now hand load 4 quad. but cassette load planned for mid 1980.
- $200K now, $250K with cassette, $300K in 1983 (inflation)
- Vertical wafer position (less particulates claimed)
- Customers (1 year + after introduction) including: Japanese (Toshiba, Mitsubishi, NEC)-18, TI, IBM, Delco - penetration deeper outside of Silicon Valley

Cassette/in-line long way off because of cost effectiveness

Etch/Clean - Natural extension of vac. tech. - RIE and Ion Mill in 1981
Deposition - Nothing planned, sputter tech. won't do. No significant advantages
Components - 50% of current business in pumps, valves, guns and power supplies. Mostly (60%) to other OEM. 40% to research labs.

General Business

Current Delivery 8 months. Action on backlog problem if applicable: Have 5X area required now

Need extra area for Special Systems

Semi Related Products/Approx. Annual Sales: Semi Equipment Only

1978: $5M 1979: $8M 1983/84: $24M New Products: Will maintain mkt. mix.

Other industry sales:
Glass plants turn key 18x100' systems and various other industrial large chambers

Major Problem Areas

Technology	No
Personnel	Technology - Microprocessor Engineers (12-18 months to find one) Production Managers Sales - Very few good ones now (will ease 6 months after next down turn)
Financial	No. Sub. of Airco $2B Corp. General funds hard-to-get
Facilities	No, good for 5 years (est. 100K sq. ft. +)
Suppliers	Delivery slippage (covers severe cash flow problems)
Others	No (OHSA plus others customer problem)

INTERVIEW GUIDE

Semiconductor Manufacturing Suppliers

DATE July 6, 1979

Company/Location Epitaxy Inc. - Santa Clara, California

Contact/Position President - Services firm now expanded to wafers, equipment and special devices

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The interviews will be conducted in two segments. We will first discuss the company's current and future potential in supplying products for Semiconductor Wafer Fabrication. Major current and anticipated problem areas will then be reviewed.

Wafer Fabrication Products

CVD - Epi Services $4M 1977, $5M 1978, $6M 1979 - 2 to 3 1983
Epi Equipment 16" vertical - versatile dual chamber at $200K with generator (TSR - Question Support) - $2M 1980 to $15M 1983

Wafers - 2/3 to 3/4 - 3" with 4" late 1979 - $2M 1977, $3M 1978, $4M 1979

Others - Buried layer, some masking and photo for special devices on 1 shift now
Could do $5-7M/year in custom by going 3 shifts

General Business

Current Delivery N.A. months. Action on backlog problem if applicable: 4-6 months general

---

Semi Related Products/Approx. Annual Sales: Equipment only

1978: - 1979: 80 / $2M 1983/84: $15M New Products:

Other industry sales:

Major Problem Areas

Technology	No
Personnel	Always
Financial	Controlled growth situation
Facilities	Could expand 2-3 times now
Suppliers	Cultivate machine shops
Others	None anticipated

INTERVIEW GUIDE

Semiconductor Manufacturing Suppliers

DATE July 10, 1979

Company/Location Accelerators Inc., Austin, Texas

Contact/Position

The interviews will be conducted in two segments. We will first discuss the company's current and future potential in supplying products for Semiconductor Wafer Fabrication. Major current and anticipated problem areas will then be reviewed.

Wafer Fabrication Products

Ion Implanters - AIM 210 mid current prime product

- Cassette loaded
- Marginal experience (reliability/support)
- Delivery problem through 1978 starting to ease
  - Averaged 1/month 1978
  - Averaging 2/month 1979

  Series III high current (mutual sales agreement with Lintott Ltd.-England)
- Good technology (magnets, high voltage)-poorly implemented
- No sales/service organization

General Business

Current Delivery 6-8 months. Action on backlog problem if applicable: 6

Semi Related Products/Approx. Annual Sales:

1978: $2.9M 1979: $6M 1983/84: 4x XXXXXXXXXXX XXXXXXXXXXX

TSR Comments: Financial Record very spotty

Other industry sales:
Looking at metal treatment for industry

Major Problem Areas

Technology	No
Personnel	Always
Financial	Could use funds
Facilities	No
Suppliers	Quality and delivery
Others	

INTERVIEW GUIDE

Semiconductor Manufacturing Suppliers

DATE (None)

Company/Location Thermco-Sunbeam, Orange, CA

Contact/Position Gen. Sales Mgr. - Subsidiary of $2.5B company. Small controlled operation with 15% growth and profit goals.

The interviews will be conducted in two segments. We will first discuss the company's current and future potential in supplying products for Semiconductor Wafer Fabrication. Major current and anticipated problem areas will then be reviewed.

NOTE: Facility laminar flow plan/hardware with services available from single source.

Wafer Fabrication Products

Oxidation/Diffusion - Leaders in direct digital control (2/3 business by volume)

- Flow control product in final test (2-3 mo. introduction) - more reliable valve, easier to maintain - OEM and captive markets
- Auto loading elevators for upper tubes planned (low priority) - TEL development - tubes high and boats heavier. No auto c-to-c planned.

High Pressure Oxidation - Slower than expected (will ship 1/mo. starting 8/79)

- Diversion from production pressure main delay
- Current customers are systems houses that have time to investigate new processes. Expect up-turn 6-12 months when industry slows down.
- Safety - pyro systems OK by add-on. Believe water inject re-design will require new design and added cost.

CVD - LP big business, complements Ox/Diff. LTO is poor/non-production, although being purchased. Oxide depo vs. plasma is open question.

LPE - Bubble memory furnace will be introduced in mid-1980.

General Business

Current Delivery 6 months. Action on backlog problem if applicable: 4-5 target best

---

Semi Related Products/Approx. Annual Sales: (90% in semi - 5% back ind. sealing ovens)

1978: $22M 1979: $30M 1983/84: $60M New Products: Narrow product line-needs expansion/acquire

Other industry sales: Some thick films, bronze etc. (10%) - Industrial

Major Problem Areas

Technology - No

Personnel - Professional of all kinds

Financial - Backed by Sunbeam

Facilities - No problem in Newport, CA area--some collection problems, get 15-20% customers on big jobs to provide progress payments

Suppliers - Component shortages (12 months for latest MPU), mass flow controllers in short supply

Others

INTERVIEW GUIDE

Semiconductor Manufacturing Suppliers

DATE 7/11/79

Company/Location Perkin-Elmer, Stanford, MA

Contact/Position Optical group - governmental and aligner business (~50/50)

The interviews will be conducted in two segments. We will first discuss the company's current and future potential in supplying products for Semiconductor Wafer Fabrication. Major current and anticipated problem areas will then be reviewed.

Wafer Fabrication Products

Alignment - 100 series (140 most popular) over 1000 in field
200 series recently introduced - upgraded 140 with 2 micron resolution capability, mechanical improvements
500 series slated for mid-1981 introduction - Deep U.V. scanning projection for 0.75 to 1 micron resolution
E-beam 1982-83 product in development direct wafer exposure

General Business

Current Delivery 12-14 months. Action on backlog problem if applicable: 12

Semi Related Products/Approx. Annual Sales:

1978: $65M 1979: $90M 1983/84: 3x New Products:

Other industry sales:

Major Problem Areas

Technology - No

Personnel - All types of professionals

Financial - Not with P-E umbrella and performance to date

Facilities - No, but planning required

Suppliers - Make most of own needs

Others

INTERVIEW GUIDE

Semiconductor Manufacturing Suppliers

DATE 7/11/79

Company/Location Cobilt Div., Computervision - Santa Clara, CA

Contact/Position 40% of corporate sales

The interviews will be conducted in two segments. We will first discuss the company's current and future potential in supplying products for Semiconductor Wafer Fabrication. Major current and anticipated problem areas will then be reviewed.

Wafer Fabrication Products

Aligners - Contact and projection
- CA 3000 - becoming established as P-E second source (better mechanics and automation)
- Contact will maintain level through next 2 years
- X-ray product for general introduction 1980 (working with GI)

Photoresist Application/Develop - Integrated pattern system introduced in 5/79. Looking for dry etch to further complete line function

Scrubbers - high pressure, brush

Inspection Stations - Generation II coming 9/79

General Business

Current Delivery 6 months. Action on backlog problem if applicable: 4 steady state

---

Semi Related Products/Approx. Annual Sales: (Semi equipment only)

1978: $24M 1979: $30M 1983/84: 3x New Products:

Other industry sales: 60% corporate effort in Computer Aided Design (CADAM Div.) for industry (oil plants, automotive, shipbuilding)

Major Problem Areas

Technology - No

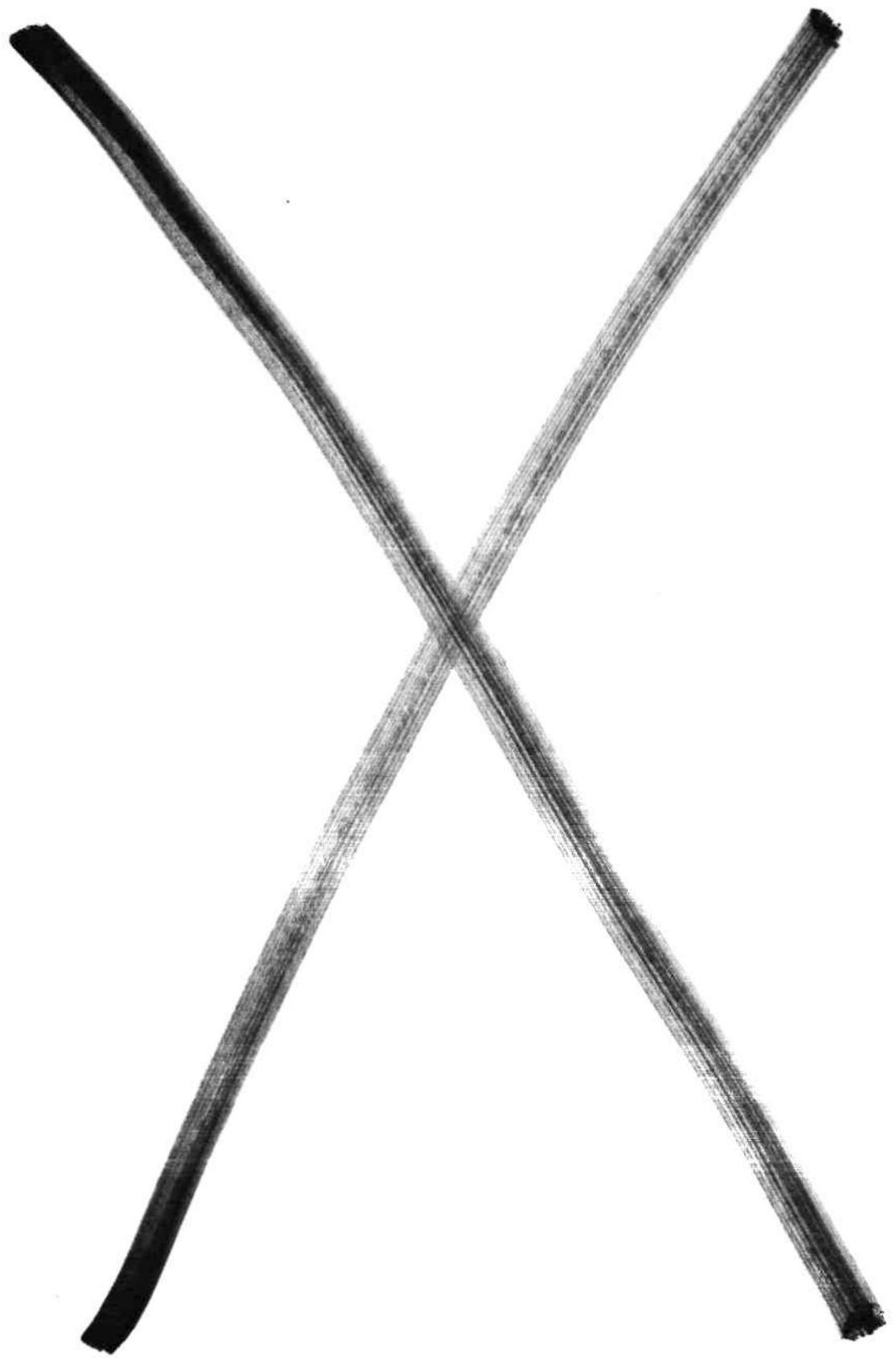
Personnel - Good,

Financial - Not problem at this time (looking for acquisitions)

Facilities - Moving out of Santa Clara proper

Suppliers - Planning focus necessary

Others - No government problems seen



3. MATERIALS SUMMARY

The primary materials considered in this section are silicon and polysilicon. Other materials are considered briefly, but no shortages are known except for an apparently temporary shortage of hydroflouric acid. Prices have increased for epoxy potting compounds due to recent price increases in petroleum, but no shortage is expected since the plastics industry consumes only a small fraction of petrochemical supplies.

Major conclusions of this section are as follows:

- Lead times are currently decreasing on silicon wafers.
- Planned capacity expansions in silicon wafers should be adequate for the next 5 years.
- Poly prices are too low to justify building new capacity.
- Worldwide poly demand is expected to exceed capacity by 1981 or 1983.
- Shortages could be acute since new poly plants take three years to build.

MATERIALS

Silicon Wafers

Polysilicon

Other

Source: DATAQUEST, Inc.
July 1979

SILICON WAFERS

Lead times increased in late 1978 from 6 to 20 weeks.

Currently, lead times run 14 weeks.

Suppliers who made appropriate vendor commitments experienced no interruption of production.

Prices recovered:

	1977	April 1978	Feb. 1979	June 1979
3-inch slice	$5.40	$4.10	$4.80	$5.20

Source: DATAQUEST, Inc.
July 1979

SILICON USAGE

Silicon usage in 1979 up 40 percent vs. 1978
(first 5-month average)

Device sales up only 26 percent

Reasons:

26%	Increased production
5	Added work in process
4	4" Conversion
2	IBM purchases
3	Inefficiency of growth
40%	

Source: DATAQUEST, Inc.
July 1979

SILICON CAPACITY (Merchant Silicon Market)

	Estimated 1979 U.S. Production (Million Sq. Inch)	Planned Capacity
Monsanto	120	280
Siltec	50	100
Wacker	50	100
Others	70	120
	290	600
		+107%

Capacity adequate for 5 years at 15% growth per year.

Source: DATAQUEST, Inc.
July 1979

U.S. SILICON USE

	Estimated 1979 Use (Million Sq. Inch)	% of U.S. Usage
Merchant Silicon	290	60%
Slice production by Merchant Suppliers (Fairchild, Motorola, TI, et al)	131	28
Slice Production by Captives (IBM, WE, et al.)	59	12
	480	100%

Source: DATAQUEST, Inc.
July 1979

POLY

Current Price - $69 to $74 per kilo

ROI - 25 percent at $70 per kilo - if plant capital cost is $55 per kilo

Present plant cost $110 per kilo

Price for 25 percent ROI - $95 per kilo

And - Maybe someone in the solar energy program will invent a $10 per kilo production method.

No one wants to build a new Poly plant.

Source: DATAQUEST, Inc.
July 1979

CURRENT PLANT CAPACITY

Worldwide	2,500-2,600	Metric Tons
Plant reactivation	500-600	Metric Tons
Easily Available Capacity	3,000-3,200	Metric Tons

Source: DATAQUEST, Inc.
July 1979

EFFECT OF LARGER WAFERS

Wafer Size	Poly Usage (g/in^2)	% Wafer Size by Year			
		1978	1979	1980	1981
3"	3.35	80%	70%	40%	20%
4"	4.20	20%	30%	60%	80%
Weighted Average (g/in^2)		3.52	3.61	3.86	4.03

Source: DATAQUEST, Inc.
July 1979

POLY USAGE
(Million Metric Tons)

	1979	1980	1981	1982	1983
Minimum Usage	1,824	2,111	2,432	2,856	3,365
Maximum Usage	2,346	2,580	3,121	3,777	4,570

Source: DATAQUEST, Inc.
July 1979

OTHER SHORTAGES

Selective lead frame shortages -

Possibly due to stamping die capacity.

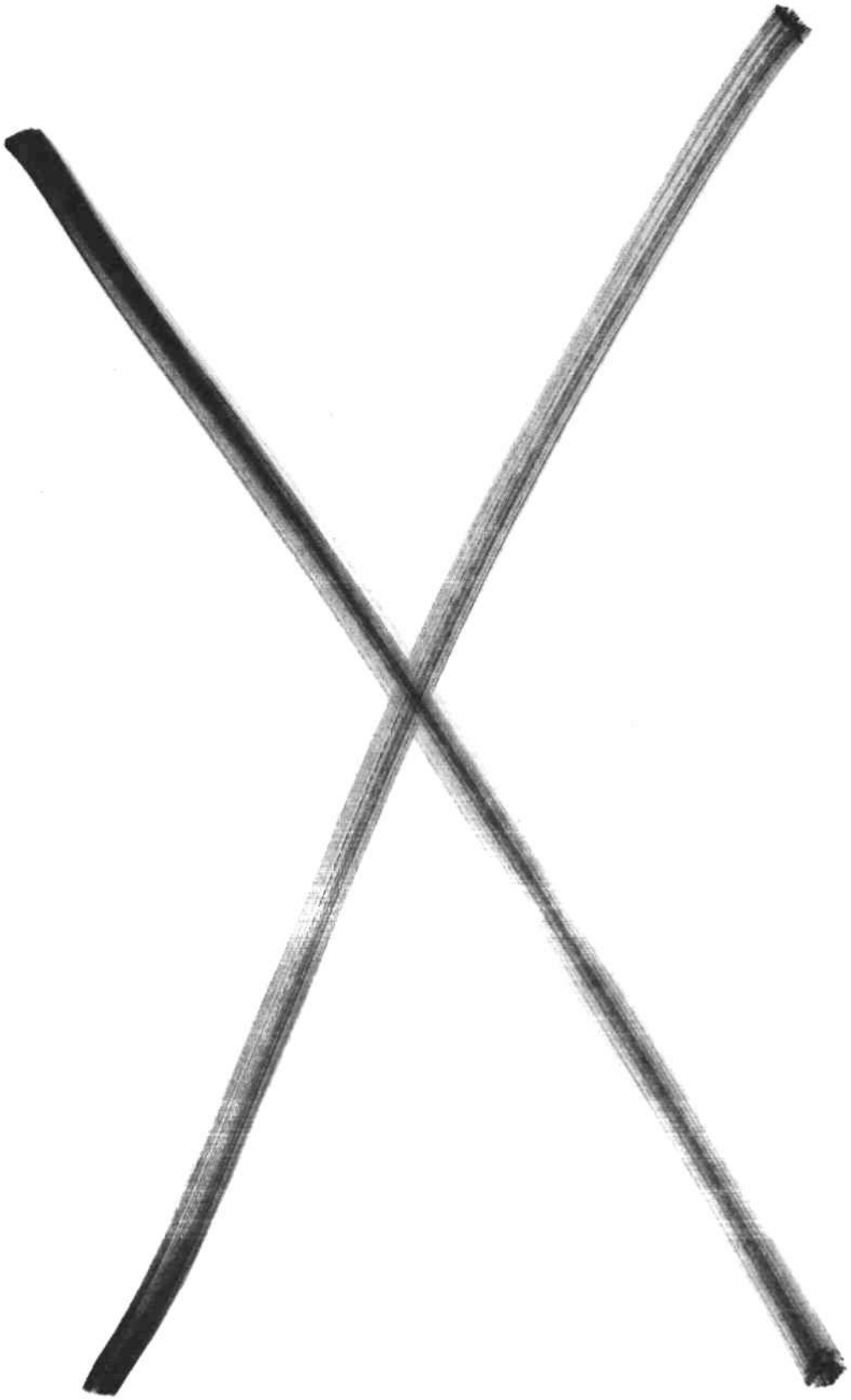
Possible shortage of gold-tin lids for ceramic packages.

Plastic prices up 40 percent, but no shortage.

Ceramic supply OK.

No known chemical or gas shortages.

Source: DATAQUEST, Inc.
July 1979



4. MAJOR MERCHANT SUPPLIER SUMMARY

Major merchant suppliers are those in the top rank of the semiconductor industry. As a general rule, they have sales considerably in excess of $50 million and focus primarily on standard components. European merchant suppliers are characterized by the fact that they have low-technology products; they capture only 2.2% of the MOS market and their offerings in memory and microprocessors are essentially nil. The Japanese are much more competant technically and supply 26 percent of the world MOS market and 100 percent of their own domestic needs. By contrast with the Europeans, they have gained share of the high technology MOS market at the expense of market share in the older IC technologies and discretes. Though the Japanese have good technology, it is not recommended that a computer manufacturer become dependant on a Japanese firm for critical components. Most Japanese firms are vertically integrated and there is always the danger that needs of the parent will take precedence.

Major conclusions of this section are as follows:

- The number of U.S. companies competing in the memory, microprocessor and bipolar digital markets is shrinking.
- Of the competing companies, only three of the major manufacturers are independent: Motorola, National and Texas Instruments.
- The number of companies purchasing over $100 million per year of semiconductors is increasing dramatically.
- More acquisitions are expected, particularly among the second tier firms.
- Major block ownership has already occurred in many semiconductor firms.
- Circuit design coats are increasing at the same rate as the number of components per circuit increase. As a result, the minimum production volume per design is increasing. As a further result, most merchant suppliers are becoming less receptive to custom design.

- The number of captive suppliers is increasing dramatically as electronic equipment manufacturers find it necessary to "make what they can't buy."

- There is an increased tendency towards multi-year procurement agreements in the semiconductor industry.

- Many semiconductor firms are integrating upwards to products offering more added value.

- The industry is becoming more capital intensive. This capital will be obtained through a combination of outside investment and higher margins.

- The lead time for new semiconductor production capacity is about 2.5 years. Firms are reluctant to add capacity without long-term commitments from their buyers.

The latter part of this section contains profiles on major semiconductor suppliers and lists captive and merchant semiconductor manufacturers vs. time. Appendix 4 provides computer-generated financial projections for a selected group of merchant suppliers. These projections are reproduced in the report even though the indicated cash needs (summarized in Figure 4-37) are somewhat misleading. In the case of Intel, Motorola, and Texas Instruments, we perceive that these firms can meet their needs for excess funds if changes in their money management practices are made.

MAJOR MERCHANT SUPPLIERS

Worldwide Supplier Overview

High-Technology Product Supplier Shrinkage

Merger-Mania

Design Availability

Capital Requirement

Company Profiles

Source: DATAQUEST, Inc.
July 1979

Table 1

ESTIMATED U.S. CONSUMPTION OF SEMICONDUCTORS
(Dollars in Millions)

	1977	1978	Percent Increase 1977-78	1979	Percent Increase 1978-79
Discrete Devices	$ 926	$1,019	10.0%	$1,191	26.9%
Integrated Circuits	1,784	2,304	30.1%	2,998	30.1%
Total	$2,710	$3,323	26.1%	$4,189	

Source; DATAQUEST, Inc.
July 1979

Table 2

ESTIMATED QUARTERLY U.S. SEMICONDUCTOR CONSUMPTION

(Dollars in Millions)

	1978				
	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Total Year
Discrete Devices	$ 233	$ 255	$ 256	$ 275	$1,019
Integrated Circuits	502	567	581	654	2,304
Total	$ 735	$ 822	$ 837	$ 929	$3,323
Percent Change From Previous Quarter or Year	0.4%	11.8%	1.8%	11.0%	22.6%

	1979				
	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Total Year
Discrete Devices	$ 279	$ 309	$ 304	$ 299	$1,191
Integrated Circuits	678	755	771	794	2,998
Total	$ 957	$1,064	$1,075	$1,093	$4,189
Previous Change From Previous Quarter	3.0%	11.2%	1.0%	1.7%	
Percent Change From Previous Year	30.2%	29.4%	28.4%	17.7%	26.1%

	1980	
	1st Qtr.	2nd Qtr.
Discrete Devices	$ 292	$ 294
Integrated Circuits	777	797
Total	$1,069	$1,091
Percent Change From Previous Quarter	(2.2%)	2.1%

Source: DATAQUEST, Inc.
July 1979

SOURCES OF REGIONAL SEMICONDUCTOR CONSUMPTION
(PERCENT OF 1978 CONSUMPTION)

		CONSUMER			
		UNITED STATES	JAPAN	EUROPE	REST OF WORLD
SUPPLIER:	U.S.	94%	13%	45%	50%
	JAPAN	4	85	2	39
	EUROPE	2	2	53	5
	ROW	0	0	0	6
	TOTAL	100%	100%	100%	100%

JAPAN SEMICONDUCTOR CONSUMPTION
(PERCENT PRODUCED BY NATIVE FIRMS)

	1974	1976	1978
TOTAL SEMICONDUCTOR	86%	93%	97%
TOTAL IC	70	85	87
BIPOLAR DIGITAL	68	64	70
MOS	58	90	100
LINEAR	88	92	81
TOTAL DISCRETE	99	100	110
OPTOELECTRONIC	52	94	104

LIMITS TO GROWTH

- Financial
- People
- Facility Construction and Initiation
- Trained/Untrained Ratio of Employees

Source: DATAQUEST, Inc.
July 1979

PEOPLE PROBLEMS

- Silicon Valley is full
- High-quality workforce areas are limited
- Training time is 3-6 months
- New employees kill yields
- Turnover is high for new employees
- 20% annual growth requires 17% of workforce (or more) to be new. That percent is barely tolerable.

Source: DATAQUEST, Inc.
July 1979

ENGINEERING GRADUATES

Year	Engineering Graduates	Percent of Total Graduates
1950	58,000	11.6%
1960	46,000	9.5%
1970	64,000	5.9%
1975	65,000	5.0%

Source: DATAQUEST, Inc.
July 1979

SUPPLY SUMMARY

- The merchant market is decreasing in numbers
- Independent merchant producers are declining
- Allocated or directed production is increasing
- Participants per market are decreasing
- Few new market entries, cost is too high, markets are too large
- Real growth rate is constrained to about 5% per quarter by financial, personnel, and facility actualization considerations

Source: DATAQUEST, Inc.
July 1979

FAB FACILITY COST

1969	$4.0M
1974	$6.0M
1979	$15.0M
1984	$30.0M +

Source: DATAQUEST, Inc.
July 1979

IN-HOUSE SEMICONDUCTOR USE
(PERCENTAGE OF COMPANY'S SEMICONDUCTOR VALUE)

(FISCAL YEARS)

	1976	1977	1978	1979
TI	4.7%	5.0%	6.0%	6.8%
Moto	5.6	7.3	6.6	6.8
Intel	11.0	11.5	9.7	12.0
NSC	8.1	10.3	11.2	9.1
FCI	9.8	3.0	4.2	4.0

Source: DATAQUEST, Inc.
July 1979

SEMICONDUCTOR VS NON-SEMICONDUCTOR REVENUES

Company	Percent Semiconductor	Percent Non-Semiconductor
Texas Instruments	36%	64%
Motorola	31	69
National Semiconductor	75	25
Fairchild	69	31
Intel	75	25
Mostek	93	7
AMD	100	-

Source: DATAQUEST, Inc.
July 1979

IN-HOUSE SEMICONDUCTOR USE
(DOLLARS IN MILLIONS)

(FISCAL YEARS)

	1976	1977	1978	1979
TI	$31	$37	$55	$77
Moto	26	40	45	62
Intel	16	23	29	54
NSC	19	28	37	43
FCI	30	15	16	20

Source: DATAQUEST, Inc.
July 1979

FOREIGN ACQUISITION OF U.S. SEMICONDUCTOR INDUSTRY

Company	Acquiring Company	Date	Percent Share
Fairchild	Schlumberger	1979	100%
AMD	Siemens	1977	20%
Litronix	Siemens	1978	100%
Dickson	Siemens	-	100%
Electronic Arrays	NEC	1978	100%
AMI	Bosch	1977	12.5%
AMI	Borg-Warner	1977	12.5%
MOS Technology	Commodore	1976	100%
Frontier	Commodore	1977	100%
Signetics	Philips	1975	100%
Interdesign	Ferranti	1977	100%
Intersil	Northern Telecom	1978	24%
Maruman	Mansei	1975	100%
Amperex	Philips	-	100%
Micropower	Seiko	1971	77%
Supertex	?	1976	?
Exar	Togo	1972	80%
Solid State Scientific	VDO	1977	25%
Monolithic Memories	Northern Telecom	1969	12.4%
Unitrode	Schlumberger	1979	17%
SSSI (RF line)	Thomson-CSF	1979	100%
Microwave Semi	Siemens	1979	100%

Source: DATAQUEST, Inc.
July 1979

COMPANIES USING MORE THAN $100 MILLION
OF SEMICONDUCTORS PER YEAR

1969	1974	1979	1981	1984
IBM	IBM	IBM	IBM	Leading companies
	WE	DEC	DEC	in these industries:
		H-P	H-P	Computers
		WE	WE	Word Processing
		NTT	NTT	Games
			Honeywell	Video/Video Games
			NCR	Minicomputers
			Burroughs	Automotive
			GM	Military/Aero
			Xerox	Telecommunications
			ITT	Instrumentation
			Philips	Process Control
				Terminals
				Discs
				Xerography
				Peripherals

In:
USA
Japan
Europe

Source: DATAQUEST, Inc.
July 1979

U.S. MAJOR MOS MEMORY MANUFACTURERS

4K (1977)	16K (1979)	64K (1981)	256K (1983)
AMD	TI	Intel	Intel
EMM	Mostek	TI	TI
Fairchild	Fairchild	Mostek	Mostek
Intel	Intel	Motorola	Motorola
Intersil	ITT	National	National
Mostek	Motorola		
Motorola	National		
Synertek	Signetics	AMD (?)	AMD
TI			
Zilog			
Signetics			
National			
ITT			

Source: DATAQUEST, Inc.
July 1979

ADVANCED MICROPROCESSOR MANUFACTURERS

1977 (8 bit)	1979 (16 bit)	1983 (16-32 bit)
Intel	Intel	Intel
Motorola	Motorola	Motorola
Fairchild	TI	National
Mostek	GI	DEC
TI	National	AMD(?)
Zilog	DG	Mostek(?)
Rockwell	DEC	Zilog(?)
AMD		Others(?)
AMI		
GI		
Hughes		
MOS Technology		
Signetics		
Synertek		

Source: DATAQUEST, Inc.
July 1979

ESTIMATED REGIONAL SELF-SUPPLY OF SEMICONDUCTOR COMPONENTS (1975-1978)

	1975	1976	1977	1978
UNITED STATES	154%	149%	149%	150%
JAPAN	86%	93%	95%	97%
EUROPE	55%	55%	53%	47%
REST OF WORLD	4%	4%	3%	4%

ESTIMATED WORLDWIDE SEMICONDUCTOR CONSUMPTION

(Dollars in Millions)

	1973	1978	1983	Compound Growth
Total	$4,798	$8,677	$17,553	15.1%
IC	2,046	5,084	12,310	19.4
Bipolar	921	1,359	2,568	13.6
MOS	585	2,289	6,632	23.7
Linear	540	1,436	3,110	16.7
Discrete	2,586	3,174	4,253	6.0
Optoelectronics	166	419	990	18.8
U.S. Companies	$2,817	$5,107	$11,224	17.1%
Market Share	59%	59%	61%	-

Source: DATAQUEST, Inc.
July 1979

BIPOLAR DIGITAL SUPPLIERS

Product	Year	Number of Suppliers
TTL	1968	16
TTL	1973	10
PROM	1979	7
RAM	1979	6
ECL	1979	3
2901	1979	3
Gate Array	1979	3
PROM	1984	6
RAM	1984	6
ECL	1984	4
Microprocessors	1984	5
Gate Array	1984	5

Source: DATAQUEST, Inc.
July 1979

→pencil figures are U.S. companies

ESTIMATED WORLDWIDE SEMICONDUCTOR CONSUMPTION

(Dollars in Millions)

	1973	1978	1983	Compound Growth
Total	$4,798	$8,677	$17,553	15.1%
IC	2,046	5,084 (3,433 67.5%)	12,310 (69.8%) 8612	19.4
Bipolar	921	1,359 (1,010 74.3%)	2,568 (1972) (76.8%)	13.6
MOS	585	2,289 (1,640 71.6%)	6,632 (4908) (74.0%)	23.7
Linear	540	1,436 (774 53.9%)	3,110 (1732) (55.7%)	16.7
Discrete	2,586	3,174 (1,406 44.2%)	4,253 1944 (45.7%)	6.0
Optoelectronics	166	419 (268 63.9%)	990 654 (66.1%)	18.8
			11,210	
U.S. Companies	$2,817	$5,107	$11,224	17.1%
Market Share	59%	59%	61%	-

Source: DATAQUEST, Inc.
July 1979

MOS MARKET (US Companies)

	1973	1978	1983	1983/1978
AMD	3	71	380	5.35:1
FAIRCHILD	12	51	155	3.04:1
INTEL	41	283	1290	4.56:1
MOSTEK	39	125	620	4.96:1
MOTOROLA	17	143	740	5.17:1
NATIONAL	21	130	660	5.08:1
SIGNETICS	7	32	75	2.34:1
TI	65	238	730	3.07:1
Synertek	0	33	151	4.56:1
AMI	56	71	143	2.01:1
SUBTOTAL	261	1177	4944	4.20:1
% OF TOTAL	63.3%	71.7%	100%	
TOTAL	412	1640	4908	

Conclusion: Fred is either Predicting that US companies will gain share of world market or that some MOS companies will drop out.

Pencil Figures Are European Cos.

ESTIMATED WORLDWIDE SEMICONDUCTOR CONSUMPTION

(Dollars in Millions)

	1973		1978		1983		Compound Growth
Total	$4,798	14.3%	$8,677	12.7%	$17,553	9.1%	15.1%
	690		1,125		1,596		
IC	2,046	7.9%	5,084	7.5%	12,310	4.9%	19.4
	161		381		602		
Bipolar	921	8.8%	1,359	9.5%	2,568	10.2%	13.6
	91		129		(264)		
MOS	585	2.2%	2,289	1.6%	6,632	1.2%	23.7
	13		36		(80)		
Linear	540	12.4%	1,436	12.8%	3,110	8.2%	16.7
	67		184		(258)		
Discrete	2,586	20.1%	3,174	21.6%	4,253	21.3%	6.0
	520		687		906		
Optoelectronics	166	5.4%	419	13.6%	990	8.9%	18.8
	9		57		88		
U.S. Companies	$2,817		$5,107		$11,224		17.1%
Market Share	59%		59%		61%		-

Source: DATAQUEST, Inc.
July 1979

Pencil Figures Are Japanese Cos.

ESTIMATED WORLDWIDE SEMICONDUCTOR CONSUMPTION

(Dollars in Millions)

	1973		1978		1983		Compound Growth
Total	$4,798	25%	$8,677	28%	$17,553	27.0%	15.1%
	1245		2,478		4747		13.8%
IC	2,046	15.6%	5,084	25.7%	12,310	25.1%	19.4
	319		1,307		3,096		18.8%
Bipolar	921	10.4%	1,359	13.8%	2,568	12.9%	13.6
	96		188		(332)		12.0%
MOS	585	23.9%	2,289	26.4%	6,632	24.8%	23.7
	140		605		(1,644)		22.1%
Linear	540	30.2%	1,436	35.8%	3,110	36%	16.7
	163		514		(1120)		16.9%
Discrete	2,586	32.3%	3,174	33.9%	4,253	33%	6.0
	836		1,077		1,403		5.4%
Optoelectronics	166	12.0%	419	22.4%	990	25%	18.8
	20		94		248		21.4%
U.S. Companies	$2,817		$5,107		$11,224		17.1%
Market Share	59%		59%		61%		

Source: DATAQUEST, Inc.
July 1979

Digital Bipolar Market (Japanese Cos)

	1973	1978	1983	Power	Rating
FUJITSU	-	47	110	2.3	+ +
HITACHI	15	38	76		+
MATSUSHITA	2	19	15		−
MITSUBISHI	11	15	20		−
NIPPON ELEC.	25	39	78		+
OKI	-	-	-		+
SANYO	-	10	15		−
TOSHIBA	7	8	20		+
	60/62.5%	167/88.8%	354/100%	1.79	
TOTAL	96	188	332		

MOS MARKET (JAPANESE COS)

	1973	1978	1983	RATIO	RATING
FUJITSU	–	38	125	3.3	+ +
HITACHI	35	139	417	3.0	+
MATSUSHITA	5	21	50		–
MITSUBISHI	12	25	51		–
NIPPON ELEC	37	189	605	3.2	+
OKI	–	–	20		
SANYO		6	15	5.3	–
TOSHIBA	15	88	242		+
	104/74.3%	506/83.6%	1525/93%		
TOTAL	140	605	1644	2.71	

LINEAR MARKET (JAPANESE COS)

	1973	1978	1983	RATIO	RATING
FUJITSU	—	6	37		++
HITACHI	18	82	215		+
MATSUSHITA	22	55	100		—
MITSUBISHI	9	30	55		—
NIPPON ELEC	31	105	275		+
OKI	—	-	-		
SANYO	—	32	50		—
TOSHIBA	19	93	235		+
	99/61%	403/78%	967/86%		
TOTAL	163	514	1120	2.2	

Discrete Market (Japanese cos)

	1973	1978	1983	RATIO	RATING
FUJITSU	–	33	63	1.9	++
HITCHI	126	196	287		+
MATSUSHITA	133	157	187		–
MITSUBISHI	52	77	105		–
NIPPON ELEC	102	222	365		+
OKI	–	–			
SANYO	–	49	73		–
TOSHIBA	108	192	293		+
	521/62%	926/86%	1373/97.9%		
TOTAL	836	1077	1403	1.30	

Opto electronic Market (JAPANESE Cos)

	1973	1978	1983	RATIO	RATING
FUJITSU	—	—	—		++
HITACHI	1	10	35		+
MATSUSHITA	2	11	21		—
MITSUBISHI	0	0	0		—
NIPPON ELEC	3	10	38		+
OKI	0	0	0		
SANYO	0	2	5		—
TOSHIBA	6	2 ↓	3		+
	12/60%	35/37%	102/41%		
	20	94	248	2.6	

AMI

Estimated Semiconductor Revenues
(Millions of Dollars)

	1973	1978	1983
MOS	$56	$71	$143

Comments:

- Commitment to custom & wafer fab
- In custom, prefer to "tailor" standard products
- Continuing VMOS commitment questionable
- Plant and equipment may be somewhat out of date

Source: DATAQUEST, Inc.
September 1979

SYNERTEK

Estimated Semiconductor Revenues
(Millions of Dollars)

	1973	1978	1983
MOS	0	$33	$151

Comments:

- Some custom and wafer fabrication work
- Pressure from Honeywell to capture output

Source: DATAQUEST, Inc.
September 1979

ESTIMATED WORLDWIDE SEMICONDUCTOR CONSUMPTION

(Millions of Dollars)

	1973	1978	1983	Compound Growth
Total	$4,798	$8,677	$17,553	15.1%
Japanese Companies	$1,245	$2,478	$ 4,747	13.8%

Source: DATAQUEST, Inc.
September 1979

FUJITSU

ESTIMATED SEMICONDUCTOR REVENUES
(Millions of Dollars)

	1978	1983
Bipolar	$47	$110
Mos	38	125
Linear	6	37
Discrete	33	63
Total	$124	$335

Comments:

- Technologically Strong
- Vertically Integrated Computer Maker

Source: DATAQUEST, Inc.
September 1979

HITACHI

Estimated Semiconductor Revenues
(Millions of Dollars)

	1973	1978	1983
Digital Bipolar	$ 15	$ 38	$ 76
MOS	35	139	417
Linear	18	82	215
Discrete	126	196	287
Optoelectronic	1	10	35
Total	$195	$465	$1,030

Comments:

- Broad-based Supplier
- Well Managed
- Steady Growth

Source: DATAQUEST, Inc.
September 1979

MATSUSHITA

ESTIMATED SEMICONDUCTOR REVENUES

(Millions of Dollars)

	1973	1978	1983
Digital Bipolar	$ 2	$ 10	$ 15
MOS	5	21	50
Linear	22	55	100
Discrete	133	157	187
Optoelectronic	2	11	21
Total	$164	$254	$373

Comments:

- Broad based
- Slower Growth Than Some Japanese Companies

Source: DATAQUEST, Inc.
September 1979

MITSUBISHI

ESTIMATED SEMICONDUCTOR REVENUES
(Millions of Dollars)

	1973	1978	1983
Digital Bipolar	$ 11	$ 15	$ 20
MOS	12	25	51
Linear	9	30	55
Discrete	52	77	105
Total	$ 84	$147	$231

Comments:

- Slower Growth Than Some Japanese Companies

Source: DATAQUEST, Inc.
September 1979

NIPPON ELECTRIC

ESTIMATED SEMICONDUCTOR REVENUES
(Millions of Dollars)

	1973	1978	1983
Digital Bipolar	$ 25	$ 39	$ 78
MOS	37	189	605
Linear	31	105	275
Discrete	102	222	365
Optoelectronic	3	10	38
Total	$198	$565	$1,361

Comments:

- Broad based, Well Managed
- Major Supplier of Dynamic RAMs
- Technologically Excellent
- Obtained U.S. Subsidiary Through Acquisition of Electronic Arrays

Source: DATAQUEST, Inc.
September 1979

OKI

ESTIMATED SEMICONDUCTOR REVENUES
(Millions of Dollars)

	1973	1978	1983
MOS	0	$20	$50

Comments:

- Currently a Major Supplier of Watch Modules in the Far East
- Have a Small U.S. Subsidiary Engaged in Design and Procurement Only

Source: DATAQUEST, Inc.
September 1979

SANYO

ESTIMATED SEMICONDUCTOR REVENUES
(Millions of Dollars)

	1978	1983
Digital Bipolar	$10	$ 15
MOS	6	15
Linear	32	50
Discrete	49	73
Optoelectronics	2	0
Total	$99	$153

Comments:

- Somewhat Slower Growth Than Some Japanese Companies

Source: DATAQUEST, Inc.
September 1979

TOSHIBA

ESTIMATED SEMICONDUCTOR REVENUES
(Millions of Dollars)

	1973	1978	1983
Digital Bipolar	$ 7	$ 8	$ 20
MOS	15	88	242
Linear	19	93	235
Discrete	6	2	3
Total	$149	$383	$793

Comments:

- Faster Growth Than Average Japanese Company
- Strong in Both Traditional and High Technology Markets
- Currently, Sales Exceed Capacity

Source: DATAQUEST, Inc.
September 1979

12 MONTHS BOOKINGS GROWTH

Europe	44%
Japan	107%
ROW	75%

Source: DATAQUEST, Inc.
July 1979

EUROPEAN COMPANIES' WORLDWIDE
MARKET SHARES - 1978

Discrete	21.6%
Linear	12.5%
Bipolar	11.8%
MOS	2.2%
MOS Memory	Nil
MOS Microprocessor	Nil
Bipolar Memory	Nil
Bipolar Microprocessor	Nil
A/D Converters	Nil

Source: DATAQUEST, Inc.
July 1979

THE PROBLEMS WITH JAPAN, INC.

- BASICALLY CAPTIVE

  - resources allocated to needs of parent
  - design limited
  - end product needs are considered first

- DISTANCE

  - 6000 miles
  - language, culture

- COMPETITION

  - Products are introduced later in United States
    - -- NEC 16 bit processor
    - -- Canon DSW machine
    - -- Automatic bonder

  - Aim of MITI is to make Japanese industry "brain" intensive, semiconductors are leading edge

- MARKET APPROACH

  - predatory
  - the Japanese play by different rules

Source: DATAQUEST, Inc.
July 1979

MOS RAM MARKET

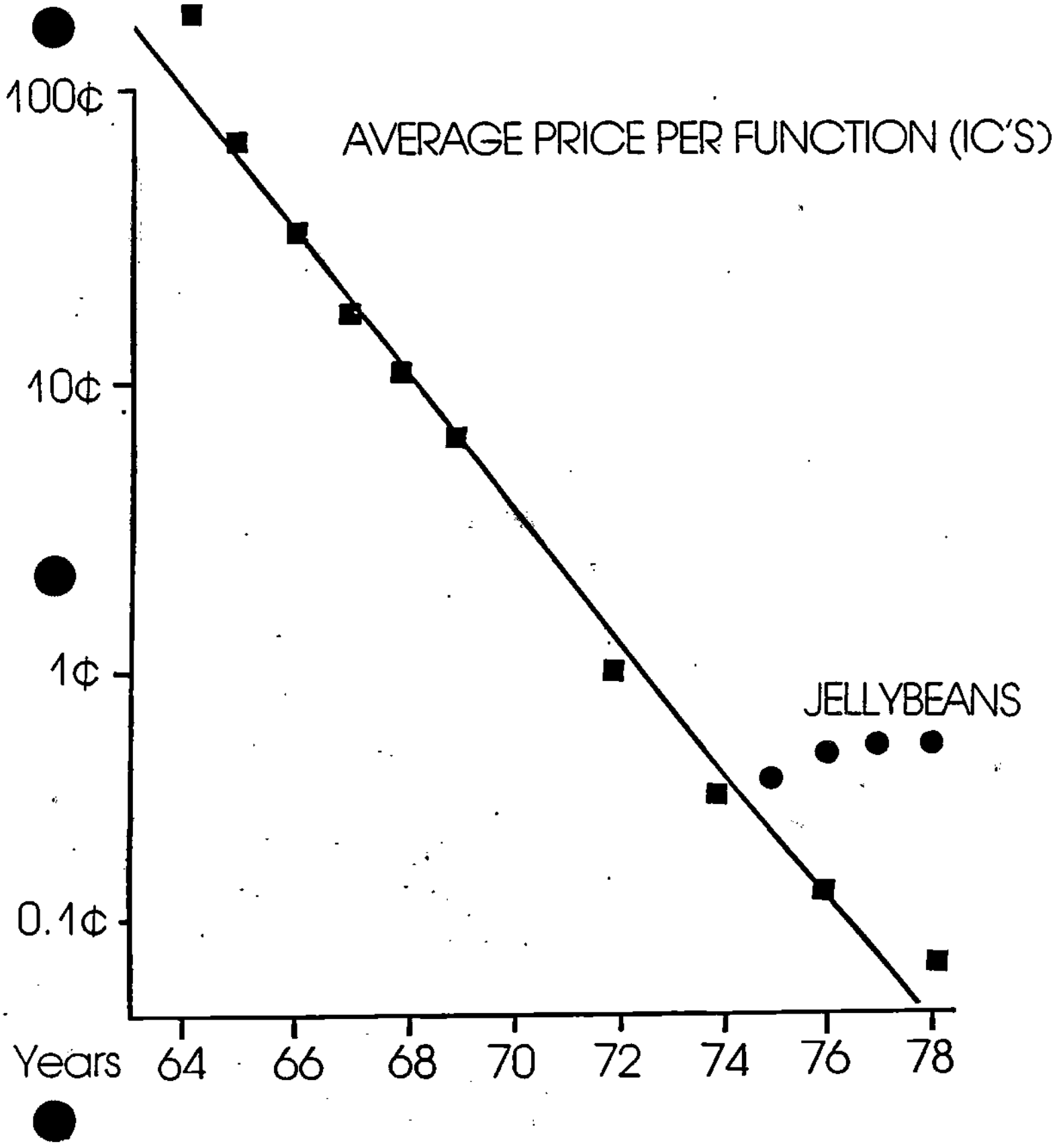
1975	50 Billion Bits
1976	148 Billion Bits
1977	316 Billion Bits
1978	774 Billion Bits
1982	8,370 Billion Bits

Source: DATAQUEST, Inc.
July 1979

ENGINES OF DEMAND
1979-1984

- ECONOMIC ELASTICITY
  - Component Substitution (Memory)
  - System Substitution (Calculators)
  - Pervasiveness (Typewriters)
- INFLATION
- CAPTIVE MANUFACTURERS INCREASING PURCHASES
  - IBM
  - WE
  - GM
- NEW MARKETS
  - Automotive
  - Telecommunications
  - Industrial
  - Toys
- DOLLAR DEVALUATION
- MILITARY MARKET RESURGENCE

Source: DATAQUEST, Inc.
July 1979


AVERAGE PRICE PER FUNCTION (IC'S)
100¢
10¢
1¢
0.1¢
JELLYBEANS
Years
64
66
68
70
72
74
76
78

COST OF DESIGN

1964	$8K	
1968	$40K	
1974	$250K	
1979	$2-4M	Memory
1979	$30M	Microprocessor
1984	?	
1984	?	

MINIMUM CIRCUIT PRODUCTION

Year	Components Per Chip	Design Cost @ $33/ Transistor (Thousands)	Minimum Production Revenue (Millions)	Minimum Units at $10 each (Thousands)
1965	60	$ 2	$ .03	3
1970	2,300	$ 43	$ 1.60	60
1975	64,000	$ 2,000	$ 30	3,000
1980	1,000,000	$33,000	$ 495	50,000
1985	3,200,000	$106,000	$1,590	159,000

Note: Customer-tooled minimums tend to run 1/5 to 1/2 the minimum revenue requirements of full custom. Minimums are lower for "easy interface" customers.

Source: DATAQUEST, Inc.
July 1979

TOTAL NUMBER OF SEMICONDUCTOR
MANUFACTURERS - WORLDWIDE

	Merchant	Captive
1955	8	3
1960	22	8
1965	36	14
1970	87	23
~~1979~~ 1975	105	36
~~1985~~ 1979	95	56

Source: DATAQUEST, Inc.
July 1979

NOT VULNERABLE TO A TAKEOVER

Companies

Texas Instruments

Motorola

Intel

Reasons

High market valuation

Broad based ownership

Profitable and sound

Source: DATAQUEST, Inc.
July 1979

VULNERABLE TO A TAKEOVER

Company	Reasons
Mostek	Attractive, Cash Poor
National Semiconductor	Attractive, Cash Poor
AMD	Major Blocks of Ownership
AMI	Major Blocks of Ownership
Intersil	Major Blocks of Ownership
Siliconix	Major Blocks of Ownership
Monolithic Memories	Private, Financial Difficulties

Source: DATAQUEST, Inc.
July 1979

MARKET VALUE-MAJOR U.S. SEMICONDUCTOR FIRMS
(DOLLARS IN MILLIONS)

	Market Value July, 1979
TI	$1920
Motorola	1287
Intel	664 — 996
NSC	318
AMD	165
AMI	108
Mostek	156
Intersil	91

Source: DATAQUEST, Inc.
July 1979

MAJOR OWNERSHIP BLOCKS
U.S. SEMICONDUCTOR MANUFACTURERS

	Semiconductor Revenues, 1978	Major Ownership Blocks (≥ 5%)
TI	$923 Million	None
Motorola	680	None
National	388	None
Fairchild	380	100% Schlumbeger, Ltd.
Intel	300	G. Moore, 10.4%, F. Sarofim 8.0% Capital Group, Inc. 6.2%
Signetics	205	100% Philips Gloelampfabriken
AMD	132	20% Siemens
Mostek	125	21% General Cable via Sprague Morgan Guaranty 8.5% Keystone Fund 5.5%
AMI	71	12.5% Robert Bosch 12.5% Borg-Warner
Intersil	61	24% Northern Telecom
Synertek	33	100% Honeywell
Spectronics	11	100% Honeywell

Source: DATAQUEST, Inc.
July 1979

Gould offers to buy Sprague's share at $42 cash. Mostek selling at 33 1/2 4 Sept '79

U.S. SEMICONDUCTOR COMPANIES ACQUIRED BY NON-SEMICONDUCTOR PARENTS

Company	Parent
Spectronics	Honeywell
Synertek	Honeywell
CTC	Varian
SEMI	EMM
Radiation	Harris
Sprague	General Cable
Reticon	EGG
PMI	Bourns
Microtechnology	Storage Technology

Out of 36 semiconductor startups since 1966, 8 remain independent.

Source: DATAQUEST, Inc.
July 1979

PRODUCT COMMITMENTS

U.S. SEMICONDUCTOR MANUFACTURERS

AMI	- 2-Year Contract To Supply $10M To Northern Telecom
Signetics	- Supplies Estimated $50M Per Year To Parent Philips
Texas Instruments	- Multiyear Contract To Supply IBM (Caribou Program)
Mostek	- Caribou Program For IBM
National Semiconductor	- Captive Line For Kodak at NSC
Motorola	- General Motors Captive Line For SLT for IBM
Intel	- $25M Contract For 4K Statics Just Expiring Caribou Program For IBM

Source: DATAQUEST, Inc.
July 1979

IMPACT OF MERGER ON STOCK PRICE

Fairchild

1979 Low	$28.00
Final Price:	$66.00
Ratio	2.3 to 1

Source: DATAQUEST, Inc.
July 1979

IMPACT OF MERGER ON SUPPLIER CAPACITY

Slower to react to market

Key personnel drift to other type start-ups

Corporate appropriations come slowly

Resources allocated to parents benefit

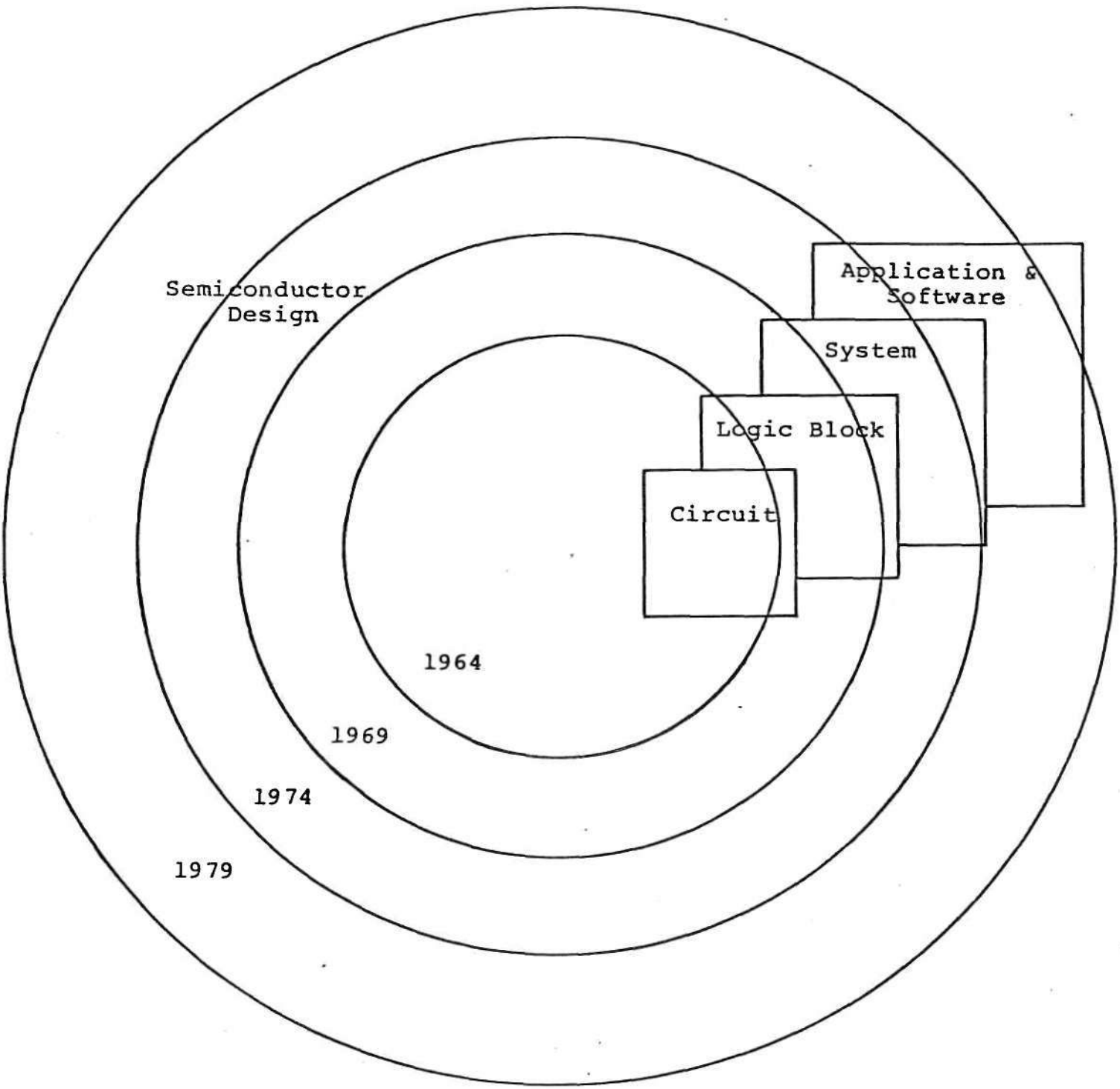
Committee management

Japanese do well at this -

Americans don't.

Source: DATAQUEST, Inc.
July 1979

EXPANDING THE VALUE ADDED



Source: DATAQUEST, Inc.

FINANCIALLY SUSTAINABLE GROWTH RATES[1]

Profit Before Interest and Tax	20% Equity	60% Equity	100% Equity
5.0%	11.3%	7.0%	6.3%
10.0%	28.3%	17.5%	12.5%
20.0%	105.0%	38.3%	25.0%

Above Figures Assume $.40 Assets for Each Dollar of New Sales.

12.5%	11.3%	7.0%	6.3%
25.0%	28.3%	17.5%	12.5%
50.0%	105.0%	38.3%	25.0%

Above Figures Assume $1.00 Assets for Each Dollar of New Sales

$ Interest Rate 10% Per Year, Taxes 50% of Profit After Interest.

Source: DATAQUEST, Inc.
July 1979

CAPITAL COSTS

Cash or Capital Expenditure for each additional dollar of revenue

	SSI	MSI	LSI (79)	VLSI (84)
Fab	6.8¢	12.0¢	35.6¢	50.0¢
Assembly	3.6	2.1	0.2	0.2
Test	4.0	6.0	8.0	10.0
Other	2.0	3.0	3.0	6.0
Subtotal	16.4¢	23.1¢	46.8¢	66.2¢
Working Capital	25.0¢	25.0¢	26.0¢	27.0¢
Total	41.4¢	48.1¢	72.8¢	93.2¢

Source: DATAQUEST, Inc.
July 1979

ESTIMATED EXTRA CAPITAL REQUIRED TO FINANCE GROWTH
1978-1985
(Dollars in Millions)

	1978	1985	Implied CAG	Excess Funds Required[1]
Intel	$ 401	$3,270	35%	$ 225
AMD	148	698	25	68
Mostek	134	691	26	139
NSC	494	2,385	25	35
Motorola	2,220	6,135	16	1,100
TI	2,550	7,486	17	(81)
FCI	534	1,350	14	437

Source: DATAQUEST, Inc.
July 1979

[1]Excess funds required, as used in these projections, are more indicative of historical money management practices than real need. Under equivalent asset management Intel, TI, and Motorola are relatively free of capital requirements, while National, AMD, Mostek, and FCI are cash poor.

REASONS TO DIVERT CAPACITY TO ONE BUYER

Sustainable Corporate Growth Exceeds Perceived Market Growth.

- "Extra" capacity may be diverted
- Long lead time required for plant construction

Sustainable Corporate Growth Less Than Perceived Market Growth.

- Does the deal provide a means to increase growth rate? Cash, profits, etc.
- If a standard, does it leave enough product available for market development?
- If a non-standard, does it bring in standard part business not in excess of limit above.

Source: DATAQUEST, Inc.
July 1979

DEMAND SUMMARY

- Long-term market growth rate has increased

- Major semiconductor users are rapidly increasing in numbers

Source: DATAQUEST, Inc.
July 1979

AMD

Estimated Semiconductor Revenues
(Dollars in Millions)

	1973	1978	1984
Total	$21	$132	$570
MOS	3	71	380
Bipolar	18	37	115
Linear	0	24	75

Comments:

Source: DATAQUEST, Inc.
July 1979

FAIRCHILD

Estimated Semiconductor Revenues
(Dollars in Millions)

	1973	1978	1984
Total	$283	$380	$850
MOS	12	51	155
Bipolar	134	143	385
Linear	40	61	120
Discrete	87	107	160
Opto	10	18	30

Comments:

Bipolar - Strong large chip capability
MOS - Low market share and investment
Discrete - Losing market share
Linear - Losing market share

Source: DATAQUEST, Inc.
July 1979

INTEL

Estimated Semiconductor Revenues
(Dollars in Millions)

	1973	1978	1984
Total	$58	$300	$1,360
MOS	41	283	1,290
Bipolar	17	17	70

Comments:

MOS - Extremely heavy investments in all areas, the market leader
Bipolar - "piggybacks" on MOS products
Bubbles - Excellent change of market success
Systems - Add-on memory, microcomputer systems, MDS systems, and large investments in data management

Source: DATAQUEST, Inc.
July 1979

MOSTEK

Estimated Semiconductor Revenues
(Dollars in Millions)

	1973	1978	1984
MOS	$39	$125	$620

Comments:

- Not broadbased
- Strength in memory

Source: DATAQUEST, Inc.
July 1979

MOTOROLA

Estimated Semiconductor Revenues
(Dollars in Millions)

	1973	1978	1984
Total	$445	$680	$1,810
MOS	17	143	740
Bipolar	75	90	210
Linear	47	96	250
Discrete	303	349	590
Opto	3	2	20

Comments:

MOS - Broadbased, heavy investment
Bipolar - ECL market leader, current investment in other areas is high, but future uncertain
Linear - Strong entertainment and communication bias
Discrete - Increasing market share
Systems - Primarily data communications (Codex), some minicomputer

Source: DATAQUEST, Inc.
July 1979

NATIONAL SEMICONDUCTOR

Estimated Semiconductor Revenues
(Dollars in Millions)

	1973	1978	1984
Total	$153	$420	$1,620
MOS	21	130	660
Bipolar	65	108	325
Linear	41	132	485
Discrete	15	32	75
Opto	11	18	75

Comments:

Broadbased in all but discretes
Current new product/process IC investment levels appear high
Major mainframe shipments, add-on memory

Source: DATAQUEST, Inc.
July 1979

SIGNETICS

Estimated Semiconductor Revenues
(Dollars in Millions)

	1973	1978	1984
Total	$98	$205	$540
MOS	7	32	75
Bipolar	73	125	340
Linear	18	48	125

Comments:

MOS - Low market share
Bipolar - Market leader in memory

Source: DATAQUEST, Inc.
July 1979

TEXAS INSTRUMENTS

Estimated Market Share
(Dollars in Millions)

	1973	1978	1984
Total	$604	$923	$2,230
MOS	65	238	730
Bipolar	255	308	700
Linear	43	123	370
Discrete	213	186	180
Opto	28	68	250

Comments:

Broadbased
Discrete - Losing market share
Microprocessors - Investment levels are low
Bipolar - Strong, all areas, especially small chips
Optoelectronics - very strong
Systems - Significant small computer and terminal manufacturer
Bubbles - Market leader, but allocation favors in-house needs

Source: DATAQUEST, Inc.
July 1979

DATAQUEST, INC. F I N A N C I A L A N A L Y S I S 26 JULY 1979

COMPANY: I[illegible] CORPORATION
DATA SOURCE: ANNUAL REPORTS
[illegible]TOR: ARTHUR YOUNG & COMPANY
FIGURES IN: MILLIONS BY: D. K. PAUL

PROJECTED SPREAD

REP	ITEM	1978	1979	1980	1981	1982	1983	1984	1985	TREND	CMPD GR
	BALANCE SHEET										
1	CASH & LIQUID SECURITIES	28.27	85.30	119.42	161.12	209.45	272.41	354.19	442.74	56.58	41.42
3	RECEIVABLES	98.18	139.02	194.63	262.59	341.37	443.97	577.26	721.57	87.88	32.78
4	INVENTORY	51.71	80.74	113.03	152.51	198.26	257.85	335.26	419.07	51.48	33.87
5	OTHER CURRENT ASSETS	2.73	4.14	5.80	7.83	10.18	13.23	17.21	21.51	2.64	33.55
6	PREPAID INCOME TAX	15.52	20.22	28.31	38.19	49.65	64.58	83.96	104.95	12.68	31.86
7	EXCESS FUNDS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	TOTAL CURRENT ASSETS	196.42	329.42	461.19	622.23	808.90	1052.05	1367.87	1709.84	211.25	34.67
9	GROSS P P E	211.52	315.00	423.00	547.00	696.00	905.00	1177.00	1471.00	175.25	31.01
10	ACCUMULATED DEPRECIATION	51.38	88.47	143.72	217.91	313.84	435.91	594.63	801.06	104.18	47.15
11	NET P P E	160.14	226.53	279.28	329.09	382.16	469.09	582.37	669.94	71.07	21.62
12	MISC ASSETS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15	*TOTAL ASSETS*	356.56	555.95	740.47	951.33	1191.06	1521.14	1950.24	2379.78	282.33	29.86
16	NOTES PAYABLE	43.64	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(3.64)	(87.02)
17	ACCOUNTS PAYABLE	22.09	31.15	43.62	58.85	76.50	99.50	129.36	161.71	19.69	32.74
18	ACCRUED TAXES	18.30	33.64	47.10	63.55	82.61	107.45	139.70	174.63	21.72	35.70
19	ACCRUED LIABILITIES	19.20	30.92	43.29	58.41	75.93	98.76	128.40	160.50	19.77	34.21
20	CURR MAT LONG TERM DEBT	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
21	DEFERRED INCOME	26.05	27.22	38.10	51.41	66.83	86.92	113.02	141.27	16.64	29.46
22	TOTAL CURR LIABILITIES	129.28	122.94	172.11	232.22	301.88	392.62	510.48	638.11	74.18	28.45
23	LONG TERM DEBT	0.00	43.64	43.64	43.64	43.64	43.64	43.64	43.64	3.64	670.29
24	DEFERRED TAXES	22.23	26.42	36.99	49.91	64.88	84.39	109.72	137.15	16.41	30.86
25	MISC LIABILITIES	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
27	DEFICIT FUNDS	0.00	96.69	141.97	172.14	185.64	216.97	255.87	225.40	31.10	851.05
28	TOTAL LIABILITIES	151.50	289.70	394.72	497.91	596.05	737.61	919.71	1044.30	125.31	28.93
29	PREFERRED STOCK	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
30	COMMON STOCK	70.62	70.62	70.62	70.62	70.62	70.62	70.62	70.62	0.00	0.00
31	CAPITAL SURPLUS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
32	RETAINED EARNINGS	134.44	195.63	275.13	382.80	524.40	712.91	959.91	1264.86	157.01	37.61
34	TOTAL EQUITY	205.06	266.25	345.75	453.42	595.02	783.53	1030.53	1335.48	157.01	30.89
35	*TOTAL LIAB & EQUITY*	356.56	555.95	740.47	951.33	1191.06	1521.14	1950.24	2379.78	282.33	29.86
36	NET WORKING CAPITAL	67.15	206.48	289.07	390.02	507.02	659.43	857.39	1071.73	137.08	41.65
	INCOME & EXPENSE										
38	SALES	400.62	630.00	882.00	1190.00	1547.00	2012.00	2616.00	3270.00	401.94	33.95
40	COST OF GOODS	167.70	285.56	399.79	539.40	701.22	911.99	1185.77	1482.21	183.34	34.84
41	GROSS PROFIT	232.92	344.44	482.21	650.60	845.78	1100.01	1430.23	1787.79	218.59	33.26
42	S G & A EXPENSE	76.33	101.28	141.80	191.31	248.71	323.46	420.57	525.71	63.62	32.06
43	R & D EXPENSE	41.36	62.63	87.68	118.29	153.78	200.01	260.05	325.06	39.83	33.53
45	OPERATING PROFIT	115.22	180.53	252.74	341.00	443.29	576.54	749.62	937.02	115.14	33.91
46	DEPRECIATION	24.13	46.61	69.42	93.22	120.55	153.39	199.45	259.39	32.03	37.13
47	LEASE PAYMENTS	4.54	9.58	13.42	18.10	23.54	30.61	39.80	49.75	6.24	37.28
48	INTEREST EXPENSE	0.00	4.36	14.03	18.56	21.58	22.93	26.06	29.95	4.14	746.49
49	MISC EXPENSE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
51	MISC INCOME	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
53	PRETAX PROFIT	86.55	119.96	155.86	211.11	277.63	369.61	484.31	597.93	72.73	32.08
54	INCOME TAXES	42.24	58.78	76.37	103.44	136.03	181.10	237.30	292.98	35.65	32.12
55	EXTRAORDINARY LOSS (GAIN)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
56	NET PROFIT	44.31	61.19	79.50	107.67	141.60	188.51	247.00	304.95	37.08	32.04
57	EPS AFTER PFD DIVIDENDS	3.24	4.47	5.81	7.86	10.34	13.77	18.04	22.27	2.71	32.04
58	COMMON DIV PER SHARE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

DATAQUEST. F I N A N C I A L A N A L Y S I S 26 JULY 1979

COMPANY: INTEL CORPORATION AUDITOR: ARTHUR YOUNG & COMPANY
DATA SOURCE: ANNUAL REPORTS FIGURES IN: MILLIONS BY: D. K. PAUL

PROJECTED FUNDS FLOW

REF	ITEM	1979	1980	1981	1982	1983	1984	1985	TREND	CMPD GR
	SOURCES									
56	NET PROFIT	61.19	79.50	107.67	141.60	188.51	247.00	304.95	40.97	31.40
46	DEPRECIATION	46.61	69.42	93.22	120.55	153.39	199.45	259.39	34.23	31.93
61	NEW LONG TERM DEBT	43.64	0.00	0.00	0.00	0.00	0.00	0.00	(4.68)	(92.76)
62	NEW EQUITY	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
63	INCR OTHER LIABILITIES	4.20	10.57	12.92	14.97	19.50	25.33	27.43	3.78	32.09
66	TOTAL SOURCES	155.64	159.49	213.81	277.12	361.40	471.78	591.77	74.31	27.04
	USES									
67	P P E EXPENDITURES	113.00	122.17	143.03	173.62	240.32	312.73	346.97	42.15	22.86
68	REPAYMENT LONG TERM DEBT	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
69	PREFERRED DIVIDENDS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
70	COMMON DIVIDENDS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
72	INCR WORKING CAPITAL	139.33	82.59	100.95	117.01	152.40	197.96	214.35	18.12	13.12
71	INCR OTHER ASSETS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
74	TOTAL USES	252.33	204.77	243.98	290.62	392.72	510.68	561.31	60.27	18.29
75	EXCESS/DEFICIT	(96.69)	(45.28)	(30.17)	(13.50)	(31.32)	(38.90)	30.46	14.04	*********
76	CUMULATIVE SUR/DEF	(96.69)	(141.97)	(172.14)	(185.64)	(216.97)	(255.87)	(225.40)	(23.53)	15.14

SPREAD

REF	ASSUMP ITE	OPTION		VALUES
1	CASH & LIQUID SECURITIES	6	PCT SALES,HIST	13.53937476
3	RECEIVABLES	6	PCT SALES,HIST	22.06632727
4	INVENTORY	6	PCT SALES,HIST	12.81560718
5	OTHER CURRENT ASSETS	6	PCT SALES,HIST	0.657744343
6	PREPAID INCOME TAX	6	PCT SALES,HIST	3.209559579
9	GROSS P P E	1	INPUT REQD	315 423 547 696 905 1177 1471
12	MISC ASSETS	6	PCT SALES,HIST	0
16	NOTES PAYABLE	1	INPUT REQD	0 0 0 0 0 0 0
17	ACCOUNTS PAYABLE	6	PCT SALES,HIST	4.945120727
18	ACCRUED TAXES	6	PCT SALES,HIST	5.340257825
19	ACCRUED LIABILITIES	6	PCT SALES,HIST	4.908388561
20	CURR MAT LONG TERM DEBT	1	INPUT REQD	0 0 0 0 0 0 0
21	DEFERRED INCOME	6	PCT SALES,HIST	4.32018299
24	DEFERRED TAXES	6	PCT SALES,HIST	4.194131545
25	MISC LIABILITIES	6	PCT SALES,HIST	0
29	PREFERRED STOCK	11	NO CHANGE	0
30	COMMON STOCK	11	NO CHANGE	70.618
31	CAPITAL SURPLUS	11	NO CHANGE	0
38	SALES	1	INPUT REQD	630 882 1190 1547 2012 2616 3270
40	COST OF GOODS	6	PCT SALES,HIST	45.32746589
42	S G & A EXPENSE	6	PCT SALES,HIST	16.07670021
43	R & D EXPENSE	6	PCT SALES,HIST	9.940752551
46	DEPRECIATION	9	PCT PR GR PPE H	22.03844193
47	LEASE PAYMENTS	6	PCT SALES,HIST	1.521416803
49	MISC EXPENSE	6	PCT SALES,HIST	0
51	MISC INCOME	1	INPUT REQD	0 0 0 0 0 0 0
55	EXTRAORDINARY LOSS (GAIN)	11	NO CHANGE	0
58	COMMON DIV PER SHARE	11	NO CHANGE	0
59	NO. OF COMMON SHARES	11	NO CHANGE	13694000
69	PREFERRED DIVIDENDS	11	NO CHANGE	0

INTEREST RATES: LTD→ 10 PCT NOTES PAY→ 10 PCT DEFICIT FNDS→ 10 PCT
INCREMENTAL DEBT 43.64 0 0 0 0 0 0
INCREMENTAL REPAY 0 0 0 0 0 0 0

Retirement Rate −0.045/yr vs. Historical −0.028
Tax Rate = 49.0% each year = historical.

DATAQUEST, INC. — FINANCIAL ANALYSIS — 26 JULY 1979

COMPANY: ADVANCED MICRO DEVICES, INC. — AUDITOR: ARTHUR YOUNG & CO
DATA SOURCE: ANNUAL REPORTS & 10K'S — FIGURES IN: MILLIONS — BY: KK FOLEY

PROJECTED SPREAD

REP	ITEM	1979	1980	1981	1982	1983	1984	1985	1986	TREND	CMPD GR
BALANCE SHEET											
1	CASH & LIQUID SECURITIES	17.141	30.667	39.852	49.926	59.852	71.852	86.222	103.407	11.757	26.429
3	RECEIVABLES	30.043	41.709	54.201	67.903	81.403	97.723	117.268	140.641	15.429	23.785
4	INVENTORY	15.544	25.840	33.579	42.067	50.431	60.542	72.651	87.131	9.814	25.657
5	OTHER CURRENT ASSETS	0.904	1.227	1.595	1.998	2.395	2.876	3.451	4.138	0.452	23.554
6	PREPAID INCOME TAX	5.646	7.212	9.372	11.742	14.076	16.898	20.278	24.320	2.630	22.929
7	EXCESS FUNDS	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
8	TOTAL CURRENT ASSETS	69.278	106.655	138.599	173.636	208.157	249.891	299.869	359.637	40.083	24.856
9	GROSS P P E	51.400	69.495	90.310	113.139	135.632	162.826	195.391	234.335	25.596	23.512
10	ACCUMULATED DEPRECIATION	14.402	22.973	34.560	49.619	68.484	91.099	118.249	150.829	19.284	39.335
11	NET P P E	36.998	46.522	55.750	63.520	67.149	71.727	77.142	83.506	6.312	11.360
12	MISC ASSETS	0.541	1.783	2.317	2.902	3.479	4.177	5.012	6.011	0.721	33.030
13	LEASED EQUIPMENT	2.660	2.660	2.660	2.660	2.660	2.660	2.660	2.660	0.000	0.000
15	*TOTAL ASSETS*	109.477	157.620	199.326	242.718	281.445	328.455	384.684	451.815	47.117	21.026
16	NOTES PAYABLE	4.621	4.621	4.621	4.621	4.621	4.621	4.621	4.621	0.000	0.000
17	ACCOUNTS PAYABLE	14.764	18.702	24.304	30.448	36.501	43.820	52.583	63.064	6.811	22.843
18	ACCRUED TAXES	7.380	7.445	9.675	12.120	14.530	17.443	20.932	25.104	2.586	20.534
19	ACCRUED LIABILITIES	10.942	13.866	18.019	22.574	27.062	32.488	38.985	46.756	5.050	22.847
20	CURR MAT LONG TERM DEBT	0.125	0.125	0.125	0.125	0.125	0.125	0.125	0.125	0.000	0.000
21	OTHER CURRENT LIAB	5.943	5.943	5.943	5.943	5.943	5.943	5.943	5.943	0.000	0.000
22	TOTAL CURR LIABILITIES	43.775	50.702	62.687	75.831	88.782	104.440	123.190	145.613	14.447	18.899
23	LONG TERM DEBT	4.371	4.246	4.121	3.996	3.871	3.746	3.621	3.496	(0.125)	(3.138)
24	DEFERRED TAXES	1.751	2.103	2.733	3.424	4.105	4.928	5.913	7.092	0.758	22.299
25	MISC LIABILITIES	2.046	2.371	3.081	3.860	4.628	5.556	6.667	7.996	0.849	21.936
27	DEFICIT FUNDS	0.000	28.367	42.428	53.621	57.289	61.246	65.021	68.433	8.600	751.958
28	TOTAL LIABILITIES	51.943	87.789	115.050	140.732	158.675	179.915	204.412	232.629	24.529	21.246
29	PREFERRED STOCK	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
30	COMMON STOCK	0.047	0.047	0.047	0.047	0.047	0.047	0.047	0.047	0.000	0.000
31	CAPITAL SURPLUS	35.540	35.540	35.540	35.540	35.540	35.540	35.540	35.540	0.000	0.000
32	RETAINED EARNINGS	21.947	34.243	48.689	66.399	87.183	112.953	144.685	183.599	22.587	34.458
33	TREASURY & NOTES REC.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
34	TOTAL EQUITY	57.534	69.830	84.276	101.986	122.770	148.540	180.272	219.186	22.587	20.969
35	*TOTAL LIAB & EQUITY*	109.477	157.620	199.326	242.718	281.445	328.455	384.684	451.815	47.117	21.026
36	NET WORKING CAPITAL	25.503	55.952	75.913	97.805	119.375	145.452	176.680	214.025	25.637	31.169
INCOME & EXPENSE											
38	SALES	148.276	207.000	269.000	337.000	404.000	485.000	582.000	698.000	76.644	23.842
40	COST OF GOODS	82.342	114.437	148.713	186.306	223.346	268.126	321.751	385.880	42.341	23.796
41	GROSS PROFIT	65.934	92.563	120.287	150.694	180.654	216.874	260.249	312.120	34.303	23.900
42	S G & A EXPENSE	27.044	43.442	56.454	70.725	84.786	101.785	122.142	146.487	16.424	25.299
43	R & D EXPENSE	10.886	14.843	19.289	24.165	28.969	34.777	41.732	50.050	5.475	23.599
45	OPERATING PROFIT	28.004	34.277	44.544	55.804	66.899	80.312	96.374	115.582	12.404	22.492
46	DEPRECIATION	5.806	11.141	15.062	19.574	24.522	29.397	35.291	42.349	5.054	29.795
47	LEASE PAYMENTS	2.060	2.060	2.060	2.060	2.060	2.060	2.060	2.060	0.000	0.000
48	INTEREST EXPENSE	(0.200)	0.905	3.730	5.123	6.230	6.584	6.968	7.333	1.104	*********
49	MISC EXPENSE	0.000	1.112	1.445	1.811	2.171	2.606	3.127	3.751	0.478	583.355
50	CHG ACCTG SHIP TO DIST	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
51	MISC INCOME	0.000	1.158	1.505	1.886	2.261	2.714	3.257	3.906	0.498	585.670
53	PRETAX PROFIT	20.338	20.217	23.752	29.122	34.177	42.378	52.185	63.996	6.266	19.071
54	INCOME TAXES	9.050	7.921	9.307	11.412	13.393	16.608	20.452	25.082	2.366	17.822
55	LOSS IN JOINT VENT.	0.333	0.000	0.000	0.000	0.000	0.000	0.000	0.000	(0.028)	(80.511)
56	NET PROFIT	10.955	12.296	14.445	17.710	20.784	25.770	31.732	38.914	3.928	20.278
[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

DATAQUEST, INC. FINANCIAL ANALYSIS 26 JULY 1979

COMPANY: ADVANCED MICRO DEVICES, INC. AUDITOR: ARTHUR YOUNG & CO
DATA SOURCE: ANNUAL REPORTS & 10K'S FIGURES IN: MILLIONS BY: KK FOLEY

PROJECTED FUNDS FLOW

REF	ITEM	1980	1981	1982	1983	1984	1985	1986	TREND	CMPD GR
	SOURCES									
56	NET PROFIT	12.296	14.445	17.710	20.784	25.770	31.732	38.914	4.374	21.293
46	DEPRECIATION	11.141	15.062	19.574	24.522	29.397	35.291	42.349	5.140	24.411
61	NEW LONG TERM DEBT	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
62	NEW EQUITY	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
63	INCR OTHER LIABILITIES	0.677	1.340	1.470	1.448	1.751	2.097	2.507	0.260	19.537
66	TOTAL SOURCES	24.114	30.848	38.754	46.754	56.918	69.120	83.770	9.774	22.725
	USES									
67	P P E EXPENDITURES	20.665	24.290	27.345	28.150	33.975	40.707	48.714	4.415	14.627
68	REPAYMENT LONG TERM DEBT	0.125	0.125	0.125	0.125	0.125	0.125	0.125	0.000	0.000
69	PREFERRED DIVIDENDS	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
70	COMMON DIVIDENDS	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
72	INCR WORKING CAPITAL	30.449	19.960	21.892	21.570	26.077	31.228	37.345	1.693	6.193
71	INCR OTHER ASSETS	1.242	0.534	0.586	0.577	0.698	0.835	0.999	0.000	1.503
74	TOTAL USES	52.481	44.909	49.947	50.422	60.875	72.895	87.182	6.107	10.081
75	EXCESS/DEFICIT	(28.367)	(14.061)	(11.193)	(3.669)	(3.957)	(3.775)	(3.412)	3.667	(30.092)
76	CUMULATIVE SUR/DEF	(28.367)	(42.428)	(53.621)	(57.289)	(61.246)	(65.021)	(68.433)	(6.179)	13.837

REF	ASSUMP ITEM	OPTION		VALUES
1	CASH & LIQUID SECURITIES	6	PCT SALES,HIST	14.81481354
3	RECEIVABLES	6	PCT SALES,HIST	20.14913441
4	INVENTORY	6	PCT SALES,HIST	12.48293539
5	OTHER CURRENT ASSETS	6	PCT SALES,HIST	0.5928873016
6	PREPAID INCOME TAX	6	PCT SALES,HIST	3.484196077
9	GROSS P P E	6	PCT SALES,HIST	33.57239314
12	MISC ASSETS	6	PCT SALES,HIST	0.861179857
13	LEASED EQUIPMENT	11	NO CHANGE	2.66
16	NOTES PAYABLE	11	NO CHANGE	4.621
17	ACCOUNTS PAYABLE	6	PCT SALES,HIST	9.034964684
18	ACCRUED TAXES	6	PCT SALES,HIST	3.596534476
19	ACCRUED LIABILITIES	6	PCT SALES,HIST	6.698521638
20	CURR MAT LONG TERM DEBT	11	NO CHANGE	0.125
21	OTHER CURRENT LIAB	11	NO CHANGE	5.943
24	DEFERRED TAXES	6	PCT SALES,HIST	1.015980752
25	MISC LIABILITIES	6	PCT SALES,HIST	1.145511731
29	PREFERRED STOCK	11	NO CHANGE	0
30	COMMON STOCK	11	NO CHANGE	0.047
31	CAPITAL SURPLUS	11	NO CHANGE	35.54
33	TREASURY & NOTES REC.	11	NO CHANGE	0
38	SALES	1	INPUT REQD	207 269 337 404 485 582 698
40	COST OF GOODS	6	PCT SALES,HIST	55.28372307
42	S G & A EXPENSE	6	PCT SALES,HIST	20.98667893
43	R & D EXPENSE	6	PCT SALES,HIST	7.170505314
46	DEPRECIATION	9	PCT PR GR PPE H	21.67418882
47	LEASE PAYMENTS	11	NO CHANGE	2.06
49	MISC EXPENSE	6	PCT SALES,HIST	0.5373519353
50	CHG ACCTG SHIP TO DIST	11	NO CHANGE	0
51	MISC INCOME	6	PCT SALES,HIST	0.559613899
55	LOSS IN JOINT VENT.	1	INPUT REQD	0 0 0 0 0 0 0
58	COMMON DIV PER SHARE	11	NO CHANGE	0
59	NO. OF COMMON SHARES	11	NO CHANGE	4930000
69	PREFERRED DIVIDENDS	11	NO CHANGE	0

INTEREST RATES: LTD→ 10 PCT NOTES PAY→ 10 PCT DEFICIT FNDS→ 10 PCT
INCREMENTAL DEBT 0 0 0 0 0 0 0
INCREMENTAL REPAY 0 0 0 0 0 0 0

-5% retirement rate vs. -3.2% /yr historical
Tax Rate - 39.2% = historical.

DATAQUEST, INC. FINANCIAL ANALYSIS 26 JULY 1979

COMPANY: MOSTEK CORPORATION AUDITOR: PEAT MARWICK MITCHELL & C
DATA SOURCE: ANNUAL REPORTS & 10K'S FIGURES IN: MILLIONS BY: KK FOLEY

PROJECTED SPREAD

REP	ITEM	1978	1979	1980	1981	1982	1983	1984	1985	TREND	CMPD GR
	BALANCE SHEET										
1	CASH & LIQUID SECURITIES	4.31	15.96	20.78	25.92	31.14	37.36	44.84	53.79	6.50	34.30
3	RECEIVABLES	31.45	46.94	61.13	76.25	91.59	109.90	131.89	158.22	17.54	24.52
4	INVENTORY	28.32	41.59	54.17	67.55	81.15	97.38	116.85	140.18	15.51	24.35
5	OTHER CURRENT ASSETS	0.37	0.51	0.66	0.82	0.99	1.19	1.43	1.71	0.19	23.58
7	EXCESS FUNDS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	TOTAL CURRENT ASSETS	64.45	104.99	136.74	170.55	204.86	245.83	295.00	353.90	39.74	25.43
9	GROSS P P E	69.93	94.58	123.18	153.63	184.54	221.45	265.74	318.79	34.80	23.50
10	ACCUMULATED DEPRECIATION	21.04	31.38	45.37	63.59	86.31	113.60	146.36	185.66	23.27	36.28
11	NET P P E	48.89	63.20	77.81	90.04	98.23	107.84	119.38	133.13	11.53	14.34
12	MISC ASSETS	0.28	1.44	1.88	2.34	2.81	3.37	4.05	4.86	0.60	38.00
15	*TOTAL ASSETS*	113.62	169.63	216.43	262.93	305.90	357.05	418.43	491.88	51.86	21.60
16	NOTES PAYABLE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
17	ACCOUNTS PAYABLE	12.06	18.25	23.77	29.64	35.61	42.73	51.27	61.51	6.83	24.66
18	ACCRUED TAXES	2.96	5.34	6.96	8.68	10.42	12.51	15.01	18.00	2.05	26.50
19	ACCRUED LIABILITIES	6.57	7.88	10.27	12.80	15.38	18.45	22.15	26.57	2.84	22.27
20	CURR MAT LONG TERM DEBT	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.00	0.00
22	TOTAL CURR LIABILITIES	21.90	31.78	41.30	51.43	61.72	74.00	88.74	106.39	11.72	24.09
23	LONG TERM DEBT	26.22	25.91	25.60	25.29	24.99	24.68	24.37	24.06	(0.31)	(1.22)
24	DEFERRED TAXES	4.73	6.13	7.98	9.96	11.96	14.35	17.22	20.66	2.24	23.06
25	MISC LIABILITIES	0.55	1.35	1.76	2.20	2.64	3.17	3.81	4.57	0.54	29.73
27	DEFICIT FUNDS	0.00	33.40	56.10	75.33	88.36	102.97	119.75	138.96	18.55	837.19
28	TOTAL LIABILITIES	53.40	98.58	132.75	164.22	189.66	219.17	253.88	294.64	32.74	24.39
29	PREPERRED STOCK	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
30	COMMON STOCK	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.00	0.00
31	CAPITAL SURPLUS	29.94	29.94	29.94	29.94	29.94	29.94	29.94	29.94	0.00	0.00
32	RETAINED EARNINGS	29.87	40.70	53.34	68.37	85v89	107.53	134.20	166.90	19.13	27.40
33	TREASURY STOCK	(0.08)	(0.08)	(0.08)	(0.08)	(0.08)	(0.08)	(0.08)	(0.08)	0.00	0.00
34	TOTAL EQUITY	60.22	71.05	83.68	98.71	116.24	137.88	164.54	197.25	19.13	18.37
35	*TOTAL LIAB & EQUITY*	113.62	169.63	216.43	262.93	305.90	357.05	418.43	491.88	51.86	21.60
36	NET WORKING CAPITAL	42.55	73.21	95.45	119.12	143.14	171.84	206.26	247.51	28.01	26.06
	INCOME & EXPENSE										
38	SALES	134.01	205.00	267.00	333.00	400.00	480.00	576.00	691.00	76.90	24.77
40	COST OF GOODS	71.57	116.02	151.11	188.47	226.39	271.67	326.00	391.09	43.88	25.38
41	GROSS PROFIT	62.45	88.98	115.89	144.53	173.61	208.33	250.00	299.91	33.02	24.03
42	S G & A EXPENSE	25.15	36.08	46.99	58.60	70.39	84.47	101.36	121.60	13.40	24.10
43	R & D EXPENSE	9.76	14.49	18.88	23.54	28.28	33.94	40.72	48.85	5.41	24.46
45	OPERATING PROFIT	27.53	38.41	50.02	62.39	74.94	89.93	107.91	129.46	14.21	23.82
46	DEPRECIATION	8.09	13.14	17.77	23.15	28.87	34.68	41.61	49.93	5.85	27.99
47	LEASE PAYMENTS	1.89	1.89	1.89	1.89	1.89	1.89	1.89	1.89	0.00	0.00
48	INTEREST EXPENSE	2.19	2.64	5.95	8.19	10.08	11.35	12.78	14.43	1.84	31.85
49	MISC EXPENSE	0.00	1.64	2.14	2.67	3.21	3.85	4.62	5.54	0.71	605.84
51	MISC INCOME	0.55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(0.05)	(81.31)
52	EQUITY IN AFFILATE ERGS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
53	PRETAX PROFIT	15.91	19.10	22.27	26.50	30.90	38.16	47.01	57.67	5.76	19.96
54	INCOME TAXES	6.42	8.26	9.64	11.47	13.37	16.52	20.35	24.97	2.53	20.67
55	EXTRAORDINARY ITEM	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
56	NET PROFIT	9.49	10.83	12.63	15.03	17.52	21.64	26.66	32.70	3.23	19.46
57	EPS AFTER PFD DIVIDENDS	1.94	2.22	2.59	3.08	3.59	4.43	5.46	6.69	0.66	19.46
58	COMMON DIV PER SHARE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

FUNDS

DATAQUEST, INC. FINANCIAL ANALYSIS 26 JULY 1979

COMPANY: MOSTEK CORPORATION AUDITOR: PEAT MARWICK MITCHELL & C
DATA SOURCE: ANNUAL REPORTS & 10K'S FIGURES IN: MILLIONS BY: KK POLEY

PROJECTED FUNDS FLOW

REF	ITEM	1979	1980	1981	1982	1983	1984	1985	TREND	CMPD GR
SOURCES										
56	NET PROFIT	10.83	12.63	15.03	17.52	21.64	26.66	32.70	3.58	20.29
46	DEPRECIATION	13.14	17.77	23.15	28.87	34.68	41.61	49.93	6.06	24.39
61	NEW LONG TERM DEBT	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
62	NEW EQUITY	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
63	INCR OTHER LIABILITIES	2.20	2.26	2.41	2.45	2.92	3.50	4.20	0.32	11.33
66	TOTAL SOURCES	26.17	32.67	40.58	48.84	59.24	71.78	86.83	9.96	21.92
USES										
67	P P E EXPENDITURES	27.45	32.39	35.38	37.06	44.29	53.15	63.68	5.68	14.29
68	REPAYMENT LONG TERM DEBT	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.00	0.00
69	PREFERRED DIVIDENDS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
70	COMMON DIVIDENDS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
72	INCR WORKING CAPITAL	30.66	22.24	23.67	24.03	28.69	34.43	41.24	2.18	7.24
71	INCR OTHER ASSETS	1.16	0.44	0.46	0.47	0.56	0.67	0.81	(0.02)	(0.06)
74	TOTAL USES	59.57	55.37	59.82	61.86	73.85	88.56	106.04	7.85	10.83
75	EXCESS/DEFICIT	(33.40)	(22.70)	(19.23)	(13.03)	(14.61)	(16.78)	(19.21)	2.11	(8.67)
76	CUMULATIVE SUR/DEF	(33.40)	(56.10)	(75.33)	(88.36)	(102.97)	(119.75)	(138.96)	(16.84)	24.37

40%, E.F

ASSUMP REF	ITEM	OPTION		VALUES
1	CASH & LIQUID SECURITIES	6	PCT SALES,HIST	7.784134623
3	RECEIVABLES	6	PCT SALES,HIST	22.89685846
4	INVENTORY	6	PCT SALES,HIST	20.28674332
5	OTHER CURRENT ASSETS	6	PCT SALES,HIST	0.2474573825
9	GROSS P P E	6	PCT SALES,HIST	46.1346799
12	MISC ASSETS	6	PCT SALES,HIST	0.7026064361
16	NOTES PAYABLE	11	NO CHANGE	0
17	ACCOUNTS PAYABLE	6	PCT SALES,HIST	8.901568357
18	ACCRUED TAXES	6	PCT SALES,HIST	2.605383935
19	ACCRUED LIABILITIES	6	PCT SALES,HIST	3.844785769
20	CURR MAT LONG TERM DEBT	11	NO CHANGE	0.309
24	DEFERRED TAXES	6	PCT SALES,HIST	2.989927587
25	MISC LIABILITIES	6	PCT SALES,HIST	0.6608640461
29	PREFERRED STOCK	11	NO CHANGE	0
30	COMMON STOCK	11	NO CHANGE	0.482
31	CAPITAL SURPLUS	11	NO CHANGE	29.944
33	TREASURY STOCK	11	NO CHANGE	-0.08
38	SALES	1	INPUT REQD	205 267 333 400 480 576 691
40	COST OF GOODS	6	PCT SALES,HIST	56.59730705
42	S G & A EXPENSE	6	PCT SALES,HIST	17.59784135
43	R & D EXPENSE	6	PCT SALES,HIST	7.069983214
46	DEPRECIATION	9	PCT PR GR PPE H	18.79043326
47	LEASE PAYMENTS	11	NO CHANGE	1.89
49	MISC EXPENSE	6	PCT SALES,HIST	0.80167761
51	MISC INCOME	1	INPUT REQD	0 0 0 0 0 0 0
52	EQUITY IN AFFILATE ENGS	11	NO CHANGE	0
55	EXTRAORDINARY ITEM	11	NO CHANGE	0
58	COMMON DIV PER SHARE	11	NO CHANGE	0
59	NO. OF COMMON SHARES	11	NO CHANGE	4885000
69	PREFERRED DIVIDENDS	11	NO CHANGE	0

INTEREST RATES: LTD→ 10 PCT NOTES PAY→ 10 PCT DEFICIT FNDS→ 10 PCT
INCREMENTAL DEBT 0 0 0 0 0 0 0
INCREMENTAL REPAY 0 0 0 0 0 0 0

Retirements - 4.0%/yr vs. 1.9% historical
Tax Rate 43.3% equals historical

COMPANY: NATIONAL SEMICONDUCTOR CORPORATION AUDITOR: PEAT MARWICK MITCHELL
DATA SOURCE: ANNUAL REPORTS & 10-K'S FIGURES IN: MILLIONS BY: L. MASON

PROJECTED SPREAD

REF	ITEM	1978	1979	1980	1981	1982	1983	1984	1985	TREND	CMPD GR
	BALANCE SHEET										
1	CASH & LIQUID SECURITIES	4.93	10.28	13.16	16.45	19.74	23.69	28.43	34.12	3.93	27.75
3	RECEIVABLES	79.64	116.57	149.20	186.50	223.80	268.56	322.24	386.79	42.55	24.03
4	INVENTORY	91.69	116.05	148.53	185.66	222.80	267.36	320.80	385.05	41.32	22.54
5	OTHER CURRENT ASSETS	4.72	4.32	5.52	6.90	8.29	9.94	11.93	14.32	1.43	19.26
7	EXCESS FUNDS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	TOTAL CURRENT ASSETS	180.98	247.22	316.42	395.52	474.63	569.55	683.40	820.28	89.22	23.32
9	GROSS P P E	170.86	245.42	314.11	392.64	471.17	565.41	678.42	814.31	89.30	23.84
10	ACCUMULATED DEPRECIATION	76.90	100.36	134.04	177.16	231.05	295.72	373.33	466.45	55.13	29.67
11	NET P P E	93.95	145.06	180.07	215.49	240.12	269.68	305.09	347.86	34.18	18.42
12	MISC ASSETS	3.94	5.43	6.95	8.68	10.42	12.50	15.00	18.01	1.96	23.40
15	*TOTAL ASSETS*	278.88	397.71	503.44	619.69	725.17	851.74	1003.49	1186.15	125.36	21.70
16	NOTES PAYABLE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
17	ACCOUNTS PAYABLE	45.59	65.79	84.20	105.25	126.30	151.56	181.86	218.28	23.96	23.89
18	ACCRUED TAXES	9.77	8.79	11.25	14.06	16.87	20.25	24.29	29.16	2.89	19.10
19	ACCRUED LIABILITIES	20.56	27.33	34.98	43.72	52.46	62.96	75.54	90.67	9.82	23.04
20	CURR MAT LONG TERM DEBT	23.36	1.50	0.00	0.00	0.00	0.00	0.00	0.00	(2.04)	(96.11)
21	OTHER CURR LIABILITIES	3.97	2.67	3.41	4.27	5.12	6.14	7.37	8.85	0.79	16.25
22	TOTAL CURR LIABILITIES	103.24	106.07	133.84	167.30	200.76	240.91	289.06	346.96	35.42	20.18
23	LONG TERM DEBT	1.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(0.12)	(82.81)
24	DEFERRED TAXES	40.77	47.88	61.26	76.60	91.92	110.30	132.34	158.85	16.80	21.78
25	MISC LIABILITIES	2.18	3.91	5.01	6.26	7.51	9.01	10.82	12.98	1.47	26.14
27	DEFICIT FUNDS	0.00	74.36	93.80	104.98	95.01	80.66	60.84	34.72	1.50	641.89
28	TOTAL LIABILITIES	147.70	232.22	293.92	355.14	395.19	440.88	493.06	553.52	55.07	18.61
29	PREFERRED STOCK	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
30	COMMON STOCK	6.54	6.54	6.54	6.54	6.54	6.54	6.54	6.54	0.00	0.00
31	CAPITAL SURPLUS	31.29	31.29	31.29	31.29	31.29	31.29	31.29	31.29	0.00	0.00
32	RETAINED EARNINGS	93.34	127.65	171.68	226.72	292.14	373.03	472.60	594.80	70.29	30.08
34	TOTAL EQUITY	131.18	165.49	209.52	264.56	329.98	410.87	510.43	632.64	70.29	25.21
35	*TOTAL LIAB & EQUITY*	278.88	397.71	503.44	619.69	725.17	851.74	1003.49	1186.15	125.36	21.70
36	NET WORKING CAPITAL	77.74	141.15	182.58	228.23	273.87	328.65	394.34	473.32	53.80	26.47
	INCOME & EXPENSE										
38	SALES	494.34	718.80	920.00	1150.00	1380.00	1656.00	1987.00	2385.00	262.07	23.97
40	COST OF GOODS	320.30	451.72	578.16	722.70	867.25	1040.69	1248.71	1498.83	163.89	23.65
41	GROSS PROFIT	174.04	267.08	341.84	427.30	512.75	615.31	738.29	886.17	98.18	24.52
42	S G & A EXPENSE	61.76	95.64	122.41	153.01	183.61	220.34	264.38	317.33	35.20	24.62
43	R & D EXPENSE	41.83	63.16	80.84	101.06	121.27	145.52	174.61	209.58	23.16	24.36
45	OPERATING PROFIT	70.45	108.28	138.58	173.23	207.88	249.45	299.31	359.26	39.81	24.54
46	DEPRECIATION	21.79	32.85	47.18	60.39	75.49	90.59	108.70	130.43	15.30	27.93
47	LEASE PAYMENTS	5.70	5.70	5.70	5.70	5.70	5.70	5.70	5.70	0.00	0.00
48	INTEREST EXPENSE	1.94	1.32	7.51	9.38	10.50	9.50	8.07	6.08	0.83	23.74
49	MISC EXPENSE	0.00	7.47	0.00	0.00	0.00	0.00	0.00	0.00	(0.44)	(74.16)
51	MISC INCOME	(0.43)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	*********
53	PRETAX PROFIT	40.60	60.94	78.19	97.76	116.19	143.66	176.84	217.05	24.16	25.47
54	INCOME TAXES	18.10	26.63	34.16	42.72	50.77	62.78	77.27	94.84	10.53	25.26
56	NET PROFIT	22.50	34.31	44.03	55.04	65.42	80.89	99.57	122.20	13.63	25.64
57	EPS AFTER PFD DIVIDENDS	1.72	2.62	3.37	4.21	5.00	6.18	7.61	9.34	1.04	25.64
58	COMMON DIV PER SHARE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

FUND

DATAQUEST, INC. FINANCIAL ANALYSIS 26 JULY 1979

COMPANY: NATIONAL SEMICONDUCTOR CORPORATION AUDITOR: PEAT MARWICK MITCHELL
DATA SOURCE: ANNUAL REPORTS & 10-K'S FIGURES IN: MILLIONS BY: L. MASON

PROJECTED FUNDS FLOW

REP	ITEM	1979	1980	1981	1982	1983	1984	1985	TREND	CMPD GR
SOURCES										
56	NET PROFIT	34.314	44.025	55.043	65.419	80.888	99.567	122.203	14.307	23.137
46	DEPRECIATION	32.849	47.184	60.391	75.489	90.587	108.704	130.432	15.928	24.837
61	NEW LONG TERM DEBT	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
62	NEW EQUITY	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
63	INCR OTHER LIABILITIES	8.831	14.496	16.571	16.571	19.885	23.848	28.675	2.912	18.324
66	TOTAL SOURCES	75.994	105.705	132.005	157.479	191.360	232.119	281.310	33.147	23.328
USES										
67	P P E EXPENDITURES	83.958	82.194	95.805	100.124	120.149	144.110	173.202	14.854	13.403
68	REPAYMENT LONG TERM DEBT	23.363	1.500	0.000	0.000	0.000	0.000	0.000	(2.610)	(98.287)
69	PREFERRED DIVIDENDS	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
70	COMMON DIVIDENDS	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
72	INCR WORKING CAPITAL	41.553	39.930	45.645	45.645	54.774	65.690	78.986	6.177	11.727
71	INCR OTHER ASSETS	1.484	1.519	1.737	1.737	2.084	2.499	3.005	0.245	12.489
74	TOTAL USES	150.358	125.143	143.187	147.506	177.008	212.300	255.194	18.666	10.739
75	EXCESS/DEFICIT	(74.364)	(19.437)	(11.182)	9.973	14.352	19.819	26.116	14.482	*********
76	CUMULATIVE SUR/DEF	(74.364)	(93.801)	(104.983)	(95.010)	(80.658)	(60.839)	(34.722)	7.471	(11.480)

DECIMALS 2

SPREAD

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OPR:  ORANGE COUNTY COMPUTER ACCESS PHONES ARE CHANGED      )LOAD 1 OC
003) 16.39.00 07/27/79 DATAQUEST

    . P C S   A P L . S V .

      )LOAD 125 BOTTOMLINE
SAVED  17.24.21 08/11/76
NYSE ID:
       NSR
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REF	ASSUMP ITEM	OPTION		VALUES
1	CASH & LIQUID SECURITIES	6	PCT SALES,HIST	1.430703246
3	RECEIVABLES	6	PCT SALES,HIST	16.21755222
4	INVENTORY	6	PCT SALES,HIST	16.14469585
5	OTHER CURRENT ASSETS	6	PCT SALES,HIST	0.6003929512
9	GROSS P P E	6	PCT SALES,HIST	34.14291036
12	MISC ASSETS	6	PCT SALES,HIST	0.7551246157
16	NOTES PAYABLE	11	NO CHANGE	0
17	ACCOUNTS PAYABLE	6	PCT SALES,HIST	9.152341622
18	ACCRUED TAXES	6	PCT SALES,HIST	1.222542552
19	ACCRUED LIABILITIES	6	PCT SALES,HIST	3.801745955
20	CURR MAT LONG TERM DEBT	11	NO CHANGE	23.363
21	OTHER CURR LIABILITIES	6	PCT SALES,HIST	0.3708949371
24	DEFERRED TAXES	6	PCT SALES,HIST	6.660519779
25	MISC LIABILITIES	6	PCT SALES,HIST	0.5443130919
29	PREFERRED STOCK	11	NO CHANGE	0
30	COMMON STOCK	11	NO CHANGE	6.543
31	CAPITAL SURPLUS	11	NO CHANGE	31.293
38	SALES	1	INPUT REQD	718.8 920 1150 1380 1656 1987 2385
40	COST OF GOODS	6	PCT SALES,HIST	62.84385962
42	S G & A EXPENSE	6	PCT SALES,HIST	13.30528301
43	R & D EXPENSE	6	PCT SALES,HIST	8.787413408
46	DEPRECIATION	9	PCT PR GR PPE H	19.22580048
47	LEASE PAYMENTS	11	NO CHANGE	5.7
49	MISC EXPENSE	1	INPUT REQD	7.47 0 0 0 0 0 0
51	MISC INCOME	1	INPUT REQD	0 0 0 0 0 0 0
58	COMMON DIV PER SHARE	13	PAYOUT RATE HIS	0
59	NO. OF COMMON SHARES	11	NO CHANGE	13081000
69	PREFERRED DIVIDENDS	11	NO CHANGE	0

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INTEREST RATES:  ~~LTD→ 5.5 PCT  NOTES PAY→ 5.5 PCT  DEFICIT FNDS→ 5.5 PCT~~  → 10%
INCREMENTAL DEBT  ~~0.437 0.437 0.437 0.437 0.437 0.437 0~~   0 0 0 0 0 0 0
INCREMENTAL REPAY 0 0 0 0 0 0 0
      CHANGE
CHANGE INTEREST RATES? 10 10 10
ENTER 3 INTEREST RATES - LTD  NOTES PAYABLE  DEFICIT FUNDS
□:
      10 10 10
INTEREST RATES ARE: LTD→10 PCT, NOTES PAYABLE→10 PCT, DEFICIT FUNDS→10 PCT
CHANGE ADDITIONAL DEBT? NO
DO YOU WANT TO LIST THE AVAILABLE OPTIONS? NO
ENTER LINE ITEM NO. FOLLOWED BY OPTION NO. - 0 TO EXIT
□:
      0
ENTER LINE NO. OF FORECAST CONSTANTS TO BE CHANGED - 0 TO EXIT
□:
      0
CALCULATING...
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Retirements used -5.5%/yr vs. -37% history
Tax Rate 43.7%

DATAQUEST INC. FINANCIAL ANALYSIS 19 JULY 1979

COMPANY: MOTOROLA AUDITOR: PEAT MARWICK MITCHELL & C
DATA SOURCE: ANNUAL REPORTS AND 10K'S FIGURES IN: MILLIONS BY: KK FOLEY

PROJECTED SPREAD

REP	ITEM	1978	1979	1980	1981	1982	1983	1984	1985	TREND	CMPD GR
BALANCE SHEET											
1	CASH & LIQUID SECURITIES	157.41	141.70	163.85	189.46	219.08	253.32	292.92	338.70	27.66	13.24
3	RECEIVABLES	454.25	542.46	627.25	725.30	838.67	969.76	1121.34	1296.61	118.24	15.94
4	INVENTORY	438.84	507.00	587.00	678.00	784.00	907.00	1049.00	1213.00	109.47	15.64
5	OTHER CURRENT ASSETS	84.50	100.01	115.64	133.72	154.62	178.79	206.74	239.05	21.74	15.86
7	EXCESS FUNDS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	TOTAL CURRENT ASSETS	1134.99	1291.17	1493.75	1726.48	1996.37	2308.87	2669.99	3087.37	277.09	15.48
9	GROSS P P E	814.40	980.72	1134.01	1311.27	1516.23	1753.23	2027.28	2344.16	214.33	16.02
10	ACCUMULATED DEPRECIATION	310.60	355.27	409.06	471.26	543.18	626.35	722.51	833.71	74.07	15.19
11	NET P P E	503.80	625.45	724.95	840.01	973.05	1126.88	1304.77	1510.45	140.26	16.51
12	MISC ASSETS	17.77	32.79	37.91	43.84	50.69	58.62	67.78	78.38	7.95	20.22
15	*TOTAL ASSETS*	1656.56	1949.41	2256.61	2610.33	3020.11	3494.37	4042.54	4676.20	425.31	15.86
16	NOTES PAYABLE	78.50	78.50	78.50	78.50	78.50	78.50	78.50	78.50	0.00	0.00
17	ACCOUNTS PAYABLE	183.34	200.30	231.61	267.81	309.67	358.08	414.05	478.77	42.36	15.09
18	ACCRUED TAXES	60.38	53.91	62.33	72.07	83.34	96.37	111.43	128.85	10.48	13.16
19	ACCRUED LIABILITIES	188.38	203.32	235.10	271.84	314.33	363.47	420.28	485.97	42.80	14.97
20	CURR MAT LONG TERM DEBT	4.46	4.46	4.46	4.46	4.46	4.46	4.46	4.46	0.00	0.00
22	TOTAL CURR LIABILITIES	515.06	540.49	612.00	694.69	790.31	900.88	1028.72	1176.55	95.64	13.03
23	LONG TERM DEBT	198.09	193.63	189.17	184.71	180.25	175.79	171.32	166.86	(4.46)	(2.42)
24	DEFERRED TAXES	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
25	MISC LIABILITIES	57.87	56.12	64.89	75.03	86.76	100.32	116.00	134.13	11.32	13.95
27	DEFICIT FUNDS	0.00	172.43	289.10	417.29	560.42	720.67	899.73	1100.25	152.10	1053.08
28	TOTAL LIABILITIES	771.02	962.66	1155.16	1371.72	1617.73	1897.65	2215.78	2577.80	254.60	18.52
29	PREFERRED STOCK	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
30	COMMON STOCK	93.26	105.22	118.73	133.96	151.16	170.55	192.44	217.14	17.57	12.83
31	CAPITAL SURPLUS	156.38	156.38	156.38	156.38	156.38	156.38	156.38	156.38	0.00	0.00
32	RETAINED EARNINGS	635.91	725.15	826.35	948.27	1094.84	1269.79	1477.94	1724.89	153.14	15.33
34	TOTAL EQUITY	885.54	986.75	1101.46	1238.61	1402.37	1596.72	1826.76	2098.40	170.71	13.12
35	*TOTAL LIAB & EQUITY*	1656.56	1949.41	2256.61	2610.33	3020.11	3494.37	4042.54	4676.20	425.31	15.86
36	NET WORKING CAPITAL	619.93	750.69	881.75	1031.79	1206.05	1407.99	1641.27	1910.81	181.45	17.23
INCOME & EXPENSE											
38	SALES	2219.74	2566.71	2967.91	3431.82	3968.24	4588.51	5305.73	6135.06	553.58	15.63
40	COST OF GOODS	1180.67	1453.45	1680.64	1943.34	2247.10	2598.34	3004.48	3474.11	319.83	16.24
41	GROSS PROFIT	1039.08	1113.25	1287.27	1488.48	1721.14	1990.17	2301.25	2660.95	233.74	14.90
42	S G & A EXPENSE	548.67	582.91	674.02	779.38	901.20	1042.07	1204.95	1393.30	122.01	14.82
43	R & D EXPENSE	133.41	165.00	191.00	221.00	255.00	295.00	341.00	394.00	36.31	16.26
45	OPERATING PROFIT	357.00	365.35	422.24	488.10	564.94	653.10	755.29	873.65	75.43	14.47
46	DEPRECIATION	83.34	89.46	107.73	124.57	144.04	166.56	192.59	222.69	20.08	15.59
47	LEASE PAYMENTS	25.73	25.73	25.73	25.73	25.73	25.73	25.73	25.73	0.00	0.00
48	INTEREST EXPENSE	27.54	27.88	44.68	55.90	68.27	82.14	97.72	115.18	12.95	24.36
49	MISC EXPENSE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
51	MISC INCOME	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
53	PRETAX PROFIT	220.39	222.27	244.10	281.90	326.89	378.67	439.26	510.05	42.40	13.65
54	INCOME TAXES	95.21	100.46	110.33	127.41	147.75	171.16	198.54	230.54	19.53	14.08
55	DISCONT. OPER. LOSS(GAIN)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
56	NET PROFIT	125.18	121.81	133.78	154.49	179.14	207.52	240.72	279.51	22.87	13.31
57	EPS AFTER PFD DIVIDENDS	4.04	3.93	4.31	4.98	5.78	6.69	7.76	9.01	0.74	13.31
58	COMMON DIV PER SHARE	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	0.00	0.00

DATAQUEST. F I N A N C I A L A N A L Y S I S 19 JULY 1979

COMPANY: MOTOROLA AUDITOR: PEAT MARWICK MITCHELL & C
DATA SOURCE: ANNUAL REPORTS AND 10K'S FIGURES IN: MILLIONS BY: KK POLEY

PROJECTED FUNDS FLOW

REF	ITEM	1979	1980	1981	1982	1983	1984	1985	TREND	CMPD GR
	SOURCES									
56	NET PROFIT	121.81	133.78	154.49	179.14	207.52	240.72	279.51	26.43	15.20
46	DEPRECIATION	89.46	107.73	124.57	144.04	166.56	192.59	222.69	21.84	16.13
61	NEW LONG TERM DEBT	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
62	NEW EQUITY	11.97	13.50	15.24	17.19	19.40	21.89	24.70	2.11	12.83
63	INCR OTHER LIABILITIES	(1.75)	8.77	10.14	11.73	13.56	15.68	18.13	2.75	*********
66	TOTAL SOURCES	221.49	263.78	304.44	352.10	407.04	470.88	545.04	53.12	15.98
	USES									
67	P P E EXPENDITURES	211.11	207.23	239.63	277.08	320.39	370.47	428.38	37.82	13.62
68	REPAYMENT LONG TERM DEBT	4.46	4.46	4.46	4.46	4.46	4.46	4.46	0.00	0.00
69	PREFERRED DIVIDENDS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
70	COMMON DIVIDENDS	32.57	32.57	32.57	32.57	32.57	32.57	32.57	0.00	0.00
72	INCR WORKING CAPITAL	130.76	131.06	150.04	174.27	201.94	233.28	269.54	24.02	13.80
71	INCR OTHER ASSETS	15.02	5.13	5.93	6.85	7.92	9.16	10.59	(0.11)	1.46
74	TOTAL USES	393.92	380.45	432.62	495.23	567.29	649.94	745.55	61.73	12.33
75	EXCESS/DEFICIT	(172.43)	(116.67)	(128.19)	(143.13)	(160.25)	(179.07)	(200.51)	(8.61)	5.63
76	CUMULATIVE SUR/DEF	(172.43)	(289.10)	(417.29)	(560.42)	(720.67)	(899.73)	(1100.25)	(153.86)	34.87

)LOAD 125 BOTTOMLINE
SAVED 17.24.21 08/11/76
NYSE ID: FCR
CHANGE

REF	ASSUMP ITEM	OPTION		VALUES
1	CASH & LIQUID SECURITIES	6	PCT SALES,HIST	5.520779914
3	RECEIVABLES	6	PCT SALES,HIST	21.13446777
4	INVENTORY	1	INPUT REQD	507 587 678 784 907 1049 1213
5	OTHER CURRENT ASSETS	6	PCT SALES,HIST	3.896498887
9	GROSS P P E	6	PCT SALES,HIST	38.209216
12	MISC ASSETS	6	PCT SALES,HIST	1.277497677
16	NOTES PAYABLE	11	NO CHANGE	78.502
17	ACCOUNTS PAYABLE	6	PCT SALES,HIST	7.803816563
18	ACCRUED TAXES	6	PCT SALES,HIST	2.100196344
19	ACCRUED LIABILITIES	6	PCT SALES,HIST	7.92126257
20	CURR MAT LONG TERM DEBT	11	NO CHANGE	4.461
24	DEFERRED TAXES	6	PCT SALES,HIST	0
25	MISC LIABILITIES	6	PCT SALES,HIST	2.186285901
29	PREFERRED STOCK	11	NO CHANGE	0
30	COMMON STOCK	4	HIST CMPD GR	12.83313594
31	CAPITAL SURPLUS	11	NO CHANGE	156.376
38	SALES	4	HIST CMPD GR	15.63084755
40	COST OF GOODS	6	PCT SALES,HIST	56.62714383
42	S G & A EXPENSE	6	PCT SALES,HIST	22.7103994
43	R & D EXPENSE	1	INPUT REQD	165 191 221 255 295 341 394
46	DEPRECIATION	9	PCT PR GR PPE H	10.98491932
47	LEASE PAYMENTS	11	NO CHANGE	25.727
49	MISC EXPENSE	6	PCT SALES,HIST	0
51	MISC INCOME	6	PCT SALES,HIST	0
55	DISCONT. OPER. LOSS(GAIN)	1	INPUT REQD	0 0 0 0 0 0 0
58	COMMON DIV PER SHARE	11	NO CHANGE	1.05
59	NO. OF COMMON SHARES	11	NO CHANGE	31019000
69	PREFERRED DIVIDENDS	11	NO CHANGE	0

INTEREST RATES: LTD→ 10 PCT NOTES PAY→ 10 PCT DEFICIT FNDS→ 10 PCT
INCREMENTAL DEBT 0 0 0 0 0 0 0
INCREMENTAL REPAY 0 0 0 0 0 0 0

Retirements − 0.055
Tax Rate 45.2%

COMPANY: [redacted]S INSTRUMENTS, INC.
DATA SOUR[redacted]ANNUAL REPORTS

[redacted]ITOR: ARTHUR YOUNG & CO.
FIGU[redacted]IN: MILLIONS
BY: KKPOLEY

PROJECTED SPREAD

REF	ITEM	1978	1979	1980	1981	1982	1983	1984	1985	TREND	CMPD GR
	BALANCE SHEET										
1	CASH & LIQUID SECURITIES	115.37	208.00	243.00	283.00	330.00	385.00	449.00	524.00	54.03	20.95
3	RECEIVABLES	443.67	514.86	600.50	700.39	816.89	952.77	1111.26	1296.11	120.50	16.58
4	INVENTORY	300.50	343.00	400.05	466.60	544.22	634.74	740.33	863.47	79.87	16.42
5	OTHER CURRENT ASSETS	55.95	29.17	34.02	39.68	46.28	53.97	62.95	73.42	4.26	9.06
7	EXCESS FUNDS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	80.60	6.72	710.70
8	TOTAL CURRENT ASSETS	915.50	1095.02	1277.57	1489.66	1737.38	2026.49	2363.54	2837.61	265.38	17.16
9	GROSS P P E	927.01	1066.63	1244.05	1450.99	1692.35	1973.86	2302.19	2685.15	249.00	16.50
10	ACCUMULATED DEPRECIATION	354.36	437.42	532.99	644.45	774.46	926.10	1102.96	1309.23	134.78	20.43
11	NET P P E	572.65	629.21	711.07	806.54	917.89	1047.76	1199.24	1375.91	114.22	13.52
12	MISC ASSETS	30.05	53.11	61.94	72.25	84.26	98.28	114.63	133.69	13.74	20.74
15	*TOTAL ASSETS*	1518.20	1777.34	2050.58	2368.45	2739.53	3172.53	3677.40	4347.22	393.34	15.98
16	LOANS PAYABLE (OVERSEAS)	45.83	45.83	45.83	45.83	45.83	45.83	45.83	45.83	0.00	0.00
17	ACCTS PYBLE & ACCD EXPNS	458.30	409.18	477.24	556.63	649.22	757.21	883.16	1030.07	86.96	14.07
18	ACCRUED TAXES	69.36	129.11	150.59	175.63	204.85	238.93	278.67	325.02	33.71	21.27
19	ACCRUED RETIREMENT BENES	40.18	52.22	60.91	71.04	82.86	96.64	112.72	131.47	12.62	17.69
20	CURR MAT LONG TERM DEBT	12.09	12.09	6.98	0.00	0.00	0.00	0.00	0.00	(1.98)	(98.39)
21	DIVIDENDS PAYABLE	11.39	12.24	14.27	16.65	19.41	22.64	26.41	30.80	2.79	15.84
22	TOTAL CURR LIABILITIES	637.16	660.67	755.82	865.78	1002.17	1161.25	1346.79	1563.20	134.11	14.37
23	LONG TERM DEBT	19.07	6.98	0.00	0.00	0.00	0.00	0.00	0.00	(2.00)	(96.39)
24	DEFERRED TAXES	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
25	MISC LIABILITIES	16.58	18.36	21.42	24.98	29.14	33.98	39.64	46.23	4.24	16.13
27	DEFICIT FUNDS	0.00	109.68	125.41	123.96	101.97	63.11	3.49	0.00	(8.81)	(20.71)
28	TOTAL LIABILITIES	672.81	795.69	902.65	1014.73	1133.28	1258.34	1389.92	1609.43	127.54	12.64
29	PREFERRED STOCK	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
30	COMMON STOCK	23.04	23.04	23.04	23.04	23.04	23.04	23.04	23.04	0.00	0.00
31	CAPITAL SURPLUS	106.91	106.91	106.91	106.91	106.91	106.91	106.91	106.91	0.00	0.00
32	RETAINED EARNINGS	715.44	851.69	1017.98	1223.77	1476.30	1784.24	2157.53	2607.84	265.80	20.37
34	TOTAL EQUITY	845.39	981.65	1147.93	1353.72	1606.25	1914.19	2287.48	2737.79	265.80	18.36
35	*TOTAL LIAB & EQUITY*	1518.20	1777.34	2050.58	2368.45	2739.53	3172.53	3677.40	4347.22	393.34	15.98
36	NET WORKING CAPITAL	278.34	434.35	521.75	623.88	735.21	865.24	1016.75	1274.41	131.27	21.83
	INCOME & EXPENSE										
38	SALES	2549.85	2974.00	3468.70	4045.69	4718.66	5503.57	6419.05	7486.80	697.16	16.63
40	COST OF GOODS	1526.40	1783.99	2080.74	2426.86	2830.55	3301.39	3850.55	4491.06	418.46	16.65
41	GROSS PROFIT	1023.45	1190.01	1387.96	1618.83	1888.11	2202.18	2568.50	2995.75	278.70	16.60
42	S G & A EXPENSE	419.80	475.60	554.71	646.98	754.60	880.12	1026.52	1197.28	110.49	16.35
43	EMPLOYEE PROFIT SHARING	61.40	70.56	82.30	95.99	111.96	130.58	152.30	177.64	16.47	16.49
44	R & D EXPENDITURES	111.05	126.90	146.00	172.62	201.34	234.83	273.89	319.45	29.56	16.44
45	OPERATING PROFIT	431.21	516.95	602.94	703.24	820.22	956.65	1115.78	1301.39	122.18	16.90
46	DEPRECIATION	131.00	166.49	191.57	223.43	260.60	303.95	354.51	413.47	39.19	17.24
47	LEASE PAYMENTS	46.70	46.70	46.70	46.70	46.70	46.70	46.70	46.70	0.00	0.00
48	INTEREST EXPENSE	8.37	7.09	16.85	17.47	16.98	14.78	10.89	4.93	(0.14)	(2.33)
49	MISC EXPENSE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
51	MISC INCOME	12.25	20.68	24.12	28.14	32.82	38.28	44.64	52.07	5.31	20.29
53	PRETAX PROFIT	257.39	317.36	371.95	443.77	528.76	629.51	748.33	888.35	88.44	19.14
54	INCOME TAXES	117.11	142.80	167.37	199.69	237.94	283.27	336.74	399.75	39.69	19.04
56	NET PROFIT	140.28	174.55	204.58	244.08	290.82	346.23	411.59	488.60	48.75	19.24
57	EPS AFTER PFD DIVIDENDS	6.15	7.66	8.98	10.71	12.76	15.19	18.06	21.44	2.14	19.24
58	COMMON DIV PER SHARE	1.68	1.68	1.68	1.68	1.68	1.68	1.68	1.68	0.00	0.00

DATAQUEST, INC. F I N A N C I A L A N A L Y S I S 19 JULY 1979

COMPANY: T[redacted] INSTRUMENTS, INC. [redacted]TOR: ARTHUR YOUNG & CO.
DATA SOURCE: ANNUAL REPORTS FIGURES IN: MILLIONS BY: KKPOLEY

PROJECTED FUNDS FLOW

REF	ITEM	1979	1980	1981	1982	1983	1984	1985	TREND	CMPD GR
	SOURCES									
56	NET PROFIT	174.55	204.58	244.08	290.82	346.23	411.59	488.60	52.08	18.85
46	DEPRECIATION	166.49	191.57	223.43	260.60	303.95	354.51	413.47	40.98	16.46
61	NEW LONG TERM DEBT	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
62	NEW EQUITY	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
63	INCR OTHER LIABILITIES	1.78	3.05	3.56	4.16	4.85	5.65	6.59	0.75	21.53
66	TOTAL SOURCES	342.83	399.20	471.08	555.58	655.03	771.75	908.67	93.81	17.74
	USES									
67	P P E EXPENDITURES	223.05	273.42	318.90	371.95	433.82	505.98	590.15	60.05	17.26
68	REPAYMENT LONG TERM DEBT	12.09	12.09	6.98	0.00	0.00	0.00	0.00	(2.41)	(99.30)
69	PREFERRED DIVIDENDS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
70	COMMON DIVIDENDS	38.29	38.29	38.29	38.29	38.29	38.29	38.29	0.00	0.00
72	INCR WORKING CAPITAL	156.02	82.29	95.15	111.33	130.03	151.51	177.06	8.44	7.07
71	INCR OTHER ASSETS	23.06	8.83	10.30	12.02	14.02	16.35	19.07	0.24	3.52
74	TOTAL USES	452.51	414.93	469.63	533.59	616.16	712.13	824.57	66.33	11.92
75	EXCESS/DEFICIT	(109.68)	(15.73)	1.45	21.99	38.87	59.61	84.09	27.48	*********
76	CUMULATIVE SUR/DEF	(109.68)	(125.41)	(123.96)	(101.97)	(63.11)	(3.49)	80.60	31.27	*********

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REF    ITEM                          OPTION                VALUES
------------------------------------------------------------------------
  1  CASH [illegible]IQUID SECURITIES     1  INPUT REQD        208 243 283[illegible] 385 449 524
  3  RECE[illegible]LES                   6  PCT SALES,HIST    17.31192558
  4  INVENTORY                    6  PCT SALES,HIST    11.53327104
  5  OTHER CURRENT ASSETS         6  PCT SALES,HIST    0.9807106181
  9  GROSS P P E                  6  PCT SALES,HIST    35.86504837
 12  MISC ASSETS                  6  PCT SALES,HIST    1.785735108
 16  LOANS PAYABLE (OVERSEAS)    11  NO CHANGE         45.833
 17  ACCTS PYBLE & ACCD EXPNS     6  PCT SALES,HIST    13.75849623
 18  ACCRUED TAXES                6  PCT SALES,HIST    4.341272594
 19  ACCRUED RETIREMENT BENES     6  PCT SALES,HIST    1.755979097
 20  CURR MAT LONG TERM DEBT     11  NO CHANGE         12.091
 21  DIVIDENDS PAYABLE            6  PCT SALES,HIST    0.411449398
 24  DEFERRED TAXES               6  PCT SALES,HIST    0
 25  MISC LIABILITIES             6  PCT SALES,HIST    0.6174688762
 29  PREFERRED STOCK             11  NO CHANGE         0
 30  COMMON STOCK                11  NO CHANGE         23.041
 31  CAPITAL SURPLUS             11  NO CHANGE         106.911
 38  SALES                        4  HIST CMPD GR      16.63419826
 40  COST OF GOODS                6  PCT SALES,HIST    59.98627364
 42  S G & A EXPENSE              6  PCT SALES,HIST    15.99183841
 43  EMPLOYEE PROFIT SHARING      6  PCT SALES,HIST    2.372676206
 44  R & D EXPENDITURES           6  PCT SALES,HIST    4.266816989
 46  DEPRECIATION                 9  PCT PR GR PPE H   17.96003283
 47  LEASE PAYMENTS              11  NO CHANGE         46.695
 49  MISC EXPENSE                 6  PCT SALES,HIST    0
 51  MISC INCOME                  6  PCT SALES,HIST    0.6954682132
 58  COMMON DIV PER SHARE        11  NO CHANGE         1.68
 59  NO. OF COMMON SHARES        11  NO CHANGE         22794000
 69  PREFERRED DIVIDENDS         11  NO CHANGE         0

INTEREST RATES:  LTD+ 10 PCT  NOTES PAY+ 10 PCT  DEFICIT FNDS+ 10 PCT
INCREMENTAL DEBT   0 0 0 0 0 0 0
INCREMENTAL REPAY 0 0 0 0 0 0 0
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Tax Rate 45%
Retirement -0.09   (True Avg is -12.7%)

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      )LOAD 125 BOTTOMLINE
SAVED  17.24.21 08/11/76
NYSE ID: MOSK
PLEASE TYPE:  NEWCO
TO INPUT NEW COMPANY DATA.

      )LOAD 125 BOTTOMLINE
SAVED  17.24.21 08/11/76
NYSE ID: MOSK
      SHOW 57
57  EPS AFTER PFD DIVIDENDS  0.1014272848 0.8060018187 1.795912807 0.9720419371 ¯0.3135764944 0.8508482564 1.303078677
      1.941862845
      PROJECT
ENTER NO. OF PERIODS TO BE FORECAST (1 TO 11)
⎕:
      7
ENTER TAX RATE(S) FOR EACH PERIOD
⎕:
      43.4
         v
         3 43.3 43.3 43.3 43.3 43.3 43.3
ENTER VALUE FOR RETIRE/PREV GROSS P P E (USE NEGATIVE ¯)
⎕:
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DATAQUEST INC. F I N A N C I A L A N A L Y S I S 19 JULY 1979

COMPANY: FAIRCHILD CAMERA AND INSTRUMENT CORP. AUDITOR: PRICE WATERHOUSE & CO
DATA SOURCE: ANNUAL REPORTS & 10K'S FIGURES IN: MILLIONS BY: D. K. PAUL

PROJECTED SPREAD

REF	ITEM	1978	1979	1980	1981	1982	1983	1984	1985	TREND	CMPD GR
	BALANCE SHEET										
1	CASH & LIQUID SECURITIES	59.25	55.32	63.16	72.12	82.35	94.03	107.37	122.59	9.60	12.28
3	RECEIVABLES	95.52	109.92	125.51	143.31	163.63	186.84	213.33	243.59	20.93	14.26
4	INVENTORY	90.48	124.63	142.31	162.49	185.53	211.84	241.89	276.19	25.21	15.98
5	OTHER CURRENT ASSETS	4.46	4.82	5.51	6.29	7.18	8.20	9.36	10.69	0.90	13.67
6	PREPAID INCOME TAI	9.17	11.67	13.32	15.21	17.37	19.83	22.64	25.86	2.30	15.21
7	EXCESS FUNDS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	TOTAL CURRENT ASSETS	258.88	306.36	349.81	399.42	456.06	520.74	594.59	678.92	58.94	14.52
9	GROSS P P E	214.30	270.14	308.46	352.20	402.15	459.18	524.31	598.66	53.14	15.13
10	ACCUMULATED DEPRECIATION	76.45	84.21	94.00	105.17	117.93	132.49	149.12	168.12	13.03	12.00
11	NET P P E	137.85	185.93	214.46	247.03	284.22	326.69	375.18	430.55	40.11	16.58
12	MISC ASSETS	22.44	22.44	22.44	22.44	22.44	22.44	22.44	22.44	0.00	0.00
13	INVEST JOINT VENTURES	4.51	4.51	4.51	4.51	4.51	4.51	4.51	4.51	0.00	0.00
15	*TOTAL ASSETS*	423.67	519.24	591.21	673.40	767.23	874.38	996.72	1136.42	99.05	14.63
16	NOTES PAYABLE	19.50	19.50	19.50	19.50	19.50	19.50	19.50	19.50	0.00	0.00
17	ACCOUNTS PAYABLE	30.39	34.09	38.93	44.45	50.75	57.95	66.17	75.55	6.43	14.02
18	ACCRUED TAXES	25.04	25.99	29.67	33.88	38.69	44.17	50.44	57.59	4.74	13.28
19	ACCRUED LIABILITIES	32.98	37.79	43.14	49.26	56.25	64.23	73.34	83.74	7.18	14.21
20	CURR MAT LONG TERM DEBT	4.52	4.52	4.52	4.52	4.52	4.52	4.52	4.52	0.00	0.00
21	ACCRUED COMPENSATION	23.34	21.41	24.45	27.91	31.87	36.39	41.55	47.45	3.68	12.12
22	TOTAL CURR LIABILITIES	135.78	143.29	160.21	179.52	201.58	226.76	255.51	288.34	22.03	11.74
23	LONG TERM DEBT	69.18	64.66	60.14	55.62	51.10	46.58	42.06	37.54	(4.52)	(8.30)
24	DEFERRED TAXES	7.47	6.29	7.18	8.20	9.37	10.69	12.21	13.94	1.03	11.33
25	MISC LIABILITIES	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
26	EMPL. BENEFIT RESERVES	5.33	5.55	6.33	7.23	8.26	9.43	10.77	12.29	1.01	13.30
27	DEFICIT FUNDS	0.00	72.60	113.59	161.86	217.20	280.66	353.45	436.96	59.76	962.93
28	TOTAL LIABILITIES	217.76	292.39	347.46	412.44	487.50	574.13	674.01	789.08	79.31	19.35
29	PREFERRED STOCK	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
30	COMMON STOCK	5.39	5.39	5.39	5.39	5.39	5.39	5.39	5.39	0.00	0.00
31	CAPITAL SURPLUS	82.26	82.26	82.26	82.26	82.26	82.26	82.26	82.26	0.00	0.00
32	RETAINED EARNINGS	118.26	139.19	156.10	173.30	192.08	212.60	235.06	259.68	19.73	11.52
34	TOTAL EQUITY	205.92	226.85	243.75	260.95	279.73	300.25	322.72	347.33	19.73	7.55
35	*TOTAL LIAB & EQUITY*	423.67	519.24	591.21	673.40	767.23	874.38	996.72	1136.42	99.05	14.63
36	NET WORKING CAPITAL	123.10	163.06	189.60	219.89	254.48	293.98	339.08	390.57	36.91	17.02
	INCOME & EXPENSE										
38	SALES	533.83	609.54	695.99	794.69	907.40	1036.08	1183.02	1350.80	115.70	14.18
40	COST OF GOODS	283.92	332.18	379.29	433.08	494.50	564.63	644.70	736.13	63.64	14.41
41	GROSS PROFIT	249.91	277.36	316.70	361.62	412.90	471.46	538.32	614.67	52.07	13.91
42	S G & A EXPENSE	123.48	133.06	151.93	173.48	198.08	226.18	258.25	294.88	24.68	13.63
43	R & D EXPENSE	56.21	68.39	78.09	89.17	101.81	116.25	132.74	151.56	13.29	14.79
44	DISCONT. PRODUCT LINE	5.93	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(0.49)	(84.67)
45	OPERATING PROFIT	64.28	75.91	86.68	98.97	113.00	129.03	147.33	168.22	14.59	14.50
46	DEPRECIATION	22.71	22.33	28.15	32.15	36.71	41.91	47.86	54.64	4.73	14.38
47	LEASE PAYMENTS	10.30	13.31	15.19	17.35	19.81	22.62	25.82	29.49	2.64	15.36
48	INTEREST EXPENSE	7.28	9.09	15.90	19.55	23.92	29.01	34.90	41.73	4.93	28.32
49	MISC EXPENSE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
51	ROYALTY & OTHER INCOME	16.61	12.00	9.00	7.00	7.00	7.00	7.00	7.00	(1.17)	(10.69)
53	PRETAX PROFIT	40.60	43.18	36.43	36.92	39.56	42.49	45.75	49.36	1.13	2.64
54	INCOME TAXES	15.83	17.44	14.71	14.91	15.98	17.16	18.48	19.94	0.50	2.94
55	EXTRAORD. ITEM	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
56	NET PROFIT	24.76	25.74	21.71	22.01	23.58	25.33	27.27	29.43	0.63	2.44

DATAQUEST, INC. F I N A N C I A L A N A L Y S I S 19 JULY 1979

COMPANY: FAIRCHILD CAMERA AND INSTRUMENT CORP. AUDITOR: PRICE WATERHOUSE & CO
DATA SOURCE: ANNUAL REPORTS & 10K'S FIGURES IN: MILLIONS BY: D. K. PAUL

PROJECTED FUNDS FLOW

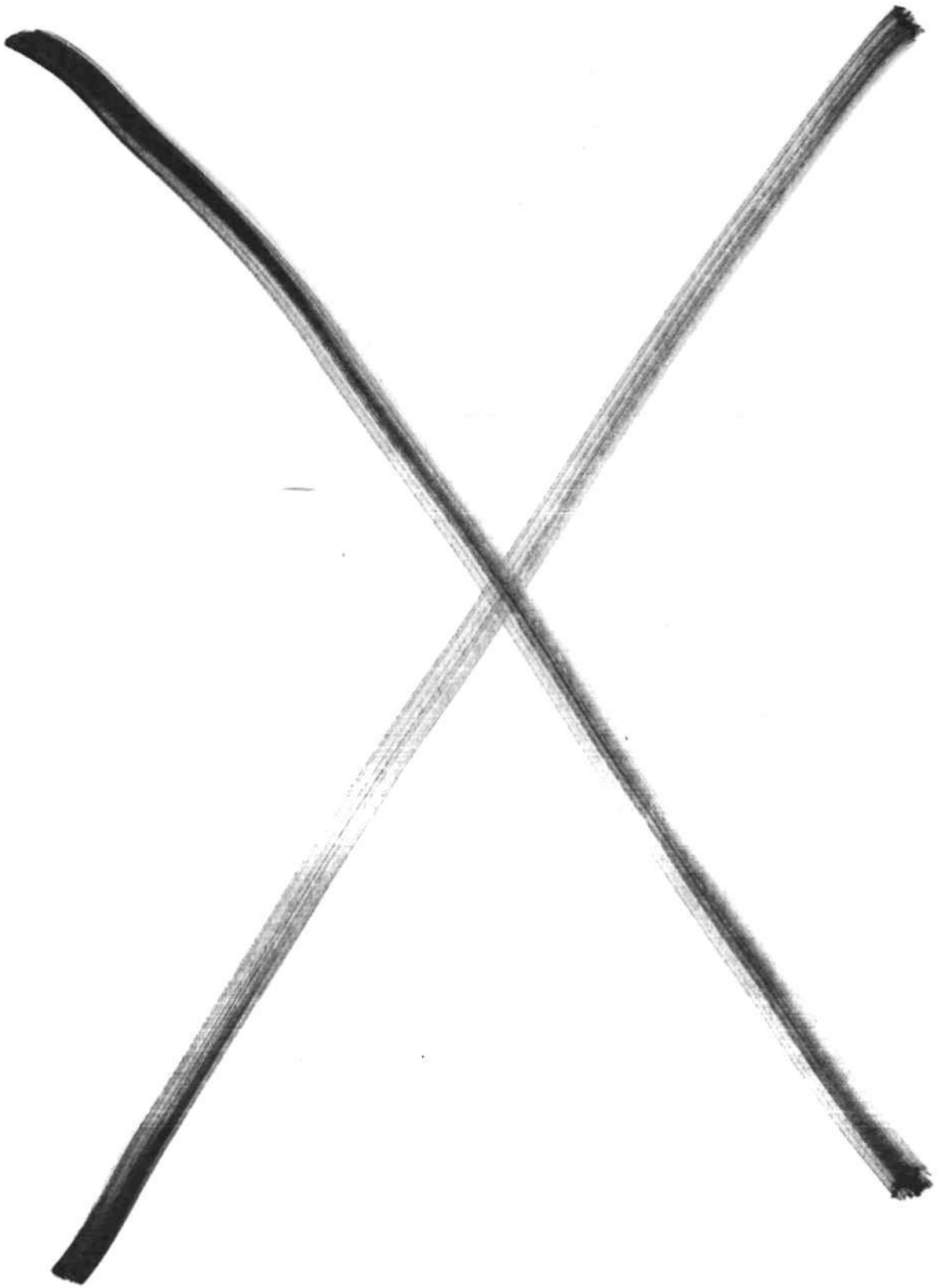
REF	ITEM	1979	1980	1981	1982	1983	1984	1985	TREND	CMPD GR
	SOURCES									
56	NET PROFIT	25.74	21.71	22.01	23.58	25.33	27.27	29.43	0.91	3.63
46	DEPRECIATION	22.33	28.15	32.15	36.71	41.91	47.86	54.64	5.22	15.40
61	NEW LONG TERM DEBT	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
62	NEW EQUITY	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
63	INCR OTHER LIABILITIES	(0.96)	1.68	1.92	2.19	2.50	2.85	3.26	0.56	*********
66	TOTAL SOURCES	47.11	51.55	56.08	62.48	69.74	77.98	87.33	6.68	10.90
	USES									
67	P P E EXPENDITURES	70.42	56.68	64.72	73.90	84.38	96.35	110.01	7.78	9.98
68	REPAYMENT LONG TERM DEBT	4.52	4.52	4.52	4.52	4.52	4.52	4.52	0.00	0.00
69	PREFERRED DIVIDENDS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
70	COMMON DIVIDENDS	4.81	4.81	4.81	4.81	4.81	4.81	4.81	0.00	0.00
72	INCR WORKING CAPITAL	39.96	26.53	30.29	34.59	39.50	45.10	51.49	2.89	7.74
71	INCR OTHER ASSETS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
74	TOTAL USES	119.71	92.54	104.34	117.82	133.20	150.77	170.83	10.67	)8.51
75	EXCESS/DEFICIT	(72.60)	(40.99)	(48.27)	(55.34)	(63.46)	(72.79)	(83.51)	(3.98)	6.80
76	CUMULATIVE SUR/DEF	(72.60)	(113.59)	(161.86)	(217.20)	(280.66)	(353.45)	(436.96)	(60.41)	34.05

REF	ASSUMP ITEM	OPTION		VALUES
1	CASH & LIQUID SECURITIES	6	PCT SALES,HIST	9.075557534
3	RECEIVABLES	6	PCT SALES,HIST	18.03301663
4	INVENTORY	6	PCT SALES,HIST	20.44659555
5	OTHER CURRENT ASSETS	6	PCT SALES,HIST	0.7912134568
6	PREPAID INCOME TAX	6	PCT SALES,HIST	1.914137319
9	GROSS P P E	6	PCT SALES,HIST	44.31924958
12	MISC ASSETS	11	NO CHANGE	22.436
13	INVEST JOINT VENTURES	11	NO CHANGE	4.513
16	NOTES PAYABLE	11	NO CHANGE	19.497
17	ACCOUNTS PAYABL+	6	PCT SLES,HIST	5.593203943
*18	ACCRSED TAXES	6	PCT SALES,HIST	4.263603072
19	ACCRUED LIABILITIES	6	PCT SALES,HIST	6.198973841
20	CURR MAT LONG TERM DEBT	11	NO CHANGE	4.52
21	ACCRUED COMPENSATION	6	PCT SALES,HIST	3.512484955
24	DEFERRED TAXES	6	PCT SALES,HIST	1.032170255
25	MISC LIABILITIES	6	PCT SALES,HIST	0
26	EMPL. BENEFIT RESERVES	6	PCT SALES,HIST	0.9100427711
29	PREFERRED STOCK	11	NO CHANGE	0
30	COMMON STOCK	11	NO CHANGE	5.392
31	CAPITAL SURPLUS	11	NO CHANGE	82.261
38	SALES	4	HIST CMPD GR	14.18209789
40	COST OF GOODS	6	PCT SALES,HIST	54.49616986
42	S G & A EXPENSE	6	PCT SALES,HIST	21.82993137
43	R & D EXPENSE	6	PCT SALES,HIST	11.22033252
44	DISCONT. PRODUCT LINE	1	INPUT REQD	0 0 0 0 0 0 0
46	DEPRECIATION	9	PCT PR GR PPE H	10.42203752
47	LEASE PAYMENTS	6	PCT SALES,HIST	2.102959047
49	MISC EXPENSE	6	PCT SALES,HIST	0
51	ROYALTY & OTHER INCOME	1	INPUT REQD	12 9 7 7 7 7 7
55	EXTRAORD. ITEM	1	INPUT REQD	0 0 0 0 0 0 0
58	COMMON DIV PER SHARE	11	NO CHANGE	0.8
59	NO. OF COMMON SHARES	11	NO CHANGE	6010000
69	PREFERRED DIVIDENDS	11	NO CHANGE	0

INTEREST RATES: LTD+ 10 PCT NOTES PAY+ 10 PCT DEFICIT FNDS+ 10 PCT
INCREMENTAL DEBT 0 0 0 0 0 0 0
INCREMENTAL REPAY 0 0 0 0 0 0 0

Tax Rate 40.4%
Retirements -0.068

)LOAD 125 BOTTOMLINE
SAVED 17.24.21 08/11/76
NYSE ID: AMDV



5. CRUCIAL STRATEGIC QUESTION SUMMARY

This section summarizes the previous four sections and recommends a new procurement strategy. Wafer fabrication vendors are recommended for low-technology custom circuits. Capital equipment supply is deemed adequate and should have little impact on component procurement. However, it is recommended that purchasers of capital equipment check the market position of their suppliers before making commitments. We believe that most captive manufacturers will be unable to supply all of their own needs. Silicon supply is deemed adequate, but a poly silicon shortage is possible in 1981-83. Nevertheless, no action by component purchasers relative to poly silicon is recommended.

Among the major merchant vendors, there is a long term supply-demand imbalance. Purchasers will have to alter their procurement strategy dramatically to maintain supply in the future.

This section recommends a centralized approach to procurement:

- Forecast five year component requirements by technology. The ultimate objective is to translate component needs into wafer fabrication requirements.
- Stratify component needs by the type of vendor relationship required. The highest technology, highest volume components will require the most intimate relationship.
- Charter the captive facility so that it supports other needs. Keep it process-compatible with high technology suppliers to serve as a custom prototype shop and back-up.
- Organize acquisition; consolidate purchasing, inspection, and test. Schedule vendor's capacity.
- Analyze vendors to assess their strengths and weaknesses, and future plans.
- Establish vendor partnerships. Put the vendor on your team, keep him informed, and make him feel you need him.

5. CRUCIAL STRATEGIC QUESTIONS

Wafer Fabrication Summary

Capital Equipment Summary

Materials Summary

Merchant Supplier Summary

What To Do

Source: DATAQUEST, Inc.
July 1979

A MULTI-LEVEL APPROACH TO COMPONENT ACQUISITION IS REQUIRED:

Make-It-Yourself

Your Tooling on Purchased Wafers

Intimate Relationship with Major Vendor(s)

Conventional Procurement

Distributor Inventory Buffer

Source: DATAQUEST, Inc.
July 1979

WAFER FABRICATION SUMMARY

Not Cutting Edge Technology

Best Price is not Best Security

Multi-Sources Possible

Mostly MOS

High Trust Relationship Needed

Customers Must Sell Vendors on Technical Capability

Capital Problems with Vendors

Vendors May Disappear Through Merger

Source: DATAQUEST, Inc.
July 1979

WAFER FABRICATION CONCLUSIONS

It Has A Place: Low Technology Custom

Keep Your Vendor Viable:

- Adequate Prices
- Capital Infusions

Independent Founderies May Attract Technical Talent Through Stock Options

Source: DATAQUEST, Inc.
July 1979

CAPITAL EQUIPMENT SUMMARY

Emerging Large Sophisticated Suppliers

Lead Times Increasing

Supplier and Technology Selction Important

Equipment Procurement in Competition with Merchant Suppliers

Difficult for Captives to Increase Share of Wafer Starts

Perkin-Elmer - A Major Equipment Supplier

Supply Appears Adequate

Source: DATAQUEST, Inc.
July 1979

CAPITAL EQUIPMENT CONCLUSION

Need Two Year Technology Horizon

Vendor/Technology Selection Important For DEC

Technology Insights May Be Gained Through Close Vendor Relationships

Not Possible To Make All Your Own Semiconductors

Source: DATAQUEST, Inc.
July 1979

MATERIALS SUMMARY

Polished Silicon Wafer Availability Good

Possible Poly Shortage 1981-1983

Limited Shortages Of Lead Frames

Source: DATAQUEST, Inc.
July 1979

MAJOR MERCHANT VENDOR SUMMARY

Chronic Long Term Supply-Demand Imbalance

Minimum Production Volume Per Design Increasing

Universal Aversion To Custom

Highest Available Production Technology

Will Take Customer Tooling With Right Business Relationship

Fewer Vendors In Each Technology

Long Lead Time On New Capacity

Nickel And Dime Purchasing Is Passé

New Relationships On Capacity Commitments

- Take or Buy
- Lease A Line

All Majors Except National Have A Corporate Investor

Source: DATAQUEST, Inc.
July 1979

MAJOR MERCHANT VENDOR CONCLUSIONS

Select Vendor, Technology Carefully

Put The Vendor On Your Team

Worry About The Vendor's Profitability

Bring Captive Production Into Harmony With Vendor(s)

Sell Him On Your Company

Source: DATAQUEST, Inc.
July 1979

WHAT TO DO

Forecast

Stratify

Charter Captive

Organize Acquisition

Analyze Vendors

Establish Vendor Partnership

Source: DATAQUEST, Inc.
July 1979

FORECAST

Five Year Product Forecast

- Includes those yet to be developed
- By Model
- By Year
- Highest, Lowest, Expected Production
- Competitive Environment

Pick The Winning Technologies

- Processing
- Manufacturing Equipment
- LSI Design
- Markets & Applications
- Economics

Choose Needed Technologies

- Minimize the number
- Establish level of need
  - Components
  - Semi-Custom
  - Custom

Source: DATAQUEST, Inc.
July 1979

STRATIFY

I. Analyze Component Usage By Product

A. Establish Component Hierarchy

1. Critical Technology-High Volume

Standard Parts
Customer Tooled Parts
Two Technologies Maximum

2. High Technology Components

Standard Parts
High Volume
Vendor Semi-Custom
LSI "Glue": PROM, ROM, PLA, FPLA, PAL

3. Wafer Foundry Custom

4. Declining Commodities

DTL
RTL
H Series Shottkey

5. "Niche" Parts

Sensors
Optoelectronics
Power Transistors
Zener Diodes

B. Develop Strategies By Categories

Source: DATAQUEST, Inc.
July 1979

CHARTER CAPTIVE

Make What You Can't Buy

- Critical Technology Custom
- El-Unique-O Technology

Maximum Two Technologies Per Facility

Critical Technology Must Mask-Match Vendor

Sell Captive Technology Internally

Develop Corporation-Wide Design Capability

Establish Interfaces To Captive Line

- Transfer Prices
- Design Rules
- Competition

Adjust Charter As Plans Develop

Source: DATAQUEST, Inc.
July 1979

ORGANIZE ACQUISITION

Put The Vendor On Your Team

Establish Engineer-Engineer Communication With Class 1, 2, and 3 Vendors

Charter For Service, Not Cost

Corporate Presence In Silicon Gulch, Silicon Arroyo, Silicon Panhandle

Consolidate: Purchasing, Inspection, Test, Inventory, Specification (Univac-SCF does a good job)

Control Component Usage

Schedule Capacity At Class 1, 2, and 3 Vendors And Captive Line

Staff With Intelligent People

Execute At All Levels

Communicate Strategy To Design Engineers

Source: DATAQUEST, Inc.
July 1979

ANALYZE VENDORS

Technological Strengths

Competitors

Ownership

Investments In New Technology

Planned Expansion

Other Long-Term Commitments

Working-Level Chemistry

Conflict With Vendor's System Efforts

Source: DATAQUEST, Inc.
July 1979

ESTABLISH VENDOR PARTNERSHIP

Top Level Communication

Discussion Of Mutual Goals - "Open Kimono"

Long Term Contracts

Convince Vendor Of Your Concern For His Success

"I Need You"

Reverse Sell - "We Will Have A Leading Position In Growth Markets"

Establish Belly-to-Belly Technical Liason

Develop Bargaining Chips

Source: DATAQUEST, Inc.
July 1979

HAPPENINGS

Intel's Top 20 - No Shortage Of 16K Dynamics

Apple Computer Feeding At The Same Trough As IBM

Datapoint - Major Supplier: An Extra 10¢

Milton Bradley - No Parts

Cray Pays With Stock

Perkin Elmer Pay With Aligners

IBM Caribou Program
5 Year Min/Max Expected

GM Oral Discussion

Memorex

Source: DATAQUEST, Inc.
July 1979

BARGAINING CHIPS

CAD Software

General Software - Applications Of Microprocessors

Overflow Wafer Processing

Computers For Parts

Rights To Proprietary Array Designs

A Friendly Customer For New Technology, Software, Relationships

Insight Into Other Sources Of Business

Money

Big Buys

Source: DATAQUEST, Inc.
July 1979

THE OPEN KIMONO

USER TELLS:

1) 5-Year Product Plans Plus/Minus Expected
2) Structure Of The Market
3) Reasons For Wanting Technology
4) Usage Of Components As Derived
5) How Components Are To Be Acquired

VENDOR TELLS:

1) Technological Plans 1-3 Years
2) Developmental Products
3) Total Manufacturing Capacity In Wafers By Technology
4) Planned Additions To Capacity
5) Standard Yields By Die Size Present and Projected
6) Capacity That Can Be Made Available

Source: DATAQUEST, Inc.
July 1979

BUY A COMPANY

The Ultimate Open Kimono

Desired Acquisitions Will Come From Preceeding Analyses

A Part Of The Solution--Not The Solution

Source: DATAQUEST, Inc.
July 1979

HOW TO GET THE VENDOR'S ATTENTION

Make A Plan

Organize

Normalize Usage

Extrapolate

Yell

Source: DATAQUEST, Inc.
July 1979