

12th Annual Seminar

SEMICON/West Sheraton Palace Hotel San Francisco, California July 21, 1993

# '93 SEMICON/West Seminar: Status 1993

Sponsored by Dataquest's Semiconductor Equipment, Manufacturing, and Materials Service

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#### **Program**

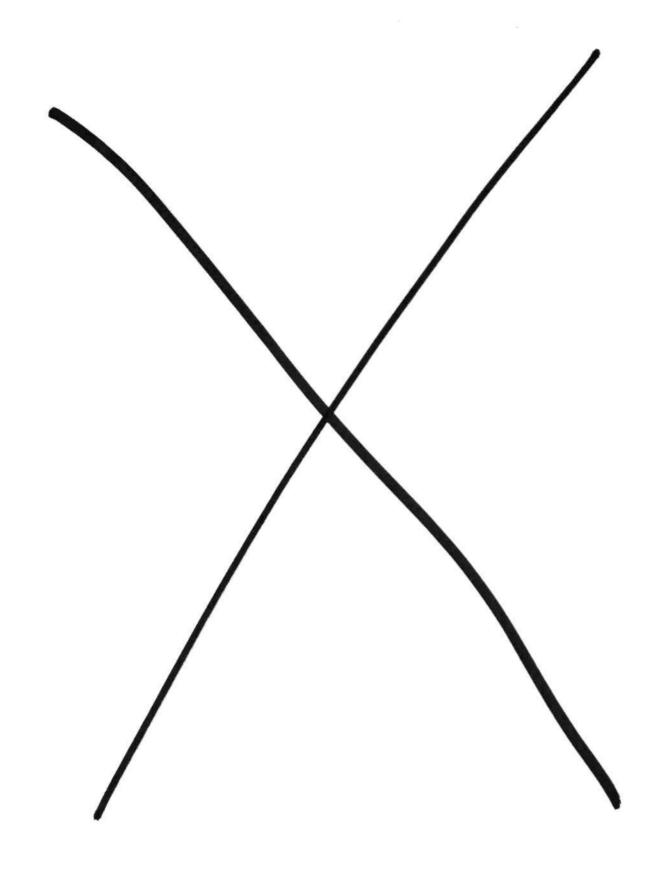
Complete Agenda

#### **Presentations**

Slides and Notes

#### Attendees

Attendee List by Company



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#### ATTENDEES' SURVEY

#### 1993 SEMICON/WEST SEMINAR

In order to continually improve the Semiconductor Equipment, Manufacturing, and Materials SEMICON/West Seminar, we must better understand your information needs. Please help us by completing the following questionnaire. We would appreciate it if you would list your company name and/or attach your business card.

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8.	Peggy Marie V "The New Ord		tructural Change	e in the Semicono	fuctor Industry*
	Content:	Excellent	Good	Fair	Poor
	Presentation:	Excellent	Good	Fair	Poor
	Comments:				
b.	Charles Bouch "Dealing With	er The High Cost (	of Wafer Fab E	quipment"	
	Content:	Excellent	Good	Fair	Poor
	Presentation:	Excellent	Good	Fair	Poor
	Comments:				
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c.	Krishna Shank A Wall Street l	ar Perspective on th	ne Semiconduct	or Industry	
	Content:	Excellent	Good	Fair	Poor
	Presentation:	Excellent	Good	Fair	Poor
	Comments:				<u> </u>
d.	Lane Mason "Making More Next Year?"	in '94: Will Re	cent Investment	Levels support I	ORAM Market Growth
	Content:	Excellent	Good	Fair	Poor
	Presentation:	Excellent	Good	Fair	Poor
	Comments:				· · · ·
e.	Greg Sheppard "New Markets	for Chips: The	Growth Continu	ecs"	
	Content:	Excellent	Good	Fair	Poor
	Presentation:	Excellent	Good	Fair	Poor
	Comments:				

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Please rate the speakers:

#### SEMICON/West Seminar: Status 1993

July 21, 1993 Sheraton Palace Hotel San Francisco, California

#### Wednesday, July 21

7:30 a.m. Registration and Continental Breakfast

8:00 a.m. Welcome

Peggy Marie Wood, Ph.D. Director/Principal Analyst

Semiconductor Equipment, Manufacturing, and Materials Service

8:10 a.m. The New World Order: Surviving Structural Change in the Semiconductor Industry

Peggy Marie Wood, Ph.D. Director/Principal Analyst

Semiconductor Equipment, Manufacturing, and Materials Service

8:55 a.m. Dealing With The High Cost of Wafer Fab Equipment

Charles Boucher, Ph.D. Senior Industry Analyst

Semiconductor Equipment, Manufacturing, and Materials Service

9:40 a.m. A Wall Street Perspective on the Semiconductor Industry

Special Guest Speaker: Krishna Shankar

Vice President, Equity Research

Salomon Brothers

10:10 a.m. Coffee Break

10:30 a.m. Making More in '94: Will Recent Investment Levels Support

DRAM Market Growth Next Year?

Lane Mason

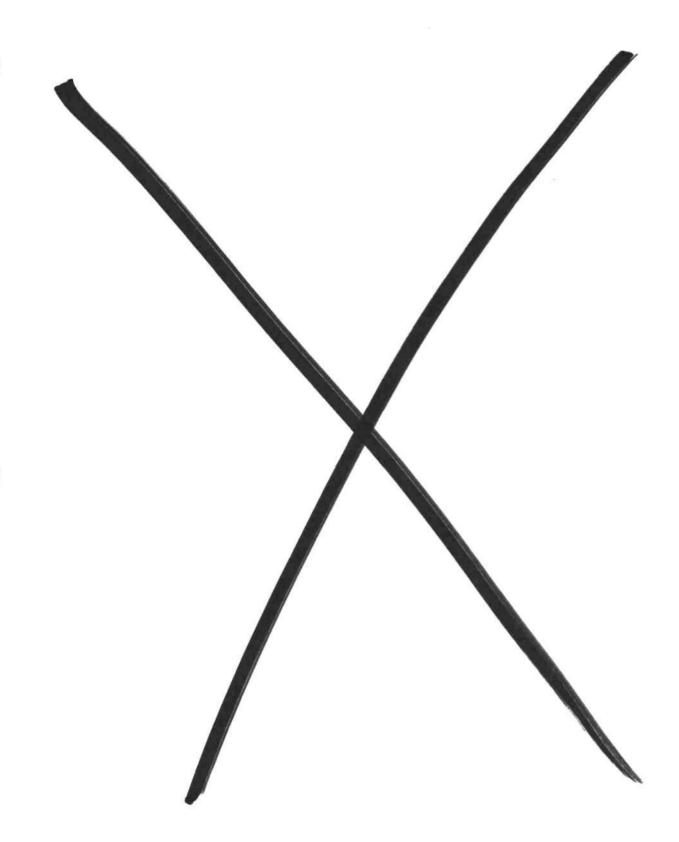
Director/Principal Analyst Semiconductor Memories

11:00 a.m. New Markets for Chips: The Growth Continues

Gregory L. Sheppard Director/Principal Analyst

Semiconductor Application Markets

11:30 a.m. Session Concludes



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#### Advantest America, Inc.

Jack Jania Multimedia Service Group Leader Robert Lee Product Marketing Manager

#### Air Liquide

Michel Madsac International Business Development Manager

#### Air Products and Chemicals, inc

Arthur Katsaros Vice President and General Manager, Electronics Division

#### Applied Materials, Inc.

Dana Ditmore
Vice President, Sales
Don Fuller
Marketing Manager/ACET Division
Michael G. Musson
Director, Investor Relations
Steve Newberry
Vice President
Rich Tauber
Director of Strategic Programs

#### **Applied Materials Europe**

Steve Lindsay President

#### AT&T Microelectronics de Espana

Emilio Martinez David A.Oneda

#### BP Chemicals, Inc.

Robert H. Metter Operations Manager

#### **Capital Associates**

Richard Abernathy
Manager, Equipment Valuation

#### CFM Technologies, inc.

Pam McCardell National Sales Manager

#### Cirrus Logic, Inc.

Michael Canning
Executive Vice President

#### Cisco Systems, Inc.

Robert Vellios Strategic Commodity Specialist

#### **Cymer Laser Technologies**

Uday Sengupta Vice President, Marketing

#### Daymarc

Mel Bosch President Kevin Brennan Product Manager

#### **DuPont**

Pankaj Mehta
Development Specialist
David Peet
Market & Development Manager
Greg Pfister
Industry Manager

#### **Eaton Corporation**

Ian Morris Manager Business Development

#### Edwards High Vacuum

Robert Adams
Vice President of Marketing

#### EKC Technology, Inc.

Kathy Warrick Vice President, Business Development

#### ESI

Russell Schlager
Product Marketing Manager

#### Fluoroware, inc.

Dave Ring Sales Manager

#### Fresh Quest Corporation

Dan H. Higgins Vice President, Chief Technical Officer

#### FSI International, Inc.

Peter Pope
Executive Vice President
Laurie Walker
Marketing Services Manager

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#### G.E. Capital Corporation

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#### GaSonics/IPC

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#### **Hemlock Semiconductor**

Duane Townley Vice President

#### **Hewlett-Packard Company**

Jim Lee Procurement Engineer

#### Hill & Knowlton

Bruce LeBoss
Senior Vice President, Adv. Tech. Practice Director

#### Independent Equipment Company

Jane Holland

Marketing Associate

#### **Integrated Circuit Systems**

James Donaghy
Vice President, New Business

#### **Intel Corporation**

Ryan Hoover
Industry Analyst
Young-Joon Kim
Senior Industry Analyst
Tzu-Ting Mau
Senior Technology Analyst
Eiichi Shibasaki
Senior Research Analyst
Jacques Vuye
Group Manager, Strategic Research

#### Karl Suss America, Inc.

Peter Heinz Vice President and General Manager

#### Kobe Steel USA, Inc.

Mike Goto Director

#### Kulicke & Soffa Industries, Inc.

Barbara Leff
Vice President, Administration

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Senior Vice President of Finance, CFO
Karl Heiman
Product Marketing Manager
Karen McLennan
Marketing Communications Manager
John Osborne
Vice President
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Carolyn Schwartz
Investor Relations Manager
Larry Stewart
Business Unit Manager for CVD

### Leybold Inficon

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Werner Sharp Vice President of Engineering

Vice President of Operations

#### **LSI Logic Corporation**

Gary Bonham
Manager, Competitive Analysis
Dawn Chuck
Market Research Analyst
Ken Dalle-Molle
Market Research Analyst

#### **Materials Research Corporation**

Edward Erny
Director of Marketing

#### Mitsubishi EDG

Michael Bocian
Vice President, Sales

#### **MKS** Instruments

John D. Dunn Vice President

#### **Montgomery Securities**

Brett Hodess Semiconductor Cap. Equip. Analyst

#### Mosel Vitelic, Inc.

Alex Au President, CEO

#### **National Semiconductor Corporation**

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Executive Vice President of Analog Operations

#### **HCR Microelectronics Products Division**

Gayle Miller Manager, Process Development

#### Nicolet Instruments Corporation

Joni Hansen

Marketing Communications

#### **Hikon Corporation**

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#### Prayair

Thomas Nelson Process Manager, Electronics

#### Prism Technologies, Inc.

Bobby Greenberg
President

#### **Prometrix**

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#### SAES Pure Gas, Inc.

Francesco Della Porta CEO

#### Salomon Brothers, Inc.

Douglas Brengel Managing Director

#### Santa Clara Plastics

Peter Gaudette
Director of Customer Relations & Resource
Administration

#### Schumacher

Lita Shon Technical Marketing Manager

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President and CEO

#### Seki Technotron

Makoto Seki Office Manager

#### SEMATECH

Sam Harrell Chief Strategy Officer

#### SEMI

Eric Samuelson SEMI/SEMATECH

Vickie Farr

Systems & Communications Coordinator

Peggy Haggerty

Vice President, Public Policy

#### Semiconductor Industry Association

Doug Andrey

Director of Industry Statistical Programs

#### SECCAL, Inc.

Bern Beecham

Liaison

Cheryl Lathrop

President

#### **Sigma Partners**

Cliff Haas

Partner

#### Solectron

Cliff Bloch

Director of Supply Base Manager

Larry Supan

Supply Base Manager

Sam Ung

Supply Base Manager

#### Solitec, inc.

William Parrette

General Manager

#### SVG Lithography Systems, Inc.

Victor Bunze

Director of Marketing

#### Swagelok Company

James Hawley

Manager, Semiconductor Sales & Marketing

#### The Source/GE Capital

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General Manager

#### Toshiba America Electronic Corporation

Allan Cox

Vice President, Technology Planning

#### Tosoh SMD, Inc.

**Bruce Nelson** 

Vice President, Marketing

#### **U.S. Department of Commerce**

Erin Finn

Trade Analyst

Wendy Silberman

U.S. Trade Representative

#### **US Leasing Corporation**

Frances Johnson

Residential Analyst

Colleen Lusian

Manager, Asset Management REG

Nita Poonian

Residential Analyst

#### Varian Associates, inc.

Geri Actor

Manager, Technology Programs

William Johnson

Vice President, Sales

Boris Lipkin

Vice President/General Manager

Dr. Tia-Men Pang

#### **Vertex Semiconductor**

Timothy Blum

Market Research Analyst

#### Watkins-Johnson Company

E. Ronald Dornseif,

Director, Strategic Programs

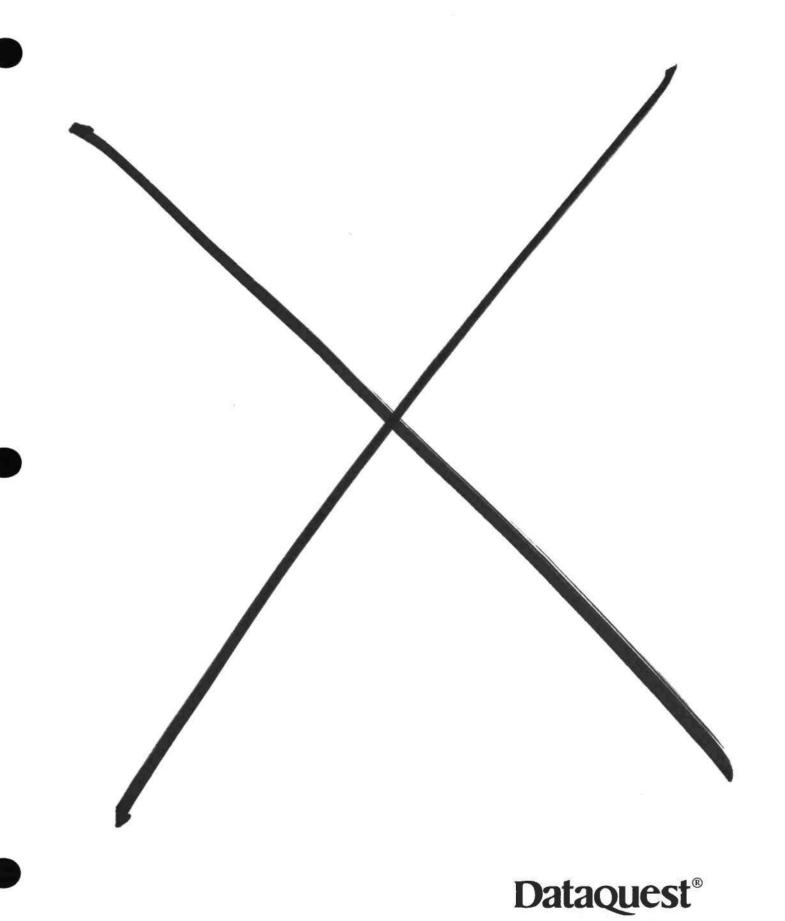
Kurt Lightfoot

Director, Marketing

#### Wells Electronic, Inc.

Rich Mullin

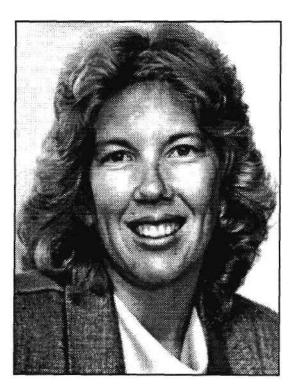
President



The New World Order: Surviving Structural Change in the Semiconductor Industry

Peggy Marie Wood
Director and Principal
Analyst Semiconductor
Equipment, Manufacturing,
and Materials Service
Dataquest Incorporated

Ms. Wood is Director and Principal Analyst for Dataquest's Semiconductor Equipment, Manufacturing, and Materials service. Her responsibilities include research and analysis of the semiconductor industry with respect to wafer fabrication equipment, electronic materials for semiconductor processing, and the technology trends of semiconductor manufacturing. Prior to joining Dataquest, Ms. Wood was a postdoctoral research affiliate in the Department of Chemistry at Stanford University. While at Stanford, she supervised the installation of new research facilities and was responsible for the purchase of optical, electronic, and laser equipment. In addition to pursuing her own research in nonlinear chemical dynamics, Ms. Wood taught undergraduate laboratory courses and supervised graduate student research. Ms. Wood received a B.S. degree in Chemistry from California State University at Sacramento and a Ph.D. in Chemistry from Stanford University.



The New World Order: Surviving Structural Change in the Semiconductor Industry:



### The New World Order: Surviving Structural Change in the Semiconductor Industry

Peggy Marie Wood, Ph.D.
Director/Principal Analyst
Dataquest Incorporated

SEMICON/West 1993 — San Francisco, California

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# Agenda

- The New World Order
- Regional market dynamics
- New ground rules for the 1990s
- Technology in transition
- Equipping your survival kit
- Summary

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The New World Order:

Surviving Structural Change

· in the Semiconductor Industry



- End of the Cold War and breakup of the former Soviet Union
- Europe in flux
  - German reunification
  - Europe 1992
- · Japan's bubble economy bursts
- Emergence of Greater China

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• A Democrat in the White House

Chinese proverb: "May you live in interesting times"

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The New World Order: Surviving Structural Change in the Semiconductor Industry

### Changes in the Electronics Industry

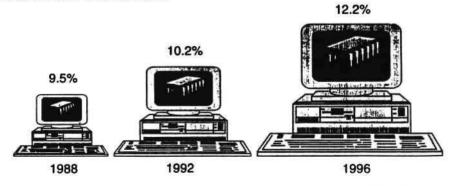
- Top end of the computer industry collapses
- Is Japan's time at the top over?
  - NEC's dominance of Japanese PC market threatened by landing of U.S. PC companies
  - Struggling to find next big consumer electronics product
- Europe plagued by economic woes
  - European semiconductor market to be surpassed by Asia/Pacific in 1993
- U.S. companies driving new emerging markets for multimedia, wireless communications (with Europe), and pen computing

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### Semiconductor Pervasiveness

Device Revenue as a Percentage of Worldwide Electronics Production



Source: Dataquest

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The New World Order:Surviving Structural Changein the Semiconductor Industry

# Regional Market Dynamics

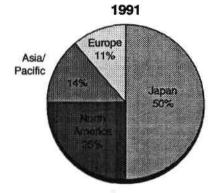
- What happened in 1992?
- · Forecast and outlook

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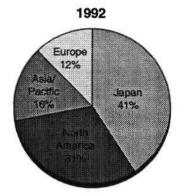
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# Regional Wafer Fab Equipment Markets: 1991 and 1992



Total = \$6.02 Billion



Total = \$5.09 Billion

Source: Dataquest

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### Wafer Fab Equipment: What Happened in 1992?

- Worst year ever in Japan: 31% decline
  - Regional economic woes
  - Significant fab capacity overhang
- Asia/Pacific: 4% decline
  - A pause in the spending frenzy
- Europe: 2% decline
  - Sluggish overall, but Intel spends heavily on Ireland fab
- North America the one bright spot: 3% growth
  - Tight fab capacity continues into 1993

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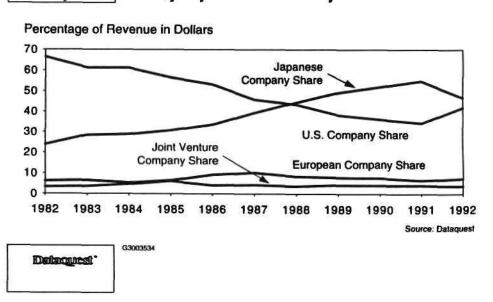
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Source: Dataquest

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- in the Semiconductor Industry

# Worldwide Market Share of Regional Wafer Fab Equipment Companies



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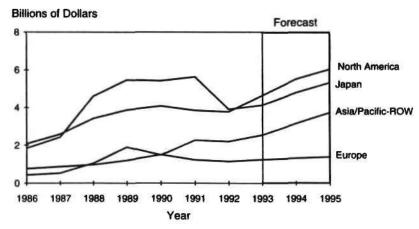
The New World Order: Surviving Structural Change in the Semiconductor Industry:

# 1992 — A Return to Health for the U.S. Wafer Fab Equipment Industry?

- . U.S. company share increases for first time in a decade
  - U.S. gain mirrored by Japanese company loss
- Still signs of sustained weakness in U.S. supplier base
  - Disproportionate decline in worldwide Japanese company share because of domestic market woes
  - U.S. share increase not broad-based

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# Regional Semiconductor Capital Spending—Merchant and Captive

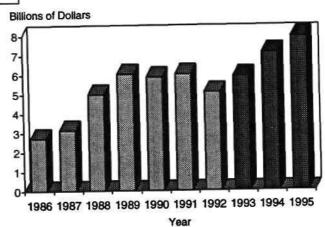


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Source: Dataquest

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# Worldwide Wafer Fab Equipment Market



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Source: Dataquest

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# New Ground Rules for the 1990s

- New ground rules for device manufacturers
- Implications for the wafer fab equipment market

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### New Ground Rules for a Maturing Semiconductor Industry

- R&D, fab, and manufacturing costs escalating
- Thin margins on commodity products
- Return on R&D, fab investment takes longer
- Pure technology no longer enough to differentiate products

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# How Semiconductor Manufacturers Are Adapting

- Development of technology, products, and manufacturing resources strongly driven by cost
  - Greater sharing of process/equipment across product lines ("harmonious" technology development)
  - Longer life cycle for plant and equipment
  - Standardization

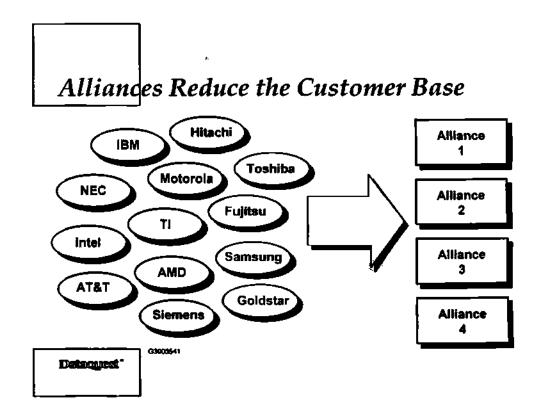
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Multinational alliances

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# Changing Market Conditions for the Wafer Fab Equipment Industry

- Alliances reduce the number of customers
- Fewer megafabs reduce TAM for equipment
- Shift from memory to ASIC/logic reduces TAM for equipment
- Changing device mix drives demand for specific equipment segments
- Equipment evaluation is more sophisticated

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Surviving Structural Change
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# Technology in Transition

• Dual technology drivers

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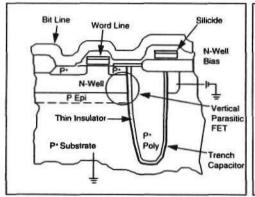
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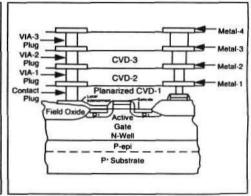
• Technology for technology's sake no longer sufficient

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# Diverging Memory and Logic Device Structures

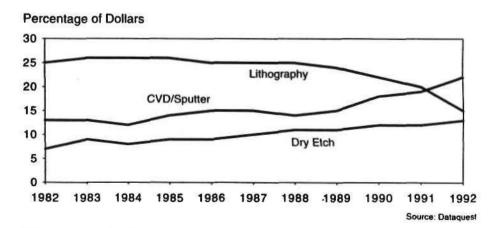




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Source: IEDM Dataquest

### Key Segments as a Percentage of Total Wafer Fab Equipment Spending



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### Technology for Technology's Sake Is Not Enough

- Other vital issues at stake for long-term success
  - Reputation for quality
  - Field applications service and support
  - Servicing an international customer base
  - Cost of ownership
  - Long-term financial viability
- Whatever happened to ...
- GCA a case in point

Definition (1993)

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The New World Order: Surviving Structural Change in the Semiconductor Industry:

Equipping Your Survival Kit

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# Survival Tips

- Keep your eye on the ball
- Gain weight
- Carry a ladder
- Be a friend to the Earth
- Don't forget your membership card

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# Target Key Market Opportunities

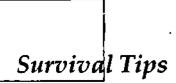
"Keep Your Eye on the Ball"

- Products that reduce manufacturing costs
  - Process simplification
  - Increased life cycle for plant and equipment
  - Reduced cost of ownership
- Products that target new manufacturing strategies
  - Modules for the cluster environment
- · Products that target changing device markets
  - Multilevel interconnection for highly integrated devices (advanced logic, ASIC, ASSP)

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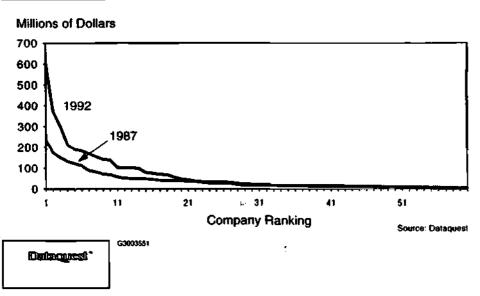
The New World Order: Surviving Structural Change in the Semiconductor Industry:



- "Keep your eye on the ball"
  - Target key market opportunities
- "Gain weight"
  - Establish critical mass

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# Critical Mass in the Wafer Fab Equipment Industry



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# Horizontal and Vertical Partnering

"Carry a Ladder"

- Partnering the economic reality of the 1990s
- Vertical partnering
  - Share the burden, risks, and rewards of new technology development
- Horizontal partnering
  - Leveraging capabilities of small companies
    - Cluster module opportunities
  - Even the big guys are doing it
    - Major device manufacturers
    - Canon and Silicon Valley Group

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### Semiconductor Industry Is Going Green

#### "Be a Friend to the Earth"

- Concern over ozone depleting etch gases and cleaning products
- SEMICON/Southwest 92 environmental focus
- SEMATECH receives mandate from U.S. Congress
- How "green" is your equipment?
  - Could be the deciding issue in equipment purchase

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# Survival Tips

- "Keep your eye on the ball"
  - Target key market opportunities
- "Gain weight"
  - Establish critical mass
- "Carry a ladder"
  - Horizontal and vertical partnering
- "Be a friend to the Earth"
  - Semiconductor industry is going green
- "Don't forget your membership card"
  - Consortia and trade organizations

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# Snapshot of the Wafer Fab Equipment Industry in Transition

1990s 1980s Regional dominance: Other regions too Japan Major device manufacturer: Intel (?) **IBM** Technology driver: DRAM Advanced logic/ **ASICs** Business philosophy: Go it alone **Partnering** Minimum stake Role of technology: Everything to play the game

Source: Dataquest

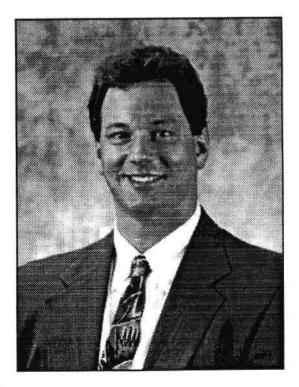
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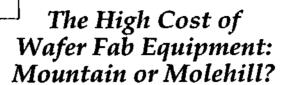
Dealing With The High Cost of Wafer Fab Equipment

Charles F. Boucher
Senior Industry Analyst,
Semiconductor
Manufacturing and
Applications Group
Dataquest Incorporated

Dr. Boucher is a Senior Industry Analyst for Dataquest's Semiconductor Manufacturing and Applications group. He is responsible for market research and analysis for the semiconductor process equipment markets, specifically thin film, etch, and diffusion process equipment. In addition, he analyzes process technology and semiconductor manufacturing trends. Dr. Boucher also participates in the analyses of semiconductor device applications in end-user equipment. Prior to joining Dataquest, Dr. Boucher was a Member of Technical Staff at Crosspoint Solutions, where he was responsible for management of domestic foundry activity, process technology development, and technology transfer from development foundries to production foundries. Before that, Dr. Boucher was marketing manager for ECL Interface Products at Integrated Device Technology. Previously, he was an engineering supervisor in the technology development group at IDT, where he was responsible for submicron CMOS and BiCMOS process integration and yield enhancement. He also worked at Harris Semiconductor as an Associate Principal Engineer, in the area of process and device development for silicon-on-insulator technology and radiation hardened technology. Dr. Boucher received a B.S. degree in Materials Science, from Brown University in 1980 and a Ph.D in Electronic Materials from the Massachusetts Institute of Technology in 1986.



# Dealing With The High Cost of Wafer Fab Equipment



Charles Boucher, Ph.D.

Senior Industry Analyst Dataquest Incorporated

SEMICON/West 1993 — San Francisco, California

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# Agenda

- Trends in manufacturing and equipment costs
- Relative cost of wafer fab investment
- Chip company financial performance
- Factors influencing the profit equation
- Dataquest conclusions

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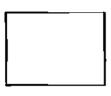
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#### A Simplified Semiconductor Business Model

- Build wafer fab
- Manufacture chips
- Sell chips
- Make money
- Mathematically stated:
  - -- Revenue -- Cost = Profit

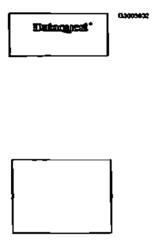
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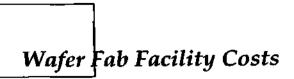
Semiconductor industry thesis:

The cost of wafer fabs and equipment is escalating faster than other costs, and is therefore inhibiting profitability

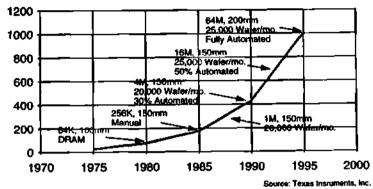


**Manufacturing Cost Trends** 

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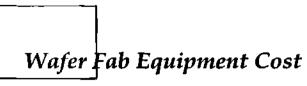


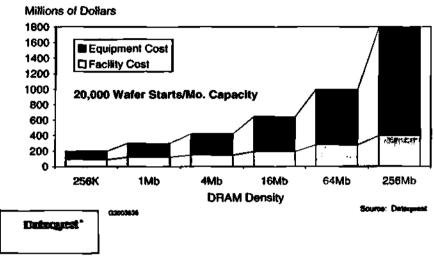




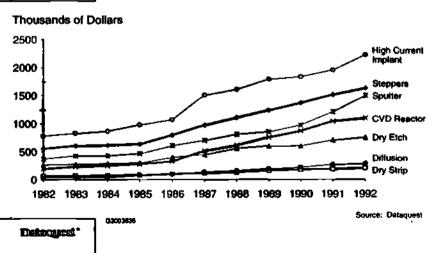
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#### Wafer Fab Equipment Price Trends

Equipment Segment	CAGR (%) 1982-1992
Stepper	11.4
Dry Strip	12.5
Dry Etch	11.2
CVD Reactor	19.1
Sputter	15.0
Diffusion	23.6
High Current Implant	11.1
Total Wafer Fab Equipment	13.7

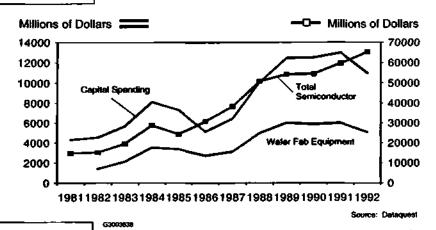
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Source: Datequest

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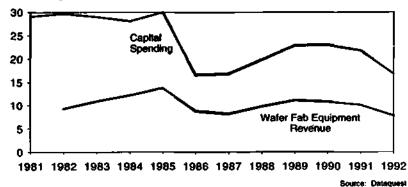
## Total Semiconductor, Capital Spending, and Equipment Markets



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## Relative Cost of Wafer Fab Equipment

#### Percentage of Total Semiconductor Revenue



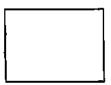
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#### Summary of Manufacturing Cost Trends

- The cost of wafer fabs has grown exponentially
- The fraction of total fab cost due to wafer fab equipment has grown and is projected to continue growing
- The price of water fab equipment has risen
- Expenditures on total capital and wafer fab equipment have remained flat to slightly down as a percentage of total semiconductor revenue
- How have semiconductor profits been impacted?

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## Financial Performance of Semiconductor Companies

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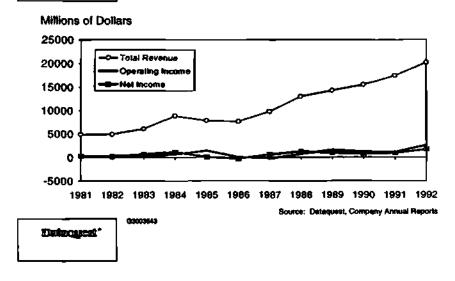
## Financial Performance of U.S. Semiconductor Companies

- How has revenue changed over time?
- How have profits changed over time?
- Breakdown of cost components: depreciable versus nondepreciable
- Productivity of semiconductor capital investment
- Analysis done on 11 U.S. companies representing 31 percent of worldwide semiconductor revenue

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## Revenue and Earnings Performance for Selected U.S. Semiconductor Companies



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## Revenue and Earnings Performance for Selected U.S. Semiconductor Companies

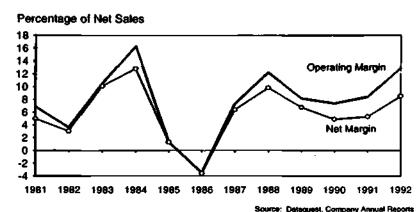
	CAGR (%) 1982-1992
Net Sales	15.1
Operating Income	30.7
Net Income	27.7

Source: Dataquest, Company Annual Reports

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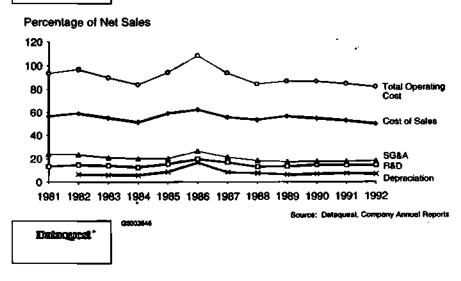
## Operating and Net Margin Trends for Selected U.S. Semiconductor Companies



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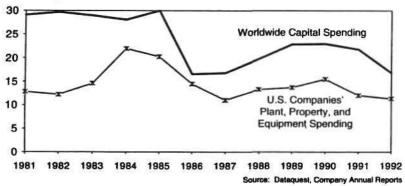
## Operating Cost Trends for Selected U.S. Semiconductor Companies



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## Capital Investment Trends for Selected U.S. Semiconductor Companies

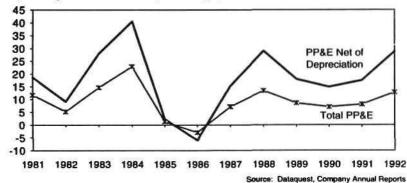




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## Capital Productivity for Selected U.S. Semiconductor Companies

#### Operating Return on PP&E (Percentage)



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#### Summary of Financial Results

- Semiconductor market has grown faster than has wafer fab equipment market
- Semiconductor profits have grown faster than has revenue
- Operating and net margins have not degraded
- Total operating costs including depreciation have remained flat
- Capital investment as a percentage of revenue has remained flat
- Return on capital investment has not degraded

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#### Other Factors in the Profit Equation

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#### Chip Profit Factors: Pluses and Minuses

#### Minuses

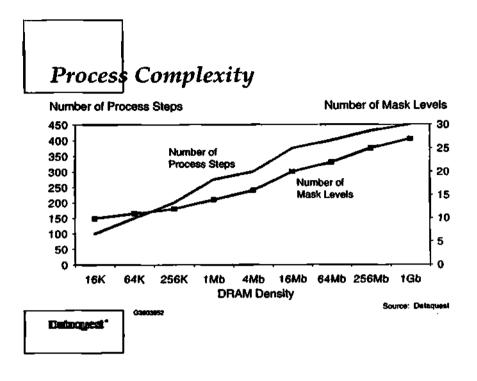
- Market factors
  - Increased global competition
- · Increased process complexity
- Higher process equipment costs

#### **Piuses**

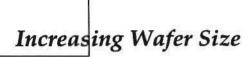
- Increasing wafer size
- Improved equipment productivity
- Improved defect control and wafer yield

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	Total Die per Water				
Die Size	5 Inch	6 Inch	8 Inch		
65 mm <sup>2</sup>	164	239	431		
82 mm <sup>2</sup>	130	186	339		
126 mm <sup>2</sup>	84	120	220		
264 mm <sup>2</sup>	39	56	102		

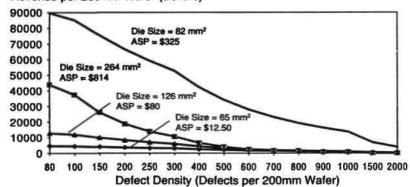
Source: Dataquest

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## Process Defects Kill Profits





Source: Dataquest

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#### Actions to Control Processing Costs

- Analyze cost of ownership rather than capital cost
- Improve equipment performance
  - --- Throughput
  - Reliability
  - Defect density
  - Consumables
- Vertical partnering for process and equipment development
- Modularize equipment to increase useful life
- Vendor-user relationship must work both ways

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#### Dataquest Conclusions

- Wafer fab equipment will comprise an increasing fraction of new fab cost
- Total investment in new fabs and equipment has remained flat as a percentage of total chip sales
- Little, if any, long-term degradation in operating income, net income, or return on capital investment
- Wafer fab equipment costs have not been a singular factor in limiting semiconductor profitability up to now

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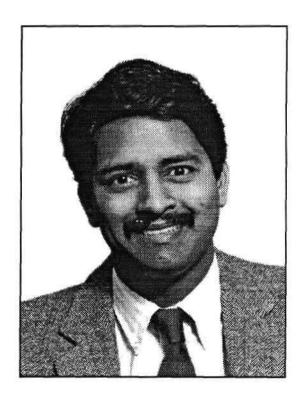
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#### A Wall Street Perspective on the Semiconductor Industry

Krishna Shankar Vice President, Equity Research Salomon Brothers

Mr. Shankar joined Salomon Brothers in April 1993 as a Vice President in U.S. Equity Research where he covers the semiconductor industry. Prior to Salomon Brothers, Mr. Shankar was a Vice President and Senior Analyst at Montgomery Securities, where he analyzed semiconductor and semiconductor capital equipment stocks. Previous to this position, Mr. Shankar was a Senior Industry Analyst at Dataquest, where he covered the semiconductor and semiconductor capital equipment industry. Mr. Shankar has worked for several years in various technology development and foundry management roles at Advanced Micro Devices and Cirrus Logic. Mr. Shankar has a B.S. degree in Chemical Engineering from IST, New Delhi, India, an M.S. degree in Chemical Engineering from the University of Southern California, Los Angeles, and an M.S. degree in Management from Stanford University.



## A Wall Street Perspective on the Semiconductor Industry

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# A Wall Street Perspective On The Semiconductor Industry

Vice President, U.S. Equity Research Salomon Brothers Incorporated

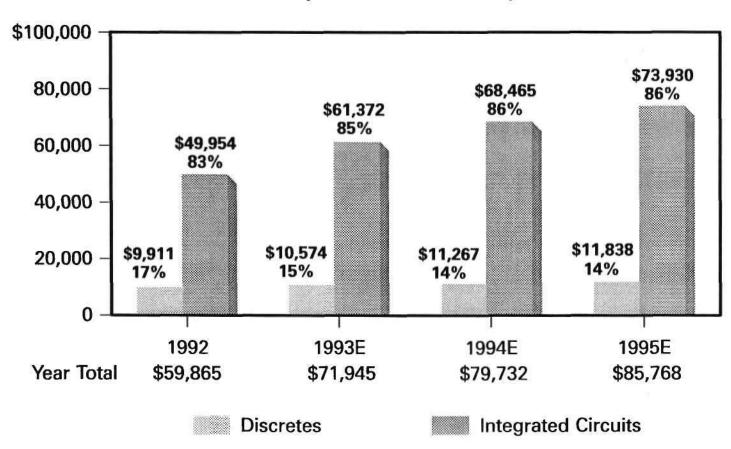
Dataquest Semicon/West Seminar
July 21, 1993
San Francisco, CA

#### Agenda

- Semiconductor Market Growth Bonanza
- Market Drivers
- Regional Trends & Market Leaders
- U.S. Semiconductors Industry Strengths
- What Constitutes Lasting Shareholder Value
- U.S. Semiconductor Stock Valuations
- Hot Products & Commodity Products
- Bellwether Stocks & Wall Street Perception
- The Moral of the Story

#### World Semiconductor Market

#### (Millions of Dollars)

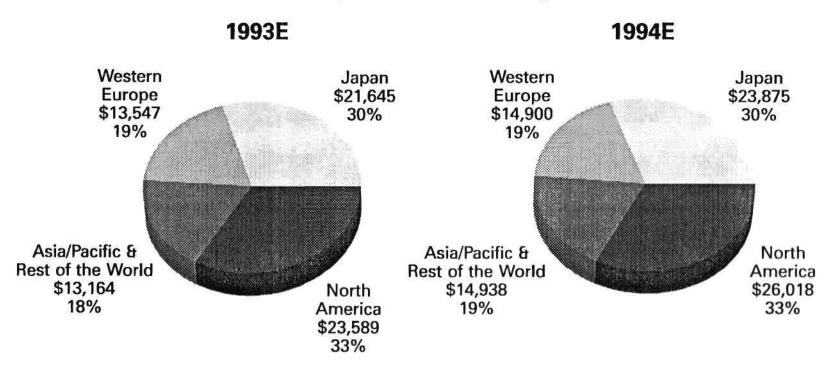


#### Market Drivers

- Booming PC Market, Low Prices, Downsizing
- Home and Business Multimedia
- Higher Semiconductor Content & Unit Volume
- Value Shift: Systems to Silicon and Software
- Productivity Enhancement: Capital vs. Labor
- NICs and Developing Region Semi Markets

#### Regional Semiconductor Markets

#### (Millions of Dollars)



Total = \$71,945

Total = \$79,732

Top 10 Semiconductor Companies

1992	1991	Company	1992 Sales	'91 - '92% Growth
#1	#3	Intel	\$5,064	26.0%
#2	#1	NEC	\$4,976	4.0%
#3	#2	Toshiba	\$4,765	4.0%
#4	#4	Motorola	\$4,635	22.0%
45	42	Hitachi	\$3,902	4.0%
9#	9#	L	\$3,052	11.0%
<b>L</b> #	<b>L</b> #	Fujitsu	\$2,583	-5.0%
8#	#8	Mitsubishi	\$2,307	%0
6#	#10	Philips	\$2,108	4.0%
#10	6#	Matsushita	\$1,929	-5.0%

Source: Dataquest

#### U.S. Industry Strength

- Increasingly High Intellectual Design/Software Content
- Microprocessors, ASSPs, Linear/Mixed Signal Devices, Field Programmable Logic
- Applications & Architecture Expertise
- DRAMs: Cyclical/Commodity or High Growth/Differentiated Market with Firm Value-Based Pricing?
- Flash Memory: Is Profitability Sustainable or Is It a Flash in the Pan as Competition Intensifies?
- U.S. Semiconductor Companies Benefit From Analog-to-Digital Transformation in Consumer, Communications & Industrial Equipment
- Process and Software-Oriented U.S. Capital Equipment Companies Increase Growth and Profitability

## Large Capital Diversified Companies

Ticker	Price 7/9/93	Market Cap (\$MM)	CY 93 P/E	CY 94 P/E	Mkt Cap/ TTM Rev	Price/ Book	ROE (TTM)	3 yr Secular EPS Growth Rate
INTC	\$54.75	\$23,072	11.1	10.1	3.48	3.62	21.7%	25%
AMD	<b>\$24.7</b> 5	\$2,236	8.9	7.0	1.42	1.89	19.3%	27%
MOT	\$84.63	\$22,988	26.4	22.1	1.66	4.26	12.4%	20%
TXN	\$68.50	\$5,687	16.2	13.1	0.75	3.16	13.8%	18%
NSM	\$16.13	\$1,723	13.3	10.0	0.86	2.06	12.5%	17%
	INTC  AMD  MOT  TXN	Ticker         7/9/93           INTC         \$54.75           AMD         \$24.75           MOT         \$84.63           TXN         \$68.50	Ticker         Price 7/9/93         Cap (\$MM)           INTC         \$54.75         \$23,072           AMD         \$24.75         \$2,236           MOT         \$84.63         \$22,988           TXN         \$68.50         \$5,687	Ticker         Price 7/9/93         Cap (\$MM)         CY 93 P/E           INTC         \$54.75         \$23,072         11.1           AMD         \$24.75         \$2,236         8.9           MOT         \$84.63         \$22,988         26.4           TXN         \$68.50         \$5,687         16.2	Ticker         Price 7/9/93         Cap (\$MM)         CY 93 P/E         CY 94 P/E           INTC         \$54.75         \$23,072         11.1         10.1           AMD         \$24.75         \$2,236         8.9         7.0           MOT         \$84.63         \$22,988         26.4         22.1           TXN         \$68.50         \$5,687         16.2         13.1	Ticker         Price 7/9/93         Cap (\$MM)         CY 93 P/E         CY 94 P/E         Mkt Cap/ TTM Rev           INTC         \$54.75         \$23,072         11.1         10.1         3.48           AMD         \$24.75         \$2,236         8.9         7.0         1.42           MOT         \$84.63         \$22,988         26.4         22.1         1.66           TXN         \$68.50         \$5,687         16.2         13.1         0.75	Ticker         Price 7/9/93         Cap (\$MM)         CY 93 P/E         CY 94 P/E         Mkt Cap/ TTM Rev Book         Price/Book           INTC         \$54.75         \$23,072         11.1         10.1         3.48         3.62           AMD         \$24.75         \$2,236         8.9         7.0         1.42         1.89           MOT         \$84.63         \$22,988         26.4         22.1         1.66         4.26           TXN         \$68.50         \$5,687         16.2         13.1         0.75         3.16	Ticker         Price 7/9/93         Cap (\$MM)         CY 93 P/E         CY 94 P/E         Mkt Cap/ TTM Rev Book         Price/ Book         ROE (TTM)           INTC         \$54.75         \$23,072         11.1         10.1         3.48         3.62         21.7%           AMD         \$24.75         \$2,236         8.9         7.0         1.42         1.89         19.3%           MOT         \$84.63         \$22,988         26.4         22.1         1.66         4.26         12.4%           TXN         \$68.50         \$5,687         16.2         13.1         0.75         3.16         13.8%

# Application Specific Standard Product (ASSP) Companies

Company	Ticker	Price 7/9/93	Market Cap (\$MM)	CY 93 P/E	CY 94 P/E	Mkt Cap/ TTM Rev	Price/ Book	ROE (TTM)	3 yr Secular EPS Growth Rate
Adaptec	ADPT	\$22.13	\$550	10.2	7.8	1.77	2.52	21.9%	22%
Zilog	ZLOG	\$25.25	\$458	18.6	14.9	2.79	3.31	14.1%	18%
Cirrus Logic	CRUS	\$16.38	\$396	25.6	11.2	1.18	2.99	20.4%	20%
Brooktre <b>e</b>	BTRE	\$15.75	\$257	18.5	15.8	2.56	2.78	12.2%	16%
Tseng Labs	TSNG	\$14.50	\$280	16.5	12.6	3.64	5.21	27.3%	20%
Dallas Semiconductor	DS	<b>\$14.88</b>	\$398	16.5	14.2	3.05	2.80	14.7%	20%
Sierra Semiconductor	SERA	\$6.63	\$73	11.6	7.1	0.81	1.33	14.7%	18%

## Linear/Mixed Signal Companies

Company	Ticker	Price 7/9/93	Market Cap (\$MM)	CY 93 P/E	CY 94 P/E	Mkt Cap/ TTM Rev	Price/ Book	ROE (TTM)	3 yr Secular EPS Growth Rate
Analog Devices	ADI	\$19.50	\$942	21.7	16.5	1.55	2.39	7.5%	18%
Linear Technology	LLTC	\$29.63	\$1,049	26.5	20.7	7.46	7.02	21.3%	26%
Maxim	MXIM	\$33.00	<b>\$</b> 498	26.2	21.7	4.82	5.61	18.5%	23%
Exar	EXAR	\$28.50	\$198	12.4	11.0	1.35	1.82	12.8%	20%

## Customer Specific Integrated Circuit (CSIC) Companies

Company	Ticker	Price 7/9/93	Market Cap (\$MM)	CY 93 P/E	CY 94 P/E	Mkt Cap/ 1TM Rev	Price/ Book	ROE (TTM)	3 yr Secular EPS Growth Rate
LSI Logic	LSI	\$15.63	\$710	15.6	11.8	1.12	3.23	-46.6%	18%
VLSI Technology	VLSI	\$11.13	\$369	46.4	16.4	0.84	2.02	-19.6%	18%

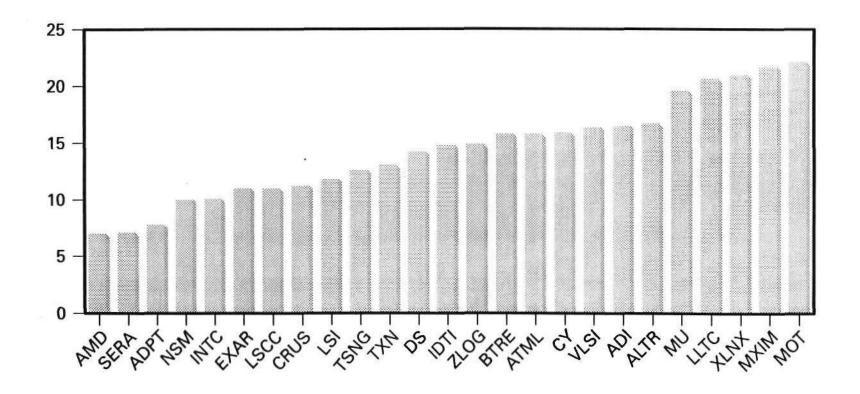
## **Memory Companies**

Company	Ticker	Price 7/9/93	Market Cap (\$MM)	CY 93 P/E	CY 94 P/E	Mkt Cap/ TTM Rev	Price/ Book	ROE (TTM)	3 yr Secular EPS Growth Rate
Micron	MU	\$41.13	\$1,619	20.6	19.6	2.46	2.89	7.6%	17%
Integrated Device Tech	IDTI	<b>\$1</b> 1.13	\$340	26.5	14.8	1.44	2.68	4.3%	18%
Atmel	ATML	\$24.25	\$463	20.4	15. <b>8</b>	3.00	3. <b>32</b>	<b>12</b> .3%	22%
Cypress Semiconductor	CY	\$14.00	\$498	28.6	15.9	1.86	1.93	-8.6%	16%

## Field Programmable Logic Companies

Company	Ticker	Price 7/9/93	Market Cap (\$MM)	CY 93 P/E	CY 94 P/E	Mkt Cap/ TTM Rev	Price/ Book	ROE (TTM)	3 yr Secular EPS Growth Rate
Altera	ALTR	\$18.50	\$373	24.0	16.7	3.71	3.71	9.2%	19%
Xilinx	XLNX	\$37.75	\$835	27.0	21.0	4.70	6.77	20.5%	21%
Lattice Semiconductor	LSCC	\$16.50	\$311	13.8	11.0	3.02	3.16	17.9%	20%

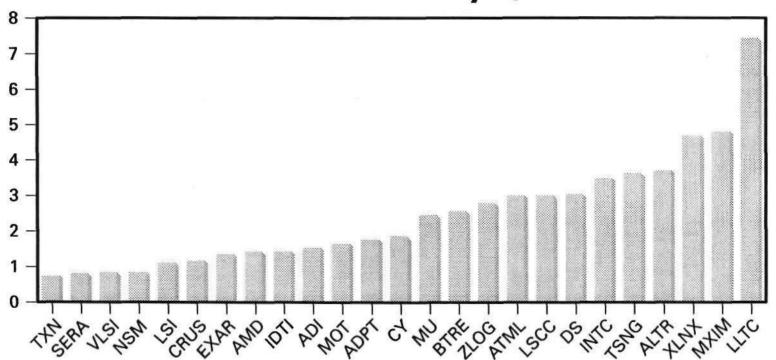
#### Semiconductor Stock Rankings P/Es Based on CY1994 EPS



Note: Priced July 9, 1993 Using Salomon/IBES EPS estimates

#### Semiconductor Stock Rankings Market Cap/TTM Revenues

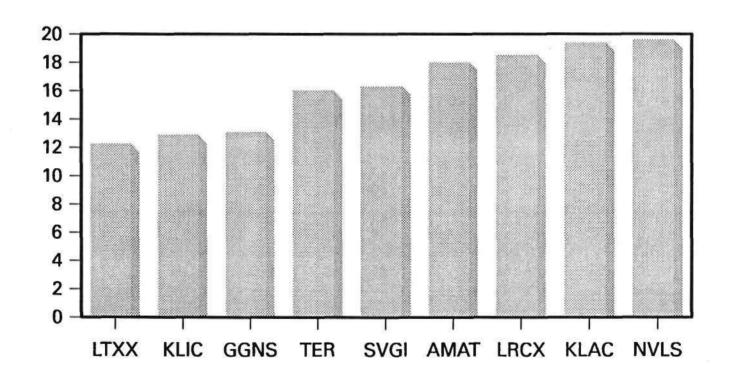
#### Stock Prices on July 9, 1993



## Semiconductor Capital Equipment Companies

Company	Ticker	Price 7/9/93	Market Cap (\$MM)	CY 93 P/E	CY 94 P/E	Mkt Cap/ TTM Rev	Price/ Book	ROE (TTM)	3 yr Secular EPS Growth Rate
Applied Materials	AMAT	\$54.13	\$2,136	23.5	18.0	2.44	4.18	11.9%	23%
Lam Resear <b>ch</b>	LRCX	\$37.00	\$594	23.9	18.5	2.63	4.90	13.1%	25%
Novellus	NVLS	\$23.50	\$338	27.6	19.6	4.89	3.93	5.2%	27%
KLA Instruments	KLAC	\$17.50	\$350	26.9	19.4	2.30	3.21	-11.0%	20%
Silicon Valley Group	SVGI	\$9.75	\$146	48.8	16.3	0.71	1.38	1.1%	17%
Genus	GGNS	\$2.63	\$32	N/A	13.1	0.89	1.00	-57.0%	10%
Teradyne	TER	\$21.50	\$727	24.7	16.0	1.39	1.98	5.7%	20%
LTX Corporation	LTXX	\$6.13	\$131	51.0	12.3	0.81	2.29	-17.2%	15%
Kulicke & Soffa	KLIC	\$20.63	\$166	18.8	12.9	1.50	3.93	-11.8%	20%

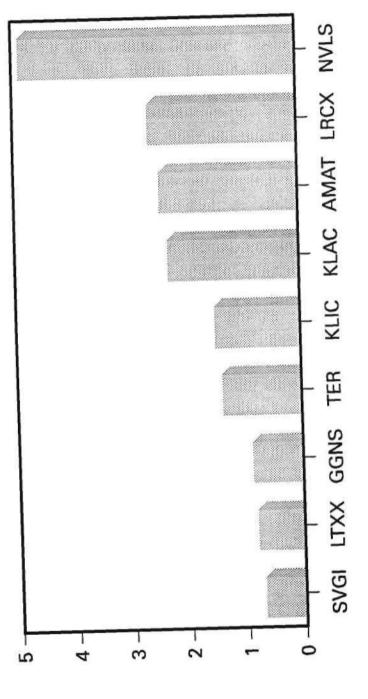
#### Semi Equip Stock Rankings P/Es Based on CY1994 EPS



Note: Priced July 9, 1993 Using Salomon/IBES EPS estimates

# Semi Equip Stock Rankings Market Cap/TTM Revenues





## What Constitutes Lasting Shareholder Value?

- Diversified Revenues and Earnings Stream
- Global Business/Strategic Customer Relations
- Topline Growth Without GM Degradation
- Tight Operating Cost Controls
- Define New Markets; Creative Self-Destruction
- Multiple, Enduring Entry Barriers
- Flat Organizations, Small Business Units
- Manufacturing, Marketing, Distribution

#### Issues

- The Damaging Quarter-to-Quarter Obsession?
- Cyclical/Capital Intensive Industry
- Managed Growth/Focus on Dividends Also
- Monopolistic Stock Valuations Not Sustainable
- Premium Valuation for Semiconductor Equipment Companies

## Today's Hot Product, Tomorrow's Commodity Product?

- Hot Products Today
  - 486 micros, flash memory, Windows GUI accelerators, FPGAs, multimedia-related ICs
- Semiconductor Industry Very Competitive
  - New innovators will level playing field
- Investors Pay for Longterm Core Competencies
- Adopt "Field of Dreams" Product Strategy
- Bellwether Stocks (e.g. INTC, AMAT, etc.)
  - Winning product architecture
  - Core organizational competencies
  - High secular revenue & earnings growth rate
  - Good follow-on product strategy
  - Mix evolutionary and revolutionary product wins

## Investors Fear Market Discontinuities What If ...

- PC Boom Stops, PC Price Elasticity Wears Off
- Multimedia Market Fizzles Out, Lack of Killer Applications and Costly Standards War
- Operating Systems and Microprocessors Become Plug-and-Play Commodities
- Semiconductor Industry Capital-Intensiveness Chokes-Off Growth
- New Revolutionary Kinds of Chips and Chip-Making Processes and Equipment
- U.S. Semiconductor/Capital Equipment Companies Challenged Again
- Government Managed Trade Distorts Market

#### The Moral of the Story

- Companies need to focus on building lasting core competencies & organizational culture. Hot products, growth and profits will follow
- Monopolistic semiconductor stock valuations are not sustainable
- Semiconductor and capital equipment companies should build "field of dreams" products and markets in order for customers to benefit and shareholder value to prosper
- High flying stocks will always be challenged by new competition

: A Wall Street Perspective on the Semiconductor Industry

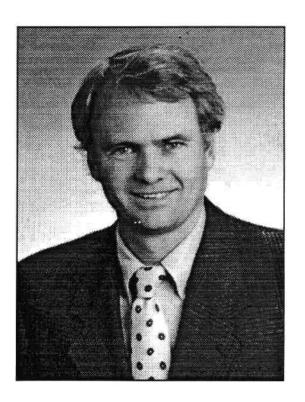
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SEMICON/West Seminar: Status 1993

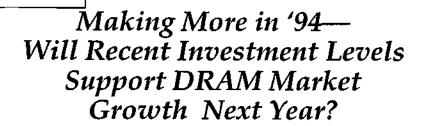
Making More in '94: Will Recent Investment Levels Support DRAM Market Growth Next Year?

Lane MasonDirector/Principal AnalystSemiconductor MemoriesDataquest Incorporated

Mr. Mason rejoined Dataquest in January 1992. He is responsible for analyzing and forecasting trends in the DRAM and video RAM market. Having helped start Dataquest's memory research in 1978, he served as Senior Memory Analyst from 1981 to 1986. His early efforts established the databases that form the basis of Dataquest's current memory research. Prior to rejoining Dataquest, Mr. Mason was founder of Viking Research, a market research company specializing in strategic alliances and DRAM market research. Mr. Mason has 14 years experience in market research for the semiconductor industry. Mr. Mason received a B.S. degree in Physics from the California Institute of Technology and attended UCLA Graduate School of Economics.



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Lane Mason
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#### Program

- Origin of the question
- Objectives of the inquiry—what are we trying to determine?
- Model of semiconductor industry "DRAM capital stock," and relation to market performance
- Results and Dataquest conclusions

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#### Origin of the Question

- · All the world's economies
- Year-end 1992—bold images of the future
- DRAM bit growth and expectations
- · Capital spending: actual and planned

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#### All the World's Economies

- United States—A new president and two quarters of 3 to 4 percent growth
- Japan—Turning the corner to recovery
- Europe—Holding its own, and strong PC market
- Asia—Slower than 1992, but still growing at a rate any G7 country would envy

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#### Year-End 1992... Bold Images for the Future

- Intel remarkable 486 demand and financial performance
- High consumer and business confidence
- Spate of major alliances into "computer-consumer" world
- Leading indicators at a peak
- Recession over at last!

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## Major DRAM Demand Elements, 1993-2000

- Software has replaced hardware as the driver of demand for DRAM bits
- Windows 3.1 is the present DRAM bit driver, "NT" is around the corner
- Multimedia is taking shape, becoming real
- "Electronics to the home," and merger of computer and consumer is today's big play in the marketplace

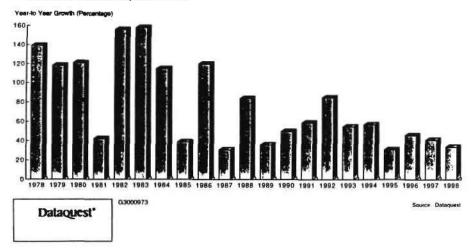
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## DRAM Bit Growth and Expectations

DRAM Bit Growth, 1978-1998



#### Capital Spending for "DRAMs", Actual and Planned for 1993

	1988	1989	1990	1991	1992	1993
U.S. Companies	958	1,256	1,284	1,324	1,136	1,325
Japanese Companies	2,435	3,195	3,423	3,355	2,493	2,860
Korean Companies	522	1,188	833	873	1,052	1,210
European Companies	40	60	64	59	47	52
Total	3,955	5,699	5,604	5,611	4,728	5,447

Source Dataquest

Dataquest\*

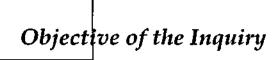
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Can we use aggregate capital spending data to assess the ability of the "DRAM industry" to respond to DRAM demand?

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#### Model of the "DRAM Industry"— Assumptions 1

- The capital stock of leading-edge MOS IC capacity determines the ability to make DRAMs (DRAM bits)
- At a given point in time, the amount of capital stock depends on recent investment levels by "DRAM makers"

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#### Model of the "DRAM Industry"— Assumptions 2

- Market prices are a major observable tied to the (im)balance between supply and demand
- In a balanced market, prices decline with manufacturing costs at a rate equal to the historical learning curve
- Under(over)capacity (with respect to demand) will be reflected in price trends that are slower (faster) than the historical learning curve
- Hooke's Law of Markets: Changes in market prices (variations from the mean) are proportional to the imbalance that exists between supply (capacity) and demand—bigger imbalances mean bigger variations

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## Definition: Capital in Production (CIP)

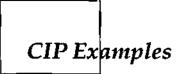
- CIP is a function of DRAM, leading-edge MOS, and related capital expenditure (CE) levels for several prior years
- At most DRAM makers, new MOS capacity starts as "DRAM" capacity
- CIP ties to "ability to economically produce, or allow to be produced, DRAM bits"
- Loosely related to "net PPE," but in fact "DRAM" capital remains in play after it has been fully depreciated
- CIP (t) =0.2\*CE(t-4) + 0.4\*CE(t-3) + 0.7\*CE(t-2) + 0.85\*CE(t-1) + 0.5\*CE(t)

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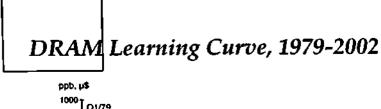
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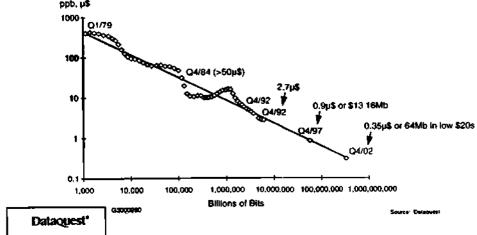
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- Micron Technology—All capital spending is "DRAM capital spending"
- Japanese companies' capital spending is that fraction devoted to "leading-edge MOS," with some (-) allowance for NVM and core logic
- There is some interplay among MOS ASICs and MPUs and DRAM capacity, within a company, and within the industry
- Linear, discretes, bipolar, and nonconvertibles play in a different universe... are not ever "DRAM capacity"

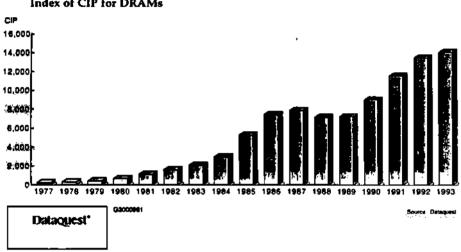
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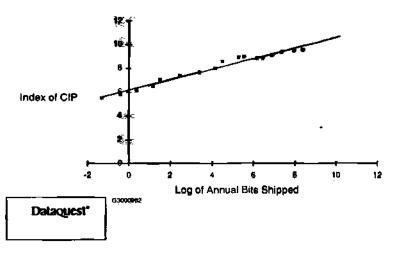


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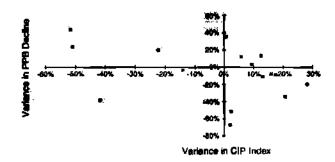


Index of CIP versus DRAM Bits Shipped (Log Scale)



Relationship of CIP Excess to Variations in Rate of Price Changes

Variance in CIP versus PPB Decline



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#### Results and Dataquest Conclusions

- Today's "DRAM capacity" will probably need a significant incremental increase in 1994 and 1995 if the "growth optimists" are correct in their assessment of future demand
- ...but incremental bit growth rates appear to need less incremental capacity than formerly
- CIP can be a useful estimator of "DRAM capacity"
- The model developed can be refined and improved in many ways to be a more accurate predictor of "DRAM capacity"; predicting demand is far more difficult

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Source: Detection

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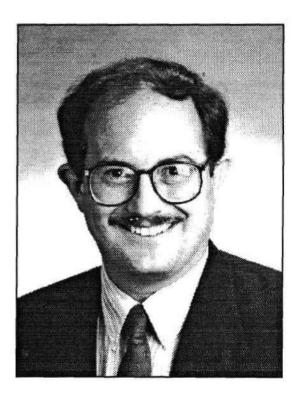
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#### New Market for Chips: The Growth Continues

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Mr. Sheppard is a Director and Principal Analyst in Dataquest's Semiconductor Application Markets Service. He is responsible for coordinating worldwide semiconductor applications research. Besides general applications trends, he specializes in multimedia, communications, and consumer applications. Before joining Dataquest, Mr. Sheppard was on the headquarters marketing staff of Fairchild Semiconductor Corporation as Manager of Business Analysis. In that capacity, he was responsible for the worldwide marketing plan, product market evaluations, and competitive analysis. He was also a board member of Worldwide Semiconductor Trade Statistics, Inc., and was Fairchild's liaison to the American Electronics Association. Earlier, Mr. Sheppard was a Hardware Design Manager and a Systems Engineer at GTE Government Systems. While there, he specialized in the design of C31 systems, man-machine interfaces, and the decision aid systems. Mr. Sheppard received a B.S.E.E./C.S. degree from the University of Colorado and an M.S. degree in System Management from the University of Southern California.



New Market for Chips: • The Growth Continues



## New Market for Chips: The Growth Continues

#### **Gregory Sheppard**

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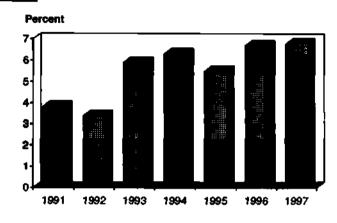
#### Agenda

- Electronic equipment market
- Plate tectonics and enablers
- Opportunities
- Implications

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#### Worldwide Electronic Equipment Production Growth



Source: Detaquest

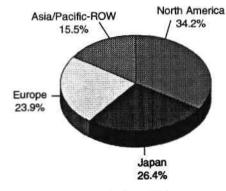
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## Worldwide Electronic Equipment Production

#### By Region



Asia/Pacific-ROW 30.3%

22.0%

Europe
23.5%

Japan
24.2%

1992 = \$642 Billion

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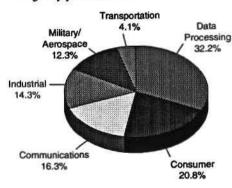
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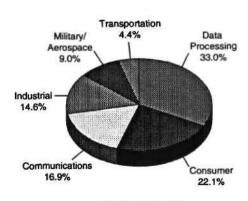
1997 = \$869 Billion

Source: Dataquest

## Worldwide Electronic Equipment Production

#### By Application





1992 = \$642 Billion

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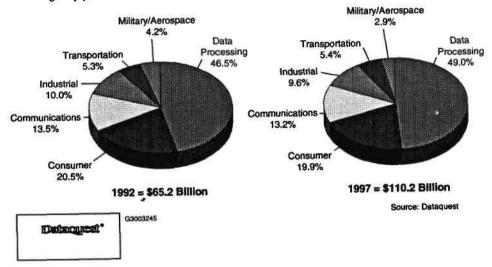
1997 = \$869 Billion

Source: Dataquest

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## Worldwide Semiconductor End Use

#### By Application

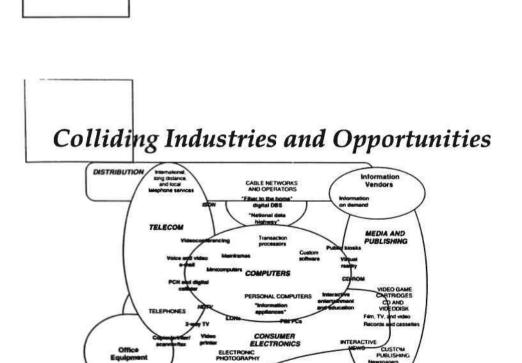


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#### Plate Tectonics and Enablers

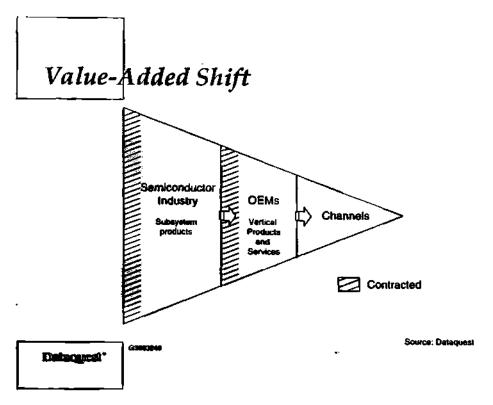


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Source: Apple Computer Inc

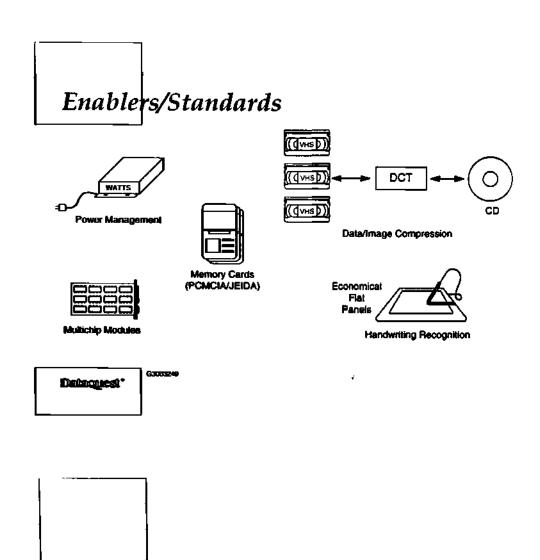
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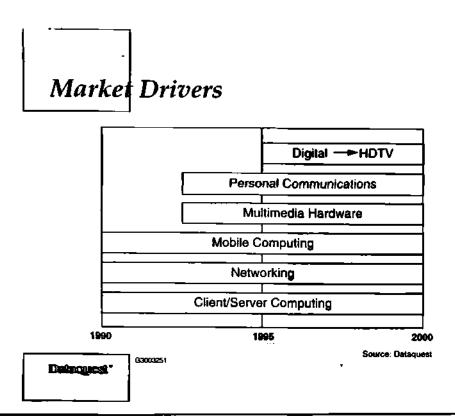
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#### **Opportunities**

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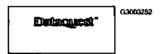


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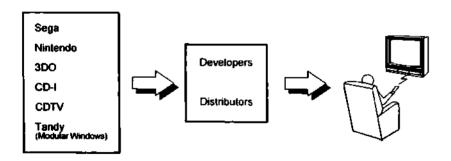
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#### Why Invest in Multimedia?

- Saturating PC and consumer markets
- Untapped home information technologies market
- Insatiable entertainment market
- Next level of productivity for business and education
- Firming computer standards

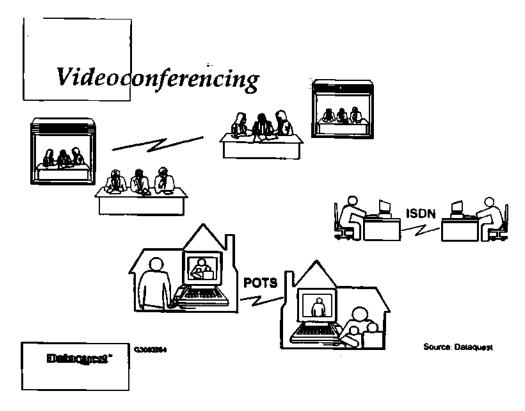


## Competitors in the Consumer Interactive Player Marketplace



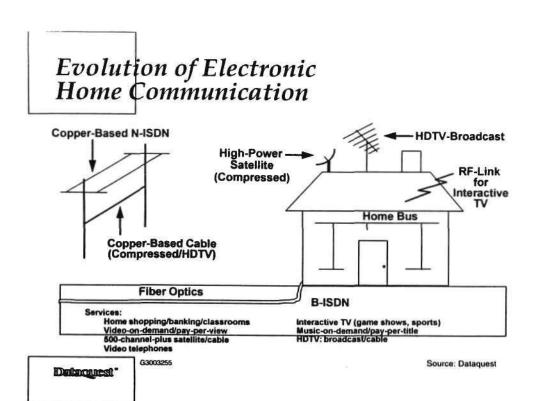
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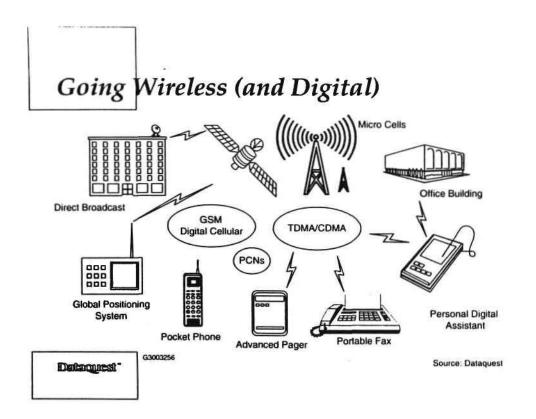
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### Implications

- 12-month design cycles
- Fragmentation and specialization
- Fabulous fabless
- Near term: United States and Asia/Pacific robust, Europe and Japan struggle

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