Digital Equipment Corporation:

R.I.P.

or

Future Lean and Mean Competitor?

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MBMG708

Management of the Firm in Trouble

Spring Semester, 1994

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Introduction

Until recently, Digital Equipment Corporation (DEC) was the second largest computer vendor in the world, behind IBM. DEC offered a unique new way to do computing: Instead of massive, multi-million dollar mainframes behind a glass wall, why not put computing power in front of people where they could use it? Ken Olsen and this vision led DEC to an unprecedented 30+ years of phenomenal growth.

For an order of magnitude less than the cost of a typical mainframe, DEC could offer minicomputers and networks to match or exceed nearly all the mainframe's capabilities. DEC pioneered commercial computer networks, distributed processing, client/server applications, clustering technology, highly available systems, and a whole host of other information technology innovations.

By 1987, DEC could do no wrong. Yet, by mid 1994, DEC's very survival as an ongoing company is questionable. What happened? Why did it happen? Can DEC stop its death spiral and, if so, how?

As a long time software consultant and DEC employee from 1981 through early 1994, I am shocked and saddened by DEC's deteriorating situation in mid 1994. It did not have to be this way.

Pre-turnaround Situation

September, 1987, DECworld, Boston World Trade Center:

Boston's World Trade Center is an ideal location for a major industry exhibit. Situated just across Boston Harbor from Logan Airport, visitors can fly to Logan, take the water shuttle from the airport to the trade center and the exhibit, and fly out that night. Visiting executives can also stay in one of several nearby hotels for extended visits and enjoy all of Boston's amenities. Rifkin and Harrar described the 1987 DECworld best:

> They called it DECworld, a single company exposition designed to show off the might of the second most powerful company in the computer world. True to its name, it was a world unto itself. Boats, planes, helicopters, buses, and limousines criss-crossed Boston, bringing 50,000 people to the World Trade Center to see DEC's product line and hear DEC's message.
>
> The QEII and the Oceanic, the world's two largest cruise ships, sat docked amid the $1 million pilings DEC had hastily built to accommodate them. The ships were a glitzy, yet practical, solution to the lack of hotel rooms. Boston had never hosted a conference so big.[1]

With the benefit of hindsight, that 1987 DECworld event marked the peak of DEC's success. For a brief period, DEC ruled the computing community. Analysts at the time stumbled all over themselves predicting a rosy future ahead; some predicted 20 percent compounded growth for the next 5 years. Jack Shields, then head of DEC sales and service, printed up party invitations for July 10, 2007, the predicted date when DEC would pass IBM in revenues.[2]

Those were heady times. We offered products no other vendors could build, we knew more about software development and project management than anyone. We were "right", everyone else was "wrong". We were smarter, more healthy, and better looking than anyone else, and we were not shy about telling everyone within earshot. In other words, we became too arrogant for our own good.[3]

Starting in the early 80's, an underground memo began circulating on how to treat customers. It showed a picture of a baby, frowning, with the middle finger extended. The picture looked like the baby was giving the photographer "the finger." The caption read, "Figure 1". After the picture and caption came several customer satisfaction scenarios with humorous parodies on how to handle the situations. Each ended with the solution, "See figure 1." Finally, the memo ended like this:

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[1] *The Ultimate Entrepreneur -- The Story of Ken Olsen and Digital Equipment Corporation*, Glenn Rifkin and George Harrar, Prima Publishing and Communications, 1988, updated 1990, page 1. Although I did not attend the 1987 DECworld, I attended subsequent events in 1990 and 1992. These shows were every bit as glitzy as Rifkin and Harrar suggest in their opening paragraphs.

[2] "Digital - The Next Generation", Glenn Rifkin, *Upside Magazine*, September 1992, page 28.

[3] I was there and just as arrogant as everyone else inside DEC.

> This isn't Burger King and you don't get it your way. You get it our way or not at all, because we're Digital and you're not! See figure 1.

Most of us officially frowned on this memo - but most of us also kept a secret copy hidden away someplace. And sometimes we really felt and acted this way towards our customers and partners. After all, we made better computers than anybody else in the world -- where else were they going to go?

This attitude, top to bottom, contributed mightily to DEC's undoing.

Brief product history and milestones

The story of DEC and Ken Olsen is well documented. The following paragraphs briefly summarize some of DEC's milestones since its founding in 1957:[4]

PDP-1 -- DEC's first computer in 1959. Rather than using the intimidating name, *computer,* Olsen called this product a *Programmable Data Processor (PDP).* ;Since this was the first one, it was the PDP-1. It featured a cathode-ray tube and keyboard, making it the first commercially available, interactive, general-purpose computer. It was priced at $120,00 and 53 were sold.

PDP-6 --DEC's first large system, introduced in 1964, and sold for $300,000. This system pioneered the concept of timesharing, but was simply too big for DEC to produce at the time. Only 23 were sold and the product was killed soon after its release.

PDP-8 -- Triggered the minicomputer industry. First introduced in 1965 and priced at an unheard-of $18,000, the PDP-8 carried DEC into the ranks of major computer vendors. DEC eventually sold more than 50,000 units.

PDP-X -- The code name for the follow-on machine to the PDP-8, this machine was never built. Edson de Castro, one of the lead designers, left DEC in 1967 and started Data General with a variant on this design.

PDP-11 -- introduced in 1970, DEC eventually sold 250,000 units of various PDP-11 models. DEC still sells models of PDP 11s in 1994.

VAX/VMS -- First unveiled in 1977, VAX/VMS set the standard for distributed computing through most of the 1980s. VAX/VMS eventually allowed DEC to mount credible challenge to IBM. By late 1987, DEC gained significant market share at IBM's expense.

VT100 -- Introduced in 1978, this computer terminal spawned an entire terminal industry as orders exceeded forecasts by huge margins and lead times stretched to more than one year. Its elegant styling and ergonomic keyboard drove it to become an industry standard even to this day. The VT200, VT300, VT420, and VT510 series terminals followed the VT100.

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[4] *The Ultimate Entrepreneur*

Personal Computers -- The Pro 325 and Pro 350, DECmate II, and Rainbow 100, launched in 1982 were failures. The Pro series software was ahead of its time and placed too much burden on the underlying PDP-11 hardware platform. The DECmate II and Rainbow 100 systems were technical successes but market flops. They failed due to lack of application software and DEC marketing blunders. The VAXmate, an Intel 80286 machine introduced in 1986, also failed to take off. It lacked many standard capabilities for standard clone PCs and was overpriced. In 1989, DEC began remarketing Tandy PCs, to limited demand. The DEC PCs were overpriced and behind the technology curve. In 1991, DEC opened a 1-800 PC telephone ordering service modeled after Dell. By late 1991 and early 1992, DEC began building its own PCs and cut its prices to near market levels. Sales started to increase and, by mid 1994, DEC is beginning to overcome the stigma from the early 80s and is emerging as a major PC vendor.

Storage -- DEC first began building its own disk drives in earnest in the early 1980s. This was a fiasco as quality problems appeared all over the place with the early RAxx disks. After 2 or 3 years, DEC fixed its manufacturing processes and quality improved. But as DEC storage devices acquired a reputation for reliability, they also acquired a reputation for being slow and overpriced. Third party storage vendors wreaked havoc in DEC's installed base. Finally, by 1992, DEC storage made a gutsy decision to change its direction. They canceled their big, proprietary disks and began to concentrate on small, standardized SCSI disks. By 1994, DEC storage devices are competitive with anyone in the market on price, performance, and reliability. DEC StorageWorks devices are widely acclaimed as innovative, inexpensive, intelligent controllers.

Seeds of destruction

Abandoned markets

Sometime in 1985, the senior managers at DEC decided to abandon their traditional market of engineering, manufacturing, and technical customers in favor of the commercial data center. The technical market was messy, difficult to support, and filled with third party devices that interfered with the purity of DEC's computing environment. The commercial data center market, the traditional IBM stronghold, was flush with money and people eager to spend it. But this new market meant a fundamental shift in DEC's focus and would eventually prove disastrous.[5]

Closed Architecture

With the PDP-11 in the 1970s, DEC pioneered the Unibus, an open computer bus architecture. With this open bus, third parties could build interface equipment to connect factory automation machines, sensors, and other intelligent devices directly to the computer. DEC actively encouraged third parties to build these devices because they spawned PDP-11 sales. DEC's first VAX products also had Unibuses and eventually lots of third party devices.

[5] Address by Don Harbert, then manager of DEC VMS Engineering, to the VMS Partners, a group of senior DEC field software consultants, March 1992 VMS Partner meeting, Nashua, New Hampshire. As a member of the VMS Partners group, I was there.

By 1985, the Unibus was obsolete and DEC introduced the BI bus in its latest VAX systems. But just as vendors made plans to introduce new interface modules, DEC closed the BI bus. DEC announced they would sue anybody who marketed a device that connected to the BI bus unless that company signed an agreement with DEC. Ken Olsen defended this strategy: "We spent millions developing this bus. I don't know why we didn't do it before."[6] This strategy infuriated many previously loyal DEC VARs (Value Added Resellers), many of whom began shopping for another computer vendor as a partner. It also infuriated end user customers, who believed they were being gouged by this move.

Restrictive Business Practices

DEC changed several other business practices during this period. For example, they decreed that software licenses would no longer transfer to the new owner when somebody sold a used piece of equipment. This meant, every time a transaction occurred on the used hardware market, the end user would need to buy new software licenses from DEC. This policy further infuriated customers and resellers. DEC eventually rescinded the no-transfer policy for operating systems. However, typical of DEC business practices, the devil is in the details. DEC kept the policy in force for layered products -- even layered products required for the hardware to work. This meant that DEC demanded - and usually got -- a piece of every used equipment transaction[7]

Hiring Binge

DEC went on a hiring binge in the late 1980s. Since DEC was going to replace IBM and own the data centers of every major corporation in the world, DEC needed industry experts for every major industry in the world. For example, to sell to paper mills, DEC needed consultants who knew paper mills forwards and backwards. To sell to banks, DEC needed bankers. The employee population exploded, along with SG&A expense, as DEC hired field sales consultants and layer after layer of administrative staff. Sales also increased, but not as fast as expenses:

DEC Expense Growth, 1986-1989

Year	1986	1987	1988	1989
Employee Population	88,300	103,000	113,900	118,400
SG&A as a percentage of revenues	21.94%	24.00%	26.72%	28.56%

[6] This was one of Ken Olsen's most famous remarks and was widely quoted in the press at the time.

[7] DEC continues this absurd policy even in mid 1994. I recently looked into purchasing a used VAXstation 4000-60 from a DEC customer for my business. Selling price would be around $2000 for the vintage 1991 hardware. But in order for DEC to bless the sale, I would need to pay DEC $300 to transfer the VMS operating system license, and $2000 for a NAS-250 license. The existing NAS 250 license would become null and void. Since the NAS-250 license includes the windowing software required to run the workstation, DEC's policy effectively prevented me from buying this equipment for a reasonable price. The customer eventually sold the equipment on the open market, likely to a broker. The broker will either sell the equipment for parts, or resell it on the gray market.

Competition

Enter Sun Microsystems. Founded in the early 1980s, Sun marketed a line of UNIX based workstations. As DEC closed its architecture, tightened its licensing policies, and alienated its partners and customers, Sun seized its opportunity. As the late 80s unfolded, "Open Systems" became a popular buzzword across the industry. Sun brilliantly took advantage of DEC's new policies by branding DEC as a closed, proprietary bloodsucker. Sun's sales took off, at the expense of DEC.

In late 1988, IBM introduced its AS/400 systems after more than a year of rumors. The AS/400 went on to generate roughly $14 billion in annual revenue for IBM -- more than all of DEC's revenue, company wide. This stopped DEC's inroads into IBM's midrange market share cold.

VAX 9000 Failure

Meanwhile, as Sun went after DEC at the low end, DEC went after IBM at the high end. One product in DEC's arsenal was the ill-fated VAX 9000 mainframe. The VAX 9000 took 7 years and cost around $1 Billion to develop. It started in 1983, when DEC bought an equity stake in Trilogy, a company that pioneered multi-chip unit technology. In essence, this technology allowed multiple chips in one "superchip", thereby increasing speed. The VAX 9000 was supposed to hit the market by late 1989. But it was delayed by at least one year, and technical glitches delayed volume shipments even further. Ongoing service and support issues also hampered the system and it never sold in significant volume.

PRISM Cancellation

By 1988, the VAX architecture was 13 years old and showing its age. Newer RISC based architectures from other companies such as HP and Sun promised eventual 100x performance improvements over the VAX architecture, and DEC needed a response. Dave Cutler, one of the lead VMS architects in the 70s, and his team developed a DEC RISC architecture, code named PRISM. They had prototype implementations up and running and were close to commercial development when senior DEC management suddenly canceled the project. The details on the story are controversial, but the results are now well known and would eventually prove devastating.

According to Rifkin:

> David Cutler, the software genius who oversaw the development of Digital's VMS operating system, had set up a group in Bellevue, Wash., to build a RISC-based UNIX workstation for the company. Code-named Prism, the group had built prototypes and was testing them when Olsen was persuaded to kill the project by Digital's West Coast workstation group. Instead, Digital should invest in a startup company called Mips, sell the RISC-based workstation Mips was building and continue to enhance

the VAX. A disappointed Cutler left Digital to go to Microsoft, where he has been overseeing development of Windows NT.[8]

The DEC rumor mill paints a different picture.[9] According to these sources, Cutler became embroiled in a political battle with Jack Shields, then second in command under Ken Olsen. Cutler lost, PRISM was canceled, and the rest is history.

Regardless of how it happened, PRISM was canceled, DEC took a 5 percent equity stake in Mips computer systems, and began to market a line of RISC UNIX workstations based on the Mips R2000 and R3000 series of chips.

The stage is set

During all this, DEC saw its most profitable years ever in 1987 and 1988 as it replaced its entire VAX line with updated and faster models. Profits in 1987 were $1.1 billion, $1.3 billion in 1988. Year over year decline began in 1989 and continued through the early 1990s. Results improved for a few quarters but the general downward trend is continuing as of mid 1994.

As 1989 opened, DEC was still an extremely profitable company, but threatened by competition from all sides. It began marketing its Mips based workstations which, at the time, were price and price/performance leaders. VAX sales were still steady but forecast to drop. Software, services, and consulting would eventually lead the company as hardware became a commodity.

[8] "Digital - The Next Generation", Glenn Rifkin, *Upside* Magazine, September 1992, page 32.

[9] This is based on conversations with several "insiders" at DEC who would be in a position to know the true story.

Corporate Management and Background of Key Principals

By spring 1994, DEC had 126 vice-presidents by some estimates. The following list details a few key players currently or recently at DEC's helm. In the plots within plots within plots of DEC power politics, these people may not have been the exclusive players. But these were the names I heard most often around the company.

- **Ken Olsen** -- DEC founder and CEO until October, 1992. Ken is no longer formally associated with Digital, although people inside the company still confide with him.[10]
- **Jack Shields** -- Hired in 1961 in the new service organization. Rose to Senior vice-president in charge of field sales and service and second in command. Left in 1989.
- **Jack Smith** -- Joined DEC as employee number 12 in 1958. Rose to Senior vice-president under Ken Olsen. Left in 1993 after Bob Palmer took over. Author of absurd penny pinching policies and proposals, including canceling water coolers and magazine subscriptions, and attempting to change payroll from weekly to biweekly.
- **Win Hindle** -- Another 30+ year DEC veteran, by mid 1994 is vice-president in charge of ethics. Largely perceived by the rank and file inside DEC as ineffective.
- **Bill Strecker** -- Chief technologist. Strecker was a brilliant engineer and one of the original VAX designers. Somewhere along the way, he became arrogant. Strecker addressed the VMS Partners in April, 1991 and at least one member of the audience found him to be arrogant and largely ignorant of the evolving world around him. His technology strategy is still controversial; some like it, some don't like it, many don't know what it is. [11]
- **Bill Demmer** -- vice-president in charge of Alpha and VAX systems. In essence, this means Bill is in charge of all Digital hardware development. Bill lead the controversial charge to publicize DEC's alpha RISC technology in 1991 and early 1992, before it was publicly announced. Some say these early speeches hurt DEC by revealing future plans. Others believe it was important to reveal a future direction so customers would believe DEC at least had a strategy for the future.
- **Don Harbert** -- by mid 1994, vice-president of Operating Systems. Don is in charge of VMS, OSF/1 (DEC UNIX) and DEC Windows NT software engineering. Don is straightforward and blunt in presentations. Some see Don as

[10] I met with Ken in March, 1993 to discuss some issues. I have also had conversations with other people who discuss DEC's situation with him. Although he will deny it, Ken Olsen is still very much part of DEC.

[11] This is based on my personal observations and conversation with people around the company.

an ineffective leader with no ability to inspire. Others appreciate his straight talk and apparent candor in public.

- **Bob Supnik** -- vice-president in charge of getting alpha to market. Bob is popular with rank and file DEC employees because he regularly mixes it up in electronic conferences. Bob also regularly appears in front of DEC employee groups to explain product strategy.

- **Bob Palmer** -- DEC CEO as of October, 1992. Left Texas Instruments in the 1970s to start Mostek, a memory chip company. United Technologies bought Mostek a few years later. Bob took a job with DEC in 1985 as vice-president of manufacturing. Tapped by the DEC Board of Directors to succeed Ken Olsen in July, 1992. Widely acclaimed as a take-charge manager when promoted, but has so far failed to deliver results. Some complained early on because he failed to appear live before employee groups and field ad-hoc questions. Bob set up the business unit structure in late 1992 and early 1993. It fell apart by early 1994.

- **Ed Lucente** -- Hired by Bob Palmer in early 1993 to head DEC sales and marketing world-wide. Ed was a long time IBM sales rep and manager. He left IBM to become executive vice-president for sales and marketing at Northern Telecom for 2 controversial years. He was fired from DEC in April, 1994, after a disastrous 9 months of FY 1994, especially the third quarter. Some liked Ed's take-charge attitude, others found his abrasive management style to be a hindrance.[12]

- **Gresham Brebach** -- Hired by Bob Palmer in 1992 from McKinsey Consulting to lead Digital Consulting. By early 1994, has not delivered results in this business as morale at the grass roots continues to deteriorate. In a booming consulting market, Digital Consulting is one of DEC's biggest disappointments.

- **Russ Gullotti** -- Long time DEC veteran, Russ replaced Don Zereski as head of U.S. field operations. By mid 1994., he is head of all Sales and Service in the "Americas Zone", essentially the western hemisphere.

- **Don Zereski** -- Replaced Dave Grainger as head of U.S. Sales and Service in 1991. He was fired in 1993 for failing to deliver a profit..

- **Dave Grainger** -- Was put in charge of U.S. Sales and Service in 1989 after the U. S. slid into the red after 1987. He was fired in 1991 after a rumored fist-fight with Zereski in the Mill parking lot.[13]

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[12] "Striving to adapt: At Digital Equipment, A Resignation Reveals Key Problem: Selling", Wall Street Journal, April 26, 1994, page 1

[13] "The Mill" is the old Maynard Mill, in Maynard Mass, DEC's original headquarters. Palmer is moving DEC's headquarters down the street to a more modern building. The fist-fight was widely reported inside DEC's electronic rumor mill, but Grainger and Zereski deny it. However, after several meetings with Zereski and witnessing his temper first hand, the fist-fight story is credible.

- **Enrico Pesatori** -- Recruited from Zenith Data Systems, Enrico is now head of the DEC PC business. After successfully building the PC business, Enrico was tapped to fill Lucente's former position as head of DEC Sales and Marketing. After being a laughingstock in the industry, DEC's PC business is one of the few bright spots in mid 1994.
- **Charlie Christ** -- vice-president and head of the Storage Business Unit. He successfully lead the storage group through the painful transition to small, fast, open products. DEC's storage business was also a laughingstock through the 80s, and one of the few bright spots by mid 1994.

Description of Crisis

Some call it a paradigm shift. Some call it an economic crisis. Whatever the name, by 1989, the rate of change in the economics of the computer industry accelerated as rapid innovation and new technology introductions forced prices through the floor. Consider these jargon-filled examples:

In mid 1994, I can buy an IBM compatible PC with 50-60 times the CPU power of the original DEC VAX 11/780, 24 MB memory, 1 GB of disk space, 600 MB CD-ROM, screaming fast 1024 X 768 resolution color graphics display, for roughly $6000 list price[14]. For less than $10,000, I can buy a similarly configured RISC system with roughly 150 times the CPU power of that original VAX.

The original VAX 11/780 with assorted peripheral devices sold for roughly $500,000. By mid 1994, I can buy a low end PC with more disk space and memory, better applications, and 3 year warranty for roughly $1500.

By mid 1994, people buy computers from warehouse superstores, catalogs, or 1-800 telephone numbers. Personal computers make up more than half the entire market in dollar volume. In 1984, most computers were sold direct from vendors to end-user customers with lots of hand-holding. Personal computers were expensive toys.

In 1994, Microsoft Office, a personal computer software package, lists at Computer City Superstore for roughly $500. The product bundles a WYSIWYG word-processor, spreadsheet, database, and slide presentation package into a single offering. A WYSIWYG (What You See is What You Get) word processor allows the user to compose a document, complete with graphics, on a computer screen and actually see the document on the screen as it will appear when she sends it to her attached laser printer. In 1984, minicomputer and mainframe based word processing packages alone cost thousands and thousands of dollars and offered far fewer capabilities. WYSIWYG did not yet exist.

As systems become smaller, faster, cheaper, and more powerful, the computer hardware and software markets continue to change radically from low volume, high margin products to high volume, low margin, commodity products. As this unprecedented revolution sweeps the industry, brutal competition forces faster and faster innovation and ever shorter product cycles. Vendors who refuse to accept this new paradigm will die. Vendors who learn to exploit this new paradigm will prosper.

DEC was caught flat-footed and arrogant, starting in late 1988, after several wildly successful years.

[14] Digital PC Catalog, Spring 1994; see the model DEC PC XL 560 with associated peripheral devices. Note that prices are incorrect in this catalog due to a price reduction in March, 1994. I took delivery on this system in May, 1994 for my consulting business.

Deteriorating Profit (Loss) Picture

The deteriorating financial picture of the 1990s sums up DEC's crisis:

Dollars x 1,000,000	*1993*	*1992*	*1991*	*1990*	*1989*	*1988*
Revenue	14,371	13,931	13,911	12,942	12,742	11,475
Profit (Loss)	(251)	(2,796)	(617)	74	1,073	1,306

(The losses in 1991 and 1992 included massive restructuring charges.)

As the first three quarters of 1994 unfold, the story gets even bleaker. DEC's revenue is now shrinking as VAX sales decline and Alpha fails to compensate.

Dollars x 1,000,000	*9 months 1994*	*9 months 1993*	*Q3 FY94*	*Q3 FY93*	*Q2 FY94*	*Q2 FY93*	*Q1 FY94*	*Q1 FY 1993*
Revenue	9,528	10,457	3,259	3,454	3,254	3,689	3,015	3,314
Profit (Loss)	(339)	(365)	(183)	(30)	(72)	(74)	(83)	(261)

DEC has had only one profitable quarter since 1991. This occurred in Q4, FY 1993. According to statements from DEC senior managers, the U.S. has not been profitable since 1987.[15]

In the 1980s, DEC was essentially debt free and boasted of a AAA bond rating. At the end of Q3, 1994, Standard and Poors downgraded DEC's senior debt again to BBB and put the ratings on credit watch with negative implications. Moodys also put the debt under review for possible downgrade.[16] In March, the company tried to raise $500 million with a preferred-stock issue, but it could find buyers for only $400 million.[17]

The only reason DEC is still alive is its strong balance sheet from the 1980s. But many of those assets are long gone. The statistics are staggering: From the end of FY 1990 through the end of Q3 FY 1994, DEC lost roughly *$4 billion*. Even with these massive losses, assets still outweigh liabilities by roughly $5 billion.

The company took a $1.5 billion charge for restructuring reserves in 1992, $1.1 billion in 1991, and $550 million in 1990. At the end of Q3 1994, only $276 million of this restructuring reserve is left. Most analysts believe DEC will need another massive

[15] Don Zereski, then DEC vice-president of the U.S. Field, in an address to a gathering of DEC field consultants, March, 1992. Although unlikely, FY 1993 may have been profitable in the U.S. DEC does not disclose segment by segment financial data in its public disclosure statements.

[16] "Digital Officers Promise Major Restructuring", *The Wall Street Journal*, April 18, 1994, pages A3 and A14.

[17] "Desperate Hours at DEC", *Business Week*, May 9, 1994, page 27.

restructuring charge in the current quarter of 1994 to cover additional layoffs and plant closings.[18]

Perhaps even more devastating than the financial statistics is the effect on people, morale, and self-worth. The first layoffs started in manufacturing in 1990 as DEC began to close plants. Layoffs hit Minneapolis and other field offices in earnest in July, 1991, again in October, 1991, and generally once per quarter since then. Before July 1991, the employee population in Minneapolis was roughly 350. By early 1994, the population was roughly 120 and shrinking.

Whispered conversations in the hallways, weekly rumors about a massive layoff round next week, managers who disappear to mysterious, closed-door meetings, hidden agendas, and plots within plots within plots are now standard operating procedure inside Digital Equipment Corporation. It is sickening to watch a once mighty company stoop so low.

DEC must return to profitability very soon or it will die.

[18] "Desperate Hours at DEC", page 27.

Remedial Steps and their effectiveness

Workstation Wars -- So Far, DEC Lost

The senior managers inside DEC never figured this out, but at the grass roots, we all saw it coming: The days of the refrigerator sized computers were numbered. The days of the liquid cooled mainframe were already over, but some people just had not figured it out yet. Customers would no longer buy a system for the elegant hardware design. The power in the industry shifted from traditional hardware vendors to application software vendors.

As sales of high margin midrange and high end systems declined, the low end, low margin market exploded. New workstations hitting the market packed as much CPU power as small mainframes at a fraction of the cost. Local area networks (LANs) of workstations were more flexible and, under certain conditions, more powerful than any mainframe.

DEC introduced the DECstation 3100 in early 1989, to rave reviews. DEC's first RISC UNIX workstation with Mips chips, it sold for roughly $20,000 and packed 10 SPECmarks of CPU power.[19] This was 10 times more powerful than DEC's original $500,000 VAX 11/780 from 1977 and, for a few short weeks, the most powerful workstation on the market.

DEC also introduced the VAXstation 3100, a 3 SPECmark VAX/VMS workstation that ran the VMS operating system and all its popular applications. Although the VAX could not sustain the same speed improvements as RISC based processors, VMS had a huge installed base and millions of customers hungry for inexpensive platforms on which to run it.

DECwindows was a breakthrough software innovation, based on the X-Window work from MIT. Unlike traditional computer windowing systems, DECwindows allowed users to run applications anywhere on the network to display on their desktop workstations. Properly engineered applications could run number-crunching jobs on, say, a Cray supercomputer host, and present a point and click graphical user interface to a user on a DECwindows workstation on the other end of the network.

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[19] The SPEC consortium consists of representatives from computer industry vendors. Its charter: to come up with an industry standard method of measuring CPU performance for all vendors. By 1989, SPEC produced the SPECmark, an average of 10 benchmarks normalized to the speed of the original VAX 11/780. By definition, the VAX 11/780 was a 1 SPECmark machine. A 10 SPECmark machine completed the SPEC benchmarks 10 times faster than the VAX 11/780. Before long, all the vendors figured out ways to 'cheat", so the SPEC consortium updated their suite of benchmarks in 1992. SPEC now publishes 2 numbers: SPECfp92 for floating point operations and SPECint92 for integer and other operations. The original SPECmark was renamed SPEC89. SPEC no longer sanctions use of the single SPEC89 number because its accuracy was compromised.

The technology was revolutionary and DEC was there first.[20]

By mid 1990, DEC was a significant player in the workstation market.

Soon after, the DECstation 5000 and follow-on VAXstation models hit the market. The new DECstation packed more than 20 SPECmarks of CPU power -- more than double the original DECstation 3100 and nearly 7 times the original VAXstation 3100 -- for roughly the same price as the DECstation 3100. Performance eventually doubled on the new VAXstations, from 3 SPECmarks to roughly 6.

Storm clouds were gathering. IBM introduced its new POWER architecture. HP improved its PA-RISC architecture. Sun brought new versions of its SPARC architecture to market. Before long, HP and IBM were duking it out for bragging rights as the performance leader, with CPUs at roughly 50 SPECmarks and promises for hundreds of SPECmarks in the near future. Suddenly, the DECstation was no longer the leader, and the VAX was not even in the pack.

DECstation sales never took off, due mostly to lack of application software. Nobody from DEC seriously recruited application vendors to port their software to Ultrix, DEC's UNIX offering at the time. Other technical problems also surfaced with Ultrix. Lack of shared libraries was one of the most important. Since many of the important UNIX application software packages depended on shared libraries, it became very difficult for software vendors to port their product to the DECstations. Further, since DEC could not provide assurances of sufficient sales volume, many application vendors stayed away or put DEC low on their priority lists.

The VAXstation enjoyed moderate success, but performance lagged badly against the competition. The VAXstation 4000, due in fall 1990, slipped month by month for an entire year. It finally started shipping in late 1991. At roughly 12 SPECmarks, it was fast by VAX standards, but obsolete versus the competition even before it hit the market. DEC lost major customers and credibility from this VAXstation debacle. For example, one department at 3M changed their strategic direction away from DEC and VMS to HP and HP-UX (HP's version of UNIX). This cost the sales team in Minneapolis at least 200 units.[21] Reports of similar situations came from around the world as DEC lost workstation market share.

[20] At that time, a big component of my job was to demonstrate this technology to potential customers. It was genuinely exciting to watch the skeptics become converts.

[21] My ears still ring from tongue lashings I took from the people at 3M during nondisclosure presentations in 1990 and 1991. After DEC broke promise after promise, the people at 3M finally became disgusted and started to get rid of VMS in favor of HP and UNIX. DEC lost 200 seats in this department alone. DEC lost thousands and thousands of seats around the world due to similar situations with other customers.

Argenti's Model Starts to Kick In[22]

As DEC lost market share in workstations, sales of larger and more profitable VAX systems also started to slide. The VAX 9000 mainframe was an expensive technical and business flop as sales failed to even come close to projections and service proved to be a nightmare.

Constraints

By late 1991 and early 1992, DEC all but abandoned its DECwindows development and laid off or reassigned most of the engineering team. Its other layered software engineering groups found themselves in constant turmoil as managers fought turf battles for dwindling budgets. Rumors flew around the world across the electronic grapevine about the demise of various popular layered products.

In the field, presales consultants were asked to find ways to bill customers for work formerly done for free. Pressure mounted to cut back on trade show appearances and local marketing activities.

In 1992, DEC closed the VAX 9000 plant in California and quietly started removing them from the field.

Mismanaged Change, Creative Bookkeeping, Backstabbing

As DEC found itself with too many people at headquarters and apparently too few people in the field, it started "Career Opportunity Days". These were one or two day internal "job fairs", where interested people could interview with managers of field groups for positions in local service offices. Participants report the sessions were poorly organized; in many cases, managers and potential interviewees did not know who they should interview, or when or where they should be.

Senior management promised to set up a central fund to pay for all this. However, after local offices hired and relocated several people in 1990 and 1991, the newly reorganized senior management team changed their minds and dictated local offices would pay from their own budgets. Since local offices had no budgets for any of this activity, other budgets were squeezed.

Results were less than satisfactory. One case in Minneapolis is typical: DEC relocated Karen from New England to Minneapolis, at a cost of several thousand dollars, put her through several months of UNIX training, spending several more thousand dollars, then finally turned her loose with customers as a UNIX Software Specialist. Karen worked hard and began building a good reputation with customers. But after just over one year on the new job, DEC managers in Minneapolis laid her off in the fall 1992. In a market demanding UNIX expertise, DEC in Minneapolis threw away 18 months of investment

[22] We discussed Argenti's model in class 2/7/94. *Corporate Collapse: The Causes and Symptoms*, John Argenti, Halstead Press, 1976.

and its only UNIX expertise. Similar stories from around the world filled the DEC electronic mail network.

Alpha -- "The Big Project"

Meanwhile, DEC quietly revived development on its own RISC chip, newly code named "Alpha", as it became clear the VAX architecture could not perform anywhere near the speed of the newer RISC architectures. The original PRISM was altered with new capabilities that would allow it to run VMS, UNIX, or any other popular operating system. An advanced development project quietly started to investigate porting VMS from the VAX to the new Alpha architecture.

As the project gained momentum through 1990 and 1991, word leaked out about a mysterious new RISC architecture from DEC[23]. DEC publicly introduced the first Alpha RISC chip at the annual ISSSC convention in February, 1992. It was a mob scene as people clamored for more information and a look at this hot new chip.[24]

VMS porting work continued in earnest and VMS Engineering delivered Alpha VMS, version 1.0, on schedule in November, 1992. Version 1.5 followed shortly after in May, 1993. By May, 1994, VMS on the Alpha platform had all the capabilities of VMS on the VAX platform as DEC simultaneously shipped VMS version 6.1 for VAX and Alpha. This was a monumental technical triumph.

DEC had a bold strategy to conquer the market on several levels:

First, it would establish Alpha as the industry standard 64 bit chip for the 21st century. It would do this by inventing the most powerful and bullet-proof RISC architecture on the market and convincing system vendors and partners to use it. DEC would also recruit other manufacturing foundries to build Alpha chips, which would provide second sources for system vendors. Alpha chips would be everywhere -- from factory assembly lines, to controlling fuel/air mixtures in automobiles, to kitchen toasters.

DEC would also build its own systems based on Alpha chips and would migrate all of its software to run on alpha based platforms. These systems would lead the world in performance, price/performance, and every relevant performance benchmark. They would be years ahead of anything the competition could offer.

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[23] A few VMS partners and I were sources of some of these early leaks in 1990. Lacking approved nondisclosure presentations, we made our own presentations and delivered to key customers we were in danger of losing. These were customers who were genuinely concerned about DEC's future research and development investments. If DEC had no plan to at least keep up with the rest of the industry, they would defect. If we could convince them DEC had a credible plan, we could hopefully keep them in our camp. In Minnesota, this strategy worked well at Mayo Clinic, not so well at 3M. Eventually, vice-president Bill Demmer began making public speeches about alpha and the floodgates opened. Some members of the press criticize those early leaks, but I still believe it was the right thing to do. Without early notice to key customers, we would have lost many of them to the competition before we had any chance to compete.

[24] The ISSSC convention is ***the*** convention for chipmakeers. Vendors deliver technical papers and introduce their wares at these shows. People who were there at the 1992 show wrote memos vividly describing people lined 10 deep all around Dan Dobberpuhl, the DEC presenter, clamoring for details.

But something happened between the chip announcement in February 1992 and introduction of formal products in November, 1992. The introduction was poorly coordinated, unclear, and unenthusiastic. DEC failed to communicate its plans to the buying public or generate any confidence in its ability to deliver. Problems with DEC sales and management were widely documented in the press.

Sales did not take off as expected, DEC never did recruit partners to generate sufficient sales volume, and, by mid 1994, far from becoming an emerging industry standard, Alpha is fast becoming a footnote.

Why isn't Alpha Successful?

I was unable to find anybody inside DEC who would tell a candid story on the failure to recruit significant partners. As a former insider, I offer this theory.

DEC lost much of its credibility in the mid 1980s when it closed the BI bus and changed business practices. Many vendors who depended on DEC went out of business because of this change. Even through mid 1994, DEC is only grudgingly and slowly opening its business practices. Nobody wants to depend on a partner who will stab them in the back.

DEC wants to sell Alpha chips to other system vendors and use Alpha chips in its own systems. These system vendors will eventually compete with DEC , yet they will also depend on DEC as a supplier -- a risky relationship, especially for a vendor with a reputation for stabbing its partners in the back.

DEC has lots of excess manufacturing capacity, and more coming online soon. With all this capacity, potential second source chip vendors are reluctant to invest in their own production facilities to build potentially competing chips. So none of the major players have signed on as second sources.

Waves of Reorganizaztions

Most of DEC's turnaround efforts centered around constant reorganization. The DEC electronic grapevine compared the situation to a bird cage; as somebody shakes the cage, the birds all fly in the air and land in different spots. Ken Olsen shook the cage for a while, then it was Bob Palmer's turn.

The situation deteriorated from 1991 through mid 1994 as vice-presidents were hired, fired, and built their empires.

Round One -- The New Management System

In 1991, Ken Olsen tried to attack the problem by reorganizing the company around "The New Management System". Sweeping reorganizations had worked at least twice in the past; first in the 1960s when DEC set up the now famous matrix management structure, and again in 1983 when DEC dismantled its product line structure.[25]

[25] This history is well documented in *The Ultimate Entrepreneur*.

Like everything else in the computer industry, TNMS soon came to be known by its acronym. The theme was simple and familiar: Set up a structure such that line managers would be accountable for their actions. Push budgeting and profit and loss responsibility as far down the organization and as close to the real work as possible.

It was a worthy goal, but scandalously implemented as vice-presidents all over the company jockeyed for strategic advantage against one another. The story from U.S. Sales may have been the most shocking.

Stovepipes

A business *stovepipe* is an organizational culture that prevents people in one segment of the business from interacting with people in another segment in a common-sense fashion. In a business stovepipe, communication travels vertically within a segment, but not laterally. The behavior is similar to a physical stovepipe above a fireplace - smoke travels straight up through the stovepipe. This is good in a fireplace, but bad in a business.

Business stovepipes create several problems. Stovepipe cultures tend to create semi-independent, vertically integrated divisions within the overall organization. The management of each of these divisions compete with each other for funds and other organizational resources. Ultimately the divisions become personal, self-serving "fiefdoms". Although each of the divisions depends on the other divisions to operate, they tend to act in heir own immediate interest, often at the expense of other divisions and the overall organization.

Unless somebody with overall responsibility intervenes, organizations with stovepipe cultures eventually become choked with waste, duplication, and mistrust. The market will eventually find a more efficient supplier and the stovepipe organization must either change or die.

Red Lines and Blue Lines

To implement TNMS in the U.S., Bob Hughes, then vice-president of U.S. sales, promised to eliminate bureaucracy and make Digital an easy company with which to do business. Bob and his team promised to change the Sales division from a strictly hierarchical, centralized organization, to a new form of organization where field managers would finally be empowered to make decisions.

Unfortunately, these grand promises turned into a disaster as they set up what may be the most confusing organizational structure ever witnessed in business. The system divided Digital's U.S. marketplace into geographies, then crossed the geographies with management structures to handle national and international customers. The idea was, each large account would have a single sales account manager with ultimate responsibility for profit and loss.

Large customers who crossed geographical boundaries and spent lots of money were called *Red Line* accounts. Each red line account was assigned an overall manager who had responsibility for profit and loss. All other accounts were called *Blue Line* accounts. These were managed as a portfolio by the existing field management team. An account

set manager would have ultimate responsibility for profit and loss for the assigned set of accounts in the territory.

Although the system was designed to be organized around customers, it quickly degenerated into chaos. Each red-line manager needed a sales force and technical support. Blue line managers also needed a sales force and technical support. Each manager drew up a budget for what they needed and where they needed them. Then they essentially picked teams from the existing sales and technical support force. Those not picked were laid off -- regardless of whether their skills were needed by the company.

The new red line managers generally had no prior relationships with their new customers. And, although the new organization was designed to give ultimate responsibility to red line and blue line managers, nobody ever built information systems to tell these managers whether or not they were profitable. This meant that managers in one part of the country made strategic decisions about customers in another part of the country without any knowledge of the history or relationship. And, even worse, they had no quantitative data to understand the basis or consequences of their decisions. This meant that significant decisions were often made with no qualitative or quantitative data. In many cases, budgets were no better than random numbers

The existing sales force in local offices across the U.S. knew their local customers down the street, but were prohibited from calling on them. Instead, the red line account managers would fly people from out of town to call on local customers. So a sales rep from Denver would call on the Minneapolis branch of a company with headquarters in Denver, while the sales rep from Minneapolis would call on the Texas branch of a company with headquarters in Minnesota.

This lead to ridiculous situations, including at least one in Minneapolis. Over the years, the Minneapolis office built a productive relationship with a large company with headquarters in Denver and significant operations in Minneapolis. But, after red lines and blue lines, people in the Minneapolis office were prohibited from calling on this customer. Instead, the account manager flew in from Denver occasionally. Results were predictable. The customer complained, ongoing projects were delayed or canceled, and the flow of money from this customer slowed down.

In several other cases, technical support people possessed skills needed to make significant sales to red line customers. But if the support people spent time with these customers, they would have to charge that time internally to the red line business, which had not budgeted for support time. It was internal accounting gone nuts. The predictable result: Digital walked away from significant pieces of business because its internal structures did not allow it to apply talent where it was needed.

The system forced sales managers to spend nearly all their time meeting or in conference calls with eachother in marathon budgeting and planning exercises. With all their time booked for planning exercises, nobody had time to run the business. Incredibly, they sometimes turned down orders because they had not yet assigned sales reps and territories, and nobody knew what to do.

In at least one case in Colorado in 1991, a customer called his local office to order a new $100,000+ VAX. The local office turned him away because it had not yet assigned a sales rep to the account.[26]

The situation ultimately degenerated into total chaos as the red line account managers quickly built their empires and the system grew increasingly corrupt. Geographical line managers found themselves forced to layoff more and more people as spending budgets were squeezed harder and harder each quarter as sales dried up.

The system took on a life of its own as the first wave of layoffs hit the U.S field in July 1991. Suddenly, it was no longer internal funny-money. In New York, security guards met people at the door as they reported to work. People on the "good" list were let inside to work. People on the "bad" list were escorted to their desks to clean out their belongings and leave.[27] In most other cities, people were escorted to the Personnel office throughout the day, told the news, then allowed to say good-bye and leave on their own. More than 20 people were let go that day in Minneapolis. To call that day stressful is a gross understatement. The next round occurred in October, 1991. From that time until mid 1994 and beyond, the constant threat of layoffs became just another fact of working life at DEC as round after round swept various groups across the company.

Red lines and blue lines could have worked had the system been implemented with at least some semblance of cooperation. Instead, it degenerated into competing empires and political maneuvering. The process failed and thousands of good people lost their jobs.

Bob Hughes eventually left DEC, "to pursue other interests", and the infamous red lines and blue lines died quietly.

Round 2 -- Customer Business Units

Bob Palmer took over as the new CEO in the summer of 1992 and reorganized the company again. This time, instead of dividing the company by geography, he divided the company into 9 business units. Four of these were product divisions, such as storage and personal computers. Five were market segments, such as medical, defense, government, and others.

The idea was to organize the company around customer issues, rather than arbitrary geographic boundaries, so each Customer Business Unit (CBU) concentrated on a group of industries world wide. Their job was to penetrate their assigned markets with Digital products and services and provide a favorable return to the company.

The 5 CBU vice-presidents were given free reign over their markets. They were empowered to make important decisions because they would be closest to the customer. Unfortunately, the results were disastrous. After 9 months of planning, the new

[26] Scott Fischer was the MIS director at Laser Magnetic Optical in Colorado and a former DEC employee from Minnesota. He told me this story at a Minneapolis DEC user group meeting in fall, 1991.

[27] People who were there documented their experiences in electronic employee forums. I also heard the story in face to face discussions with friends who were there.

organization went into effect in July 1993. By the end of the quarter, September 1993, Digital's revenues dropped 10 percent and the company lost another $83 million. The December 1993 and March 1994 quarters were equally disastrous.

Almost immediately after the CBU vice-presidents started on the job, a blizzard of announcements hit the electronic mail network about country-level vice presidents and regional level vice-presidents The new CBU vice-presidents each independently hired their own layer of geography based vice-presidents. Now, instead of one geographical structure, the company ended up with 5 separate geographical organizations, along with the original geographic organizations, each fighting for talent, customers, money, and prestige.

So much for getting close to the customer!

The story gets worse. After 9 months of planning, the senior management team finally notified individual employees in the field of the new CBU organizations to which they were assigned. Everyone received an electronic mail message and 24 hours to either accept the new assignment or be essentially terminated. Nobody in authority seemed to give much thought to the effect on employee morale or customer confidence as the word got out.

And the truly bizarre: By most estimates, $11 billion of Digital's $14 billion in revenue depend on VMS. This operating system runs the computer operations at many of the most important companies in the world. It would be really bad if a company told the world it is abandoning its flagship product.

Yet some CBU vice-presidents, in essence, did exactly that. They went out of their way to tell the press Digital does not plan to go after new markets with VMS. Instead, they told the press Digital expects its future growth to come from its UNIX offering. Predictably, customers interpreted this statement and other signals to mean Digital is abandoning VMS. This shook the confidence of many of Digital's most important VMS customers, who had bet millions of dollars and years of staff training on VMS. Many left; many are strongly considering leaving.[28]

DEC may never know how many customers they lost and continue to lose to other vendors. Despite repeated warnings and pleas from employees across the electronic network, nobody seemed to think about the consequences of alienating the company's employees and entire customer base.

[28] I talk to many people in the DEC installed base in my consulting business. Most now doubt DEC's long term viability and commitment. Also see the recent trade press article, "Good, bad news for StorageWorks, HSJ40", *Digital News and Review*, May 9, 1994, page 23. The article describes a survey of DEC's installed base customers by Reliability Ratings about disk storage upgrade plans. Very few members of DEC's installed base have plans to buy these upgrades. The article suggests the lack of interest is directly related to decreasing interest in the VAX. The survey results are consistent with my first hand observations.

Round 3 -- Back to Geographies

In the late fall, 1993, Willow Shire, medical CBU vice-president, left “to pursue other interests”. Palmer quietly put Lucente in charge of all CBUs. The business unit structure started to crumble. The rumors flew about more field reorganizations, but nobody seemed to have any solid answers.

Round 3 1/2 -- Lucente is Fired

After the March 1994 quarter, DEC’s board of directors fired Lucente and put Enrico Pesatori in charge of sales and marketing. Nobody really knows what will happen from this point.

Apparent Company Operating Conventions

Field Sales

Contrary to the lofty statements about "empowerment" and "quality", sales management inside Digital is strictly top-down and hiearchical. Budgets, quotas, and goals are decided from above after endless exercises. Most people in DEC sales become cynical after a few years of constant reassignment and incentives that have little to do with the work.

The press and analysts all argue that DEC should emphasize indirect sales channels such as distributors and retailers. DEC managers talked about this for years, but nobody ever took concrete action to make it happen. The average DEC sales rep on the street is simply not conditioned to thrive in the economy of 1994. Most end user DEC sales reps still get more credit for direct sales than indirect sales. One large system sale puts more money in their pockets than several PCs. Because of these incentives, many DEC sales reps still operate under a model that emphasizes high-priced, low volume products in a low priced, high volume world.

Digital Consulting

Digital Consulting is an industry laughingstock. This group was staffed with dedicated and capable people at the bottom, but filled with arrogance and incompetence at the top. In one noteworthy case, it took two vice-presidents of Digital Consulting to draft a one page letter to the field explaining that the company would soon be consolidating operations. When asked why, a member of their staff replied the tremendous amount of work required 2 vice-presidents.[29]

The system pits managers against eachother in a constant guerrilla war over who gets credit for orders. So management forces technical experts in the field to manually enter different, and sometimes contradictory, budget and forecast numbers into multiple systems. Instead of dealing with the real world, managers then make layoff decisions based on these numbers. The only metric that really counts is billable hours. Quality of solutions and customer satisfaction are far down on the list. The system provides every incentive to cook the books and no incentive for quality work.

Customer Service

The Customer Service group is the most efficient field group in the company. These are the people truly on the front lines, every day, troubleshooting customer hardware and software problems and maintaining customer relationships. The managers I have met are

[29] It happened in 1991. I was there and asked the question.

all top-notch, they all know their business, and they are all committed to operating efficiently and profitably.

Customer Service will need every bit of that efficiency as the market continues to squeeze revenue and profit margins. With cheap, commodity hardware and 3-5 year warranties, lucrative hardware maintenance contracts will soon be a distant memory. In fact, Service Revenues were down 11 percent in Q3 FY 1994. Since Digital combines revenue from Consulting and Customer Service operations in this single income statement line, it is not possible to tell which business took the brunt of this decline. But it is well known that other companies such as Bell Atlantic routinely try to underbid DEC service and they are making significant inroads.

Although traditionally a hardware maintenance group, Customer Service is working hard to build its software expertise. It will run into trouble as it competes internally with Digital Consulting to deliver system management and troubleshooting expertise on a consulting basis.

Storage

In mid 1994, storage is one of DEC's few bright spots. This group is becoming a competitive powerhouse and building an excellent reputation as a technology leader. In 1991, Charlie Christ, vice-president of the storage group, made a tough and unpopular decision to abandon large, proprietary disks and concentrate on smaller, more open 3.5 inch disks and standardized enclosures. Unlike other parts of DEC, they recognized where the market was going and got in front to help lead the charge. In 1990, DEC's storage products were the most expensive and slowest performing in the industry. By 1994, DEC storage is competitive with everyone on price, equal or better in performance and reliability, and constantly improving. Charlie Christ led the storage group from an industry laughingstock to leadership in 2 years.

PCs

By 1994, the PC business is another DEC success story. It was not always this way.

People still tell stories about the 1983 PRO 350, Rainbow, and DECmate II flops. These systems were technically excellent, years ahead of their time, and offered capabilities nobody could match. Unfortunately, DEC failed to recruit application software vendors and bungled its attempts at retail sales.

In 1990, DEC's PC business was a laughingstock. DEC finally made a deal with Tandy to resell their PCs and sold them at roughly double the market price. This further enhanced their reputation as a high cost producer.

In 1991, DEC started up a telephone and mail order PC business, modeled after Dell. This grew from nothing in 1991 to become one of the major PC players by 1994. Although he did not start up this operation, Enrico Pesatori is generally given credit for making it successful.

As a consumer, the PC division is pleasant to deal with. They offer good value on complete systems, but are nowhere near competitive on components and peripherals. However, they believe retailers are better able to sell components and peripherals at competitive prices. For DEC, warehousing and inventory costs are too high. Therefore, they made a conscious decision to concentrate on complete systems. They intentionally keep prices high on components and peripherals to keep demand down.[30]

They offer a responsive telephone sales staff, 3 year warranty, and reasonably priced telephone support services.

Hardware System Engineering and Manufacturing

DEC has a long reputation for excellence in hardware engineering and manufacturing. The reputation continues with the introduction of new alpha system platforms.

The forecasting system is a joke. It has been broken since at least 1979, when poor forecasts of the then new DEC VT100 terminal pushed lead times out beyond one year and spawned an entire clone terminal industry. Nobody ever wanted to spend money to fix the forecasting system, yet its shortcomings cost DEC dearly again and again. This was common knowledge at the grass roots level inside DEC for years and nobody ever figured out why management failed repeatedly to address the issue. By mid 1994, even the popular press knows about its problems:

> The next move: better systems. Insiders say one of the reasons Palmer's reorganization -- built around customer-oriented business units -- failed was inadequate sales-forecasting and manufacturing -planning systems. Designed for low-volume, high-margin products, they could not cope with the rapid shift to commodity products such as PCs and disk drives. One DEC sales manager says the sales-forecasting systems have no link to DEC's manufacturing-planning systems -- so the two are manually reconciled. Indeed, Lucente predicted as recently as February that Alpha sales were going to double in the March quarter. Instead, Alpha sales rose 66%. Admits a spokesman: 'There's some internal work that needs to be done for us to become more predictable.'[31]

The forecast system is still hurting DEC. DEC recently announced a brilliantly engineered new alpha based system, the DEC 2100. Most people at the grass roots believe demand will skyrocket for this product. Yet, according to a presentation from DEC to Minnesota DEC distributors in April, 1994, manufacturing is only planning to build 1200 systems in the June quarter. If demand is anything near expected, product shortages and lost revenue will be rampant.

DEC is pouring roughly $500 million into a new chip plant in Hudson, Mass. This state of the art facility is scheduled to come online in 1995. If DEC survives that long, it will

[30]Conversations with Cindy Perkins, DEC PC telesales rep (1-800-PCBYDEC)

[31] "Desperate Hours at DEC", *Business Week*, May 9, 1994, page 28.

build subsequent versions of its Alpha chips here. These future chips promise additional CPU performance gains of 10 to 100 times over those available in mid 1994.

Software Engineering

DEC software engineering was once widely respected in the industry. They are rapidly losing their credibility. They have lots of good ideas, but never seem to implement them, and the world will no longer wait for this group to get its act together. They have started and abandoned more ideas than most companies invent.

As recently as 1989, DEC offered unprecedented excellence in middleware and communication software. The operating motto at the time: "Build the best, integrate the rest." Unfortunately, DEC still offers roughly the same capabilities it offered in 1989. The rest of the industry passed DEC by as the engineering managers jockeyed with eachother in endless turf battles.

In 1990, David Stone was promoted to vice-president of layered software engineering. Stone was a visionary who preached the gospel of the “Information Utility” to anyone who would listen. He was one of the forces behind the scenes, long before the “Information Highway” made it to the popular press.

Stone believed that software products would soon become low margin commodities and would sit on retail shelves next to PCs. He further believed that DEC’s engineering methodology was antiquated and would not be ready for the new paradigm. So he attempted to reorganize several disparate and competing groups into “The New Software Group” (TNSG).

Evidently, Stone was more of a visionary than a practical manager.

By February, 1992, one manager from TNSG admitted in public it took them 6 months just to figure out roles and responsibilities. During this period, much of the ongoing work stopped or slowed down.[32]

Stone left later in 1992 and went to AT&T. He was replaced by Dennis Roberson, who appeared to be in way over his head. In public appearances in 1992 and 1993, Roberson was unable to give coherent answers to questions and seemed to provide little guidance or leadership to TNSG.[33]

Through 1992 and 1993, rumors flew across the electronic grapevine about the future of key application software products. With their futures uncertain, many of us in the field shied away from promoting them. Meanwhile, engineering budgets were squeezed further and further as the rest of the company went downhill.

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[32] This took place at an internal seminar, “IMSYM” (Information Management SYMposium) in Colorado Springs, February, 1992. The highlight of that seminar was a bus trip to Cripple Creek, Colorado, where I gambled away a 50 cent roll of pennies in the slot machines in one of the newly renovated main-street casinos.

[33] I remember Roberson in at least 2 appearances. The first was a company wide closed circuit TV broadcast in December, 1992. The second was a live appearance in front of the VMS Partners in July, 1993.

The casualties were heartbreaking and the stories shocking:

- DECwrite, introduced in 1989, was a great WYSIWYG word processor. DECwrite version 2, delivered in 1991, was full of bugs and had a nearly unusable user interface. From there, it failed to keep up with the times.
- DECpresent was a slide presentation package. It hit the market in the 1990/1991 time frame and died.
- DECdecision was a spreadsheet package with the capability to mix data from applications all over the computing world. It hit the market in 1989 or 1990, but was never enthusiastically promoted and never caught on.
- CDA (Compound Document Architecture) was a revolutionary innovation in 1988. It offered "live-link" capability, which meant a user of a CDA compliant application such as DECwrite could mix images, sound, video, and graphics with an electronic document. DEC introduced the beginnings of this capability in 1988, improved it somewhat in the 1990 timeframe, then let it drop. In mid 1994, Microsoft now delivers similar capability to millions of customers in its Office suite of products. DEC is not even a footnote in history.

The operating system groups were not much better, as UNIX and VMS changed strategy and direction multiple times.

Although nobody would admit it in public, ULTRIX was widely recognized as junk because it lacked key capabilities needed by third party applications. DEC invested its money on OSF/1, based on work from the Open Software Foundation.

With the rebirth of Alpha, a new conflict erupted: What should DEC offer to follow the current Mips based line of RISC workstations? Should it put OSF/1 on Alpha, or should it leave Alpha for the VMS installed base and bet on Mips for its UNIX capability?

The debates were endless and vice-presidents changed their minds constantly on what to do. OSF/1 on Alpha was on again, off again for months. This wreaked havoc on the engineering teams, which were forced to operate with no guidance from anyone in authority.

Finally, it was decided to put OSF/1 on Alpha and publicly commit to OSF/1 on the Mips based DECstation platforms.

Then the commitment to Mips started to waver as SGI bought Mips and the Mips R4000 chips became scarce. DEC's wavering commitment to Mips based workstations infuriated loyal DEC customers who bought them based on DEC promises they had a future.[34]

[34] One of these situations occurred at Mayo Clinic in 1992. The Minneapolis UNIX specialist and I delivered the presentations to them about DEC's future plans and Mayo made major commitments based on what we told them. When the plans changed a few weeks later, I was given the dubious honor of explaining the new plans. DEC eventually lost much of Mayo's workstation business to HP, as application software vendors canceled their DECstation plans.

Sometime in 1992, Alpha became the clear priority for OSF/1. DEC finally delivered OSF/1 in March 1993, to yawns in the marketplace. They never did deliver OSF/1 on a Mips DECstation platform and the Mips platform died a quiet death.

According to sources, the UNIX engineers are still groping for leadership and have no idea on what their strategic direction should be. Without goals, they just drift. Morale on the VMS side is also low as projects are canceled and more and more good people leave for better pastures.[35]

By mid 1994, Microsoft, Lotus, and other PC software companies have long since passed DEC in the marketplace. Some of their development teams are led by former DEC software engineers. Meanwhile, the once proud DEC software engineering group is a shambles.

[35]For example, Brian Breton, long time product manager, liason to user groups, and defender of VMS in electronic discussion forums and user groups, left in March to join another company.

Analysis of the Company's Cost Position

DEC's revenue per employee has steadily improved over the years. By April 1993, it was roughly $153,00. Revenue per employee for IBM is $265,000. In order for DEC to match IBM in revenue per employee, it must slash 40,000 from the payroll of 92,000. See the appendix for a trend line of revenue per employee.

At 31 percent of revenues at the end of FY 1993, SG&A expenses are way too high. In the early 1980s, SG&A was less then 20 percent of revenues. SG&A climbed steadily through the 1980s to 31 percent in 1990, 32 percent in 1991, and 34 percent in 1992. However, these figures are deceiving because the SG&A figures for 1990, 1991, and 1992 included special restructuring charges. Something happened in FY 1993 to drive SG&A expenses up. The publicly available data gives no hint on what that could be.

For the first 9 months of FY 1994, the figure was 28.71 percent, a step in the right direction.

	FY 1990	*FY 1991*	*FY 1992*	*FY 1993*	*9 months 1994*
SG&A Percentage	30.68%	32.14%	33.60%	30.94%	28.71%
SG&A Percentage without special restructuring charge	26.43%	24.23%	22.83%	N/A	N/A

Inventory turns steadily increased through the 1980s, from a low of 2.0 in 1982 to 5.1 in 1993. At first glance, this seems like good news. However, as the economics of the computer industry change from low volume, high profit hardware to high volume, low margin commodities, inventory turns *should* increase substantially.

Accounts Receivable Days Sales Outstanding also improved from 83 in 1992 to 69 in 1993. This is the best performance of all the time for which financial data is available. The number jumped back to 81 days for the first 9 months of 1994.

Much of Digital's cost comes from the relative increase in cost of product sales. The following table vividly illustrates the sinking profit margins on product sales as the industry moves towards high-volume, low-margin products. For comparison, note that service expense percentages remained steady through the same period.

	FY 1993	*FY 1992*	*FY 1991*	*FY 1990*
Cost of Product Sales as a percentage of product sales	58.83%	55.20%	47.05%	46.97%
Service Expense as a percentage of Service Sales	61.43%	62.29%	60.10%	61.89%

Analysis of the Company's Differentiation

By mid 1994, Digital has two major differentiating factors left; clustering technology and Alpha. DEC's modular storage enclosures are also innovative and unique. In the commodity markets, DEC PCs, disk drives, terminals, and printers are generally the same as everyone else's offerings.

Clustering

Clustering is the ability to connect several computer systems into a single management domain, such that users see a single system instead of disparate systems. The technology offers several advantages to users and system managers. For example, if one system fails, another system in the cluster can take over the failed system's processing load and continue. Dataquest recently evaluated cluster offerings from several vendors and rated VMSclusters on top.

VMS is still widely recognized as an excellent operating system. It is known for its stability and robustness in critical, high availability environments. VMS first hit the market in 1978 and introduced clustering to the world in 1984. Ten years later, it still provides clustering and high availability computing capabilities unmatched in the industry.

Marketing is worse than poor as DEC allowed the competition to paint VMS as a legacy, old, proprietary product with limited future life. Instead of continuing innovation, DEC allowed a massive self-fulfilling prophesy to damage its reputation possibly beyond repair. VMS may well fade from memory as other vendors catch up and pass its capabilities.

Alpha

This technology still has the potential to rule the world. It is still the only pure 64 bit chip available. 64 bit capability is fast becoming important as users deal with larger and larger databases and programs. The difference between traditional 32 bit systems and 64 bits is dramatic:

With 32 bits, it is theoretically possible to map the contents of a typical 1994 disk drive into a computer's main memory. With 64 bits, it is theoretically possible to map the contents of every disk drive ever built since the dawn of time into a computer's main memory.[36]

[36] A 32 bit word allows a computer to map 2^32 addresses, or roughly 4 GB (4 billion characters). In mid 1994, most modern disk drives hold roughly 2 GB of data. A 64 bit word allows a computer to map 2^64 addresses, or 4 billion sets of 4 billion characters each. Assuming a disk no bigger than 4 billion characters, this means 64 bits provides the capability to store the contents of 4 billion disk drives. It will be a long time before the industry produces that many disk drives!

The Alpha architecture gets rave reviews from nearly all technical evaluations and is priced just above Intel's Pentium chip. At one time, DEC had plans for a low cost Alpha chip to make another run at the PC world and knock Intel out of its leadership position.

If DEC can recruit even a few credible partners and fix its marketing problems, it may still emerge from its troubles as a force to be dealt with.

Analysis of the Company's Leadership and Organization

It is sickening for a long-time member of the DEC community to watch incompetent and uncaring management ruin the company. The recent leadership record of DEC's senior management is unimpressive:

Lack of any Strategy

As one long CIO of a long time DEC business partner put it: "When I go to Redmond and listen to Microsoft non-disclosures, everyone I talk to tells me the same story. They could all give the same presentation. But when I go to New England and listen to DEC, everyone seems to have their own agenda and everyone tells me a different story. The people at Microsoft know where they want to be. The people at DEC can't seem to figure it out."[37]

This lack of strategy explains the many organizational failures. After DEC's success with VAX/VMS, the company lost its mission. Is DEC a chip manufacturing company? Is DEC a computer system company, a software company, a UNIX company, a VMS company, a PC company? Without a clear mission and without a definition of success, no amount of reorganization will help.

Illusory Leadership - Why is Management Hiding?

After some senior DEC vice-presidents stated publicly that VMS is intended for DEC's installed base and growth will come from UNIX related sales, the DEC Users group in the Boston area -- DEC's headquarters -- met in the fall of 1993 and invited DEC's senior management to listen to their concerns. These people, with millions of dollars and years of training invested in VMS, represented some of DEC's largest customers from DEC's home turf. Those vice-president statements sent a signal to these customers that their investment in information technology over the years would soon be obsolete. Obviously, they were concerned.

They sent invitations with several weeks advance notice and publicized the meeting in the media. Yet, incredibly, nobody from DEC's senior management showed up. Instead, they sent Brian Breton, a VMS product manager with no authority to change company policy, to defend DEC's strategy or lack of strategy. Brian did an admirable job, but his statements carried no credibility. Brian subsequently left DEC in April, 1994.

In 1992, Digital in Minneapolis had the opportunity to become a major vendor at Fingerhut. Fingerhut was interested in workstations, servers, and software development to run its warehouses. The local Digital sales team put together a comprehensive

[37]Conversation with Mike Farrell, vice president of Information Services at NCS, Eden Prairie, Minnesota, May 10, 1994. People from Koch Refinery and other DEC customers in the Twin Cities made similar statements.

proposal and submitted the proposal to Fingerhut. Fingerhut asked to meet with a DEC executive for assurances that DEC would continue and enhance the proposed products. Incredibly, the Minneapolis sales rep went through 18 DEC vice-presidents before he found one willing to meet with Fingerhut.

Groups of senior field technical people meet twice yearly in New Hampshire. Ken Olsen addressed both sets of meetings in 1991, listened intently to presentations from attendees, and even argued vehemently over some points. We invited Bob Palmer and several vice-presidents to subsequent meetings. Each time, they accepted, only to cancel or disappear on mysterious vacations at the last minute. They had the opportunity to hear first-hand feedback and chose not to listen.

These stories are typical of DEC senior management. Contrary to press articles, the grass-roots view of management shows a group of people more interested in meeting with eachother than customers and employees.

Fair Play

This passage from a recent *Wall Street Journal* article describes the attitude of DEC's current senior management on fair play:

> Last month, Mr. Lucente visited Dallas to meet with some of his troops in an attempt to boost morale. His message: I'm here to listen -- ask me anything. But when a salesman requested elaboration of the company's strategy, which he called 'unclear', Mr. Lucente shot back that he was 'sick of answering this question,' according to one attendee. Mr. Lucente then 'took his head off, belittling him in front of the whole room Needless to say, no one else asked anything.'[38]

Lucente was subsequently fired in April, 1994. But several of his sales and marketing vice-presidents and earlier middle managers remain. The ones I met carried the same hostile attitude towards rank and file employees.

The recent record on fair play leaves much to be desired. Nearly every day, the employee electronic grapevine carried yet another story about management misdeeds. These stories could easily fill a book. The following examples are typical:

In July, 1993, after billions in losses and one profitable quarter, the DEC board of directors raised Bob Palmer's salary from $770,000 per year to $990,000 per year -- a 28.5 percent increase. In November, 1994, DEC cut its tuition reimbursement for employee education. Senior management relented after protests erupted all over the company and pushed the decision down to local management. But, in a sleight of hand worthy of Houdini, they gave no budget to local offices to fund employee education.

In June, 1993, after hiring dozens of new vice-presidents, 9 months of offsite planning and strategy meetings, and endless discussions, Bob Palmer's new CBU structure was

[38] "At Digital Equipment, A Resignation Reveals Key Problem: Selling.", *The Wall Street Journal*, April 26, 1994, page 1.

finally in place. Senior management sent an electronic mail message to field sales and software consultants to either accept arbitrary new job assignments or face de-facto dismissal.[39] Employees were given 24 hours to decide.

As week after week after week went by, each week brought a new rumor of yet another layoff round as managers would sneak away for secret, offsite meetings. Life inside Digital Equipment Corporation became very unpleasant during 1992 and 1993 as the fear and paranoia mounted.

[39]I saw the memos to people in the DEC office in Minneapolis. I made electronic inquiries to friends all over the United States and found everyone in Sales, technical Sales Support, and Consulting, was given a similar letter and ultimatum.

Appraisal of the Company's Handling of its Situation

Bright spots include:

- Alpha technology
- hardware system engineering
- the Alpha VMS port
- PCs
- storage

Low points:

- lack of any coherent strategy compounded by internal conflicts of interest
- too many vice-presidents
- a losing attitude throughout the company
- chronic sales and marketing failures
- software engineering other than the VMS port to Alpha
- the Mips debacle
- outdated business practices that make customers mad
- failure to recruit significant Alpha partners

Lack of Strategy and Conflicts of Interest

If Digital is to survive, Palmer and his team *must* address the strategy issue immediately. By mid 1994, since nobody can articulate any coherent strategy, people across the company fill the vacuum with their own. Without any guiding plan, the strategy for one group often conflicts with strategies of other groups. This leads to vice presidential fiefdoms, who regularly duke it out in endless turf battles.

Operating systems are a prime example. Digital offers VMS, UNIX, and Windows NT. Nobody admits to a conflict in public, but behind the scenes, the UNIX group and VMS group have been at war for years. Both are after eachother's markets and both groups regularly squash marketing and promotion efforts by the other group. This war plays itself out daily inside DEC with constant plots within plots within plots and political schemes designed to gain advantage at the expense of the other camp. Windows NT is not yet a major DEC investment, but everyone is already suspicious of them.

Conflicts of interest are everywhere. At the grass roots, Customer Service wants to expand its base by offering consulting services. But Digital Consulting offers consulting services. So Customer Service and Digital Consulting duke it out for consulting contracts.

In sales, the end-user reps and indirect channels reps regularly duke it out over customer situations. The channels reps want to see the sale go through their favorite distributor or

reseller. The end-user reps want to sell directly to the end user. The politics often get nasty as each camp hatches plots to outmaneuver the other side.

Too Many Vice Presidents

At last count, DEC had 126 vice-presidents.[40] It is mind-boggling why any company needs this many vice-presidents. I clearly remember watching the electronic memos fly almost daily announcing yet another new vice-president of something. For example, Sales has an overall vice-president company wide. Russ Gullotti is vice-president of the Americas zone. Scott Roeth is vice-president of sales in the United States. There are also regional vice-presidents and several industry specific vice-presidents left over from the CBU days. At the grass roots, nobody really knows who reports to whom or which vice-president is in charge. Many people believe the vice-presidents do not know who is in charge either, as they hatch plots against one another in an endless guerrilla war.

Meanwhile, as DEC continues to lose market share and lay off employees, the managers and vice-presidents tend to get rid of the people with weak power bases. These are usually the technical support people at the bottom of the pyramid. These people typically find jobs at other companies or start their own businesses in direct competition with Digital. This further weakens the company and accelerates the downward spiral.

The dumb ideas, poor morale, losing attitude, and many of the failures over the recent years can be traced directly back to internal conflicts of interest, political fiefdoms, hidden agendas, and seething animosities inside DEC. The system forces managers to spend their energy waging internal political wars instead of serving customers. Employees watch this happen, eventually become cynical, and eventually either leave or are laid off. DEC is on a viscous downward spiral that will only stop if top management takes decisive action.

What to do about it?

After nearly 40 pages documenting DEC's problems in detail, this section offers some get well suggestions from a long time member of the DEC community.

By mid 1994, DEC still has a limited opportunity to succeed but only if it takes immediate corrective action.

First, senior management must come out from the shadows and interact with employees and customers at the grass roots. Beyond face to face meetings, they must get involved in the electronic marketplace of ideas that regularly fly around the internet and DEC's internal network. DEC's electronic network is one of the most powerful interactive communication mediums on earth and rank and file employees are expert at using its capabilities to keep in touch with eachother and customers. At the press of a few buttons, people can send information to thousands of employees and customers around the world

[40] DEC keeps an internal electronic company database, called VTX,. A friend in the Minneapolis office looked up this figure in VTX for me.

in seconds The top DEC managers serve their egos but ignore a motherlode of valuable information by failing to exploit the electronic communication capabilities at their fingertips.

Using data gathered from electronic conversations and face to face meetings, come up with a simple, specific, coherent strategy. Write it down in one page or less and distribute it to all employees. Use the electronic network to test it informally and get feedback. Then refine it and test it again until it is right. Once the strategy is finished, convince everyone to buy into this strategy and then spin off operations not central to it.

DEC management has a huge credibility problem with employees, Wall Street, and customers. They can only overcome this problem by taking a genuine interest in the real marketplace and forgetting about internal political backstabbing.

The analysts and pundits call for radical restructuring, massive layoffs, and selling businesses. This may well be the correct course of action. But before blindly stumbling into the next quick cure and lurching wildly from one strategy to the next, DEC's management absolutely must begin listening to its employees and customers and develop a coherent strategy that makes sense. Management needs to understand why it is taking action before doing it. Once the strategy is in place, make the bold moves necessary to execute it.

Some Specific Suggestions

These are suggestions from a former employee with a strong interest in the survival of the DEC marketplace. I offer these as a test to begin discussions, not as a final product. These suggestions might be dumb ideas. The only way to find out: offer them for discussion and see what people think.

DEC needs to quit trying to kill VMS. VMS and clustering are the only software capabilities DEC has left that are unique. Instead of apologizing and trying to milk the product, DEC needs to actively develop and market it. At one time, VMS had the largest installed base and the richest set of application software of any computer operating system on earth. In mid 1994, that base is shrinking fast.

Begin active development again on DECwindows and offer a VMS PC with a usable, standalone configuration for around $3000. Add a MS-Windows programming interface and recruit Microsoft and other PC application vendors to offer their applications on this platform.

Spin off semiconductor operations into a wholly owned subsidiary or separate company. This will help DEC find alpha partners to achieve its goal of making Alpha an industry standard.

Spin off Storage, PCs, Consulting, Customer Service, Application Software, Terminals and Printers, and Databases (RDB) into subsidiary companies. Each of these businesses are separate entities with their own interests and operating conventions. It might make

sense for them to support themselves as separate businesses. They would live or die on their own merits.

This would leave the parent company with a core system business based mostly on Alpha platforms. The parent company would concentrate on these platforms and offer a choice of VMS, OSF/1 (UNIX), Windows NT, and perhaps Novell Netware for operating systems. Customers and distributors would contract directly with Storage, Consulting, Customer Service, etc. for application software, support, and peripheral components. In a free market, customers and distributors would also be free to contract with competitors for value added components.

In large system integration situations, the Consulting company would contract with the DEC parent or another system vendor for hardware platforms, and with other subsidiary companies or outside vendors for other components as needed.

The various operating systems offered by the remaining DEC parent company would likely compete with eachother for the same markets. But this time, instead of guerrilla warfare, actively promote the competition. The sales force and distributors would be free to choose products that make most sense in the individual situation, and engineering groups would openly compete with eachother for sales in an internal market. This way, prosperity would be determined by market acceptance, not internal politics.

Time is fast running out. DEC can still save itself by taking positive action. And, in the spirit of a free enterprise economy, if it takes the right steps, it will prosper. If it takes the wrong steps, it will die.

Appendix - Financial Performance over Several Years

Operating Summary -- Fiscal 1982 through Fiscal 1993

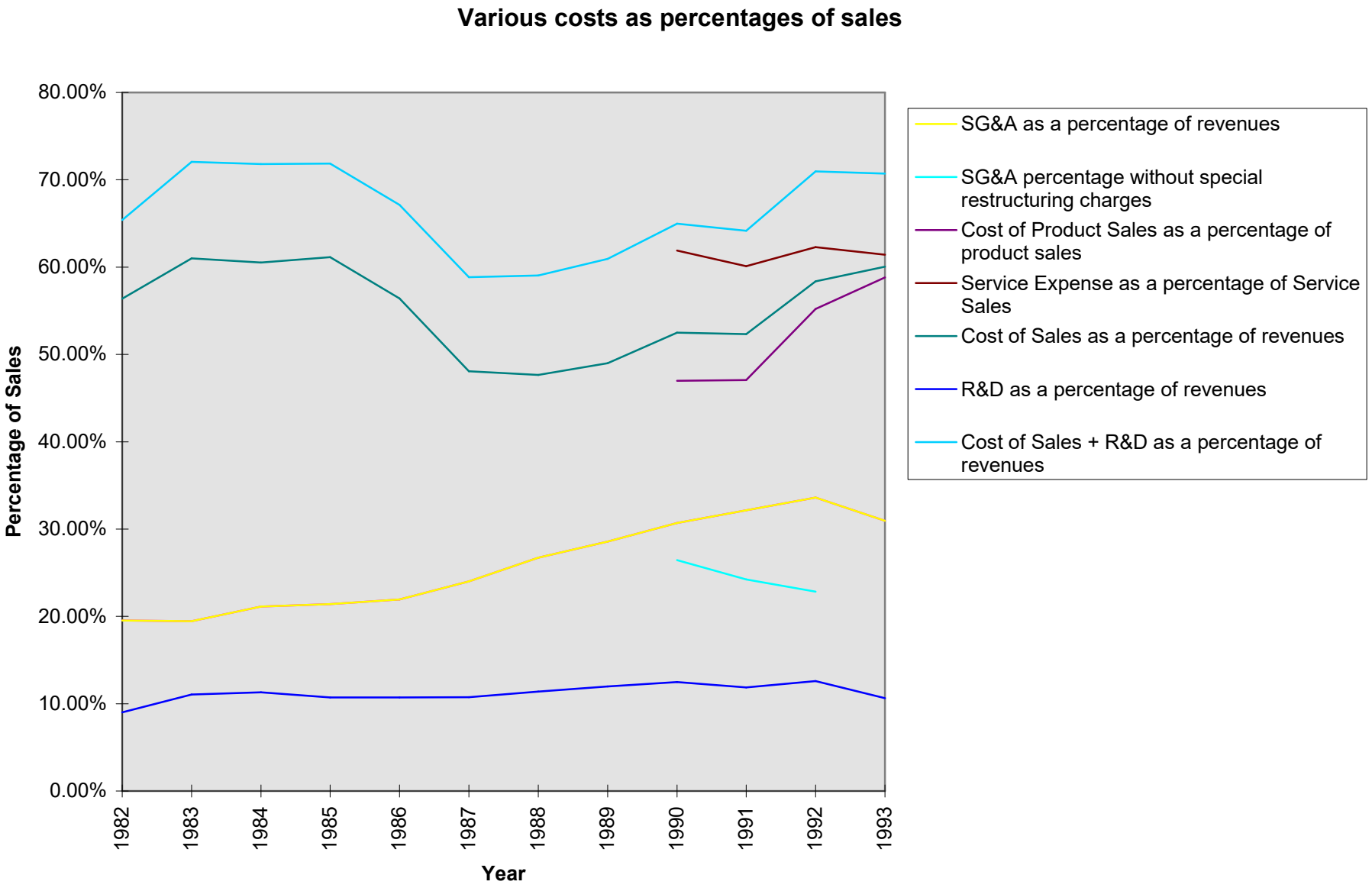
Dollars not adjusted for inflation due to computer industry

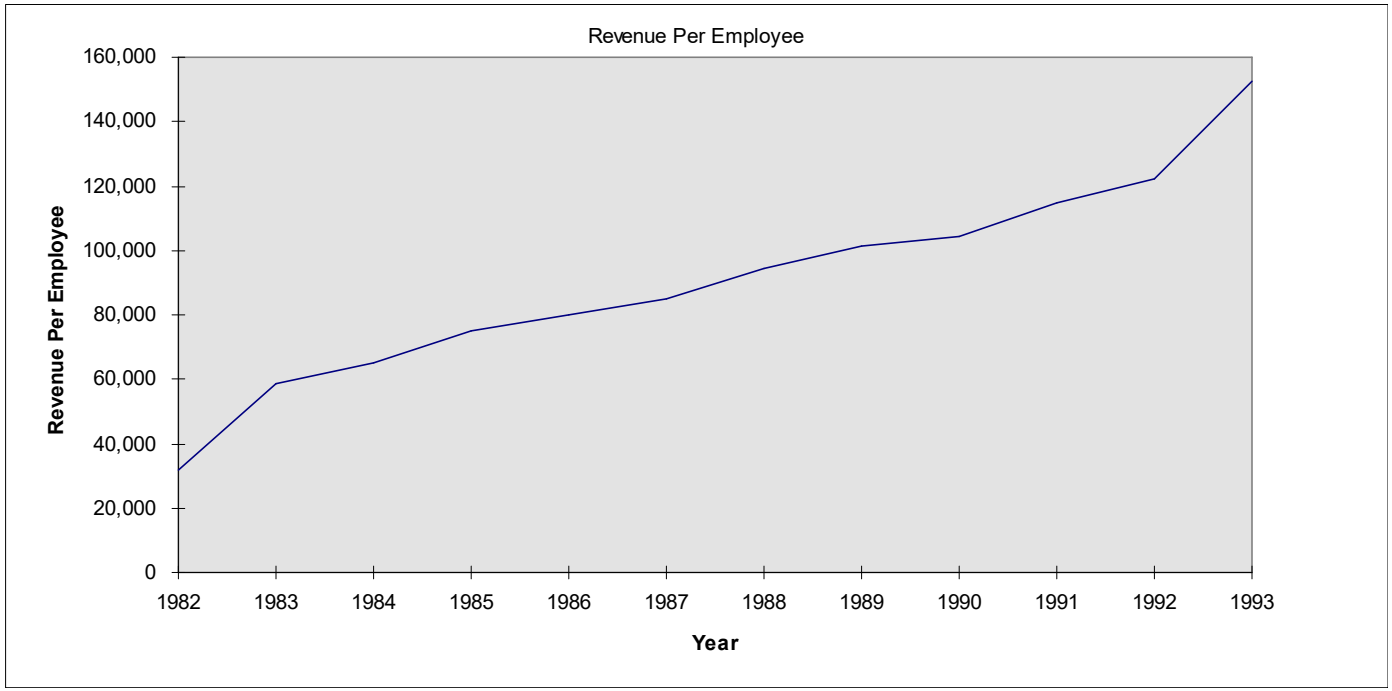
Dollars in millions except per share data and stock price	1993	1992	1991	1990	1989	1988	1987	1986	1985	1984	1983	1982
Revenues												
Product Sales	7,588	7,696	8,299	8,145	8,190	7,541	6,254	5,103	4,530	3,804	2,828	2,739
Service and other revenues	6,783	6,235	5,612	4,797	4,552	3,934	3,135	2,487	2,156	1,780	1,444	1,142
Total Operating Revenues	14,371	13,931	13,911	12,942	12,742	11,475	9,389	7,590	6,686	5,584	4,272	3,881
Costs and Expenses												
Cost of Product sales	4,464	4,248	3,905	3,826								
Service expense and cost of other revenues	4,167	3,884	3,373	2,969								
Total cost of product sales and service expense	8,631	8,132	7,278	6,795	6,242	5,468	4,514	4,282	4,087	3,379	2,606	2,188
Research and engineering expense	1,530	1,754	1,649	1,614	1,525	1,306	1,010	814	717	631	472	350
Selling, General, and Administrative expense	4,447	4,681	4,471	3,971	3,639	3,066	2,253	1,665	1,432	1,179	831	758
Restructuring Charges		1,500	1,100	550								
Operating Income (Loss)	(237)	(2,136)	(587)	12	1,336	1,635	1,612	829	450	395	363	585
Interest Income	64	96	113	142	124	144	122	116	63	41	61	103
Interest Expense	51	39	45	31	39	38	45	88	82	35	13	15
Profit (Loss) before cumulative effect of change in accounting principle	(224)	(2,079)	(519)	123	1,421	1,741	1,689	857	431	401	411	673
Provision for income taxes	27	232	98	49	348	435	552	240	(16)	72	127	256
Profit (Loss) before cumulative effect of change in accounting principle	(251)	(2,311)	(617)	74	1,073	1,306	1,137	617	447	329	284	417
Cumulative effect of change in accounting principle, net of tax		485										
Net income (Loss)	(251)	(2,796)	(617)	74	1,073	1,306	1,137	617	447	329	284	417
Weighted number of shares outstanding (million)	130,409	124,864	121,558	125,222	127,000	132,000	133,000	131,000	124,000	115,000	113,000	111,000
Net income (loss) per share	(1.92)	(22.39)	(5.08)	0.59	8.45	9.89	8.55	4.71	3.60	2.86	2.51	3.76

Financial Position Summaries, General Information, and Ratios

(dollars in millions except per share data and stock price)	**1993**	**1992**	**1991**	**1990**	**1989**	**1988**	**1987**	**1986**	**1985**	**1984**	**1983**	**1982**
Financial Position Summary												
Inventories	$1,755	$1,614	$1,595	$1,538	$1,638	$1,575	$1,453	$1,200	$1,756	$1,852	$1,354	$1,137
Accounts receivable, net of allowance	$3,020	$3,594	$3,317	$3,207	$2,965	$2,592	$2,312	$1,903	$1,539	$1,527	$1,125	$808
Net property, plant and equipment	$3,178	$3,570	$3,778	$3,868	$3,646	$3,095	$2,127	$1,867	$1,731	$1,511	$1,340	$1,605
Total assets	$10,950	$11,284	$11,875	$11,655	$10,668	$10,112	$8,407	$7,173	$6,369	$5,593	$4,541	$4,024
Long term debt	$1,018	$42	$150	$150	$136	$124	$269	$333	$837	$441	$93	$92
Stockholders' equity	$4,885	$4,931	$7,624	$8,182	$8,036	$7,510	$6,294	$5,728	$4,555	$3,979	$3,541	$3,165
Stockholders' equity per share	$36.19	$38.58	$61.18	$66.76	$66.12	$59.47	$49.87	$44.54	$38.43	$34.42	$31.42	$28.65
General Information and Ratios												
Current ratio	1.8:1	1.4:1	2.0:1	2.3:1	2.0:1	2.9:1	3.4:1	4.9:1	4.9:1	3.8:1	3.9:1	4.1:1
Quick Ratio	1.2:1	1.0:1	1.4:1	1.6:1	1.9:1	2.0:1	2.4:1	3.5:1	2.8:1	1.9:1	2.0:1	2.3:1
Working Capital	$2,964	$2,015	$3,777	$4,332	$4,501	$4,516	$4,377	$4,223	$3,694	$3,001	$2,377	$2,181
Investments in property, plant, and equipment	$529	$710	$738	$1,028	$1,223	$1,518	$748	$564	$572	$452	$419	$511
Depreciation	$699	$733	$772	$759	$659	$516	$435	$384	$315	$253	$203	$153
Total debt as a percentage of total debt plus equity	17.50%	1.80%	2.20%	2.00%	2.00%	3.60%	4.20%	5.90%	15.70%	10.30%	3.00%	3.20%
Operating income (loss) as a percentage of revenues	(1.70%)	(15.30%)	(4.20%)	0.10%	10.50%	14.20%	17.20%	10.90%	6.70%	7.10%	8.50%	15.10%
Income before taxes as a percentage of revenues	(1.60%)	(14.90%)	(3.70%)	1.00%	11.20%	15.20%	18.00%	11.30%	6.40%	7.20%	9.60%	17.30%
Effective tax rate	12.00%	11.20%	18.80%	40.00%	24.50%	25.00%	32.70%	28.00%	(3.70%)	18.00%	31.00%	38.00%
Net income (loss) as a percentage of revenues	(1.70%)	(20.10%)	(4.40%)	0.60%	8.40%	11.40%	12.10%	8.10%	6.70%	5.90%	6.60%	10.70%
Net income (loss) as a percntg of avg stockholders' equity	(5.10%)	(44.50%)	(7.80%)	0.90%	13.80%	18.90%	18.90%	12.00%	10.50%	8.70%	8.50%	14.30%
Net income (loss) as a percentage of average total assets	(2.30%)	(24.10%)	(5.20%)	0.70%	10.30%	14.10%	14.60%	9.10%	7.50%	6.50%	6.60%	11.20%
Number days accounts receivable outstanding	69	83	76	86	76	75	78	79	75	83	82	73
Inventory turns	5.1	5.1	4.6	4.3	3.9	3.6	3.4	2.9	2.3	2.1	2.1	2.0
Number of employees at year end - regular	89,900	107,900	115,100	116,900	118,400	113,900	103,000	88,300	83,000	79,800	68,100	67,100
Number of employees at year end - other	4,300	5,900	5,900	7,100	7,400	7,600	7,500	6,400	6,000	5,800	4,900	55,227
Stockholders at year-end	86,611	99,644	98,023	92,934	99,084	103,162	99,379	76,860	68,810	44,389	40,903	44,706
Common stock yearly high and low sales prices	49-30	72-33	87-45	103-70	122-86	199-99	174:82	94-46	63-39	61-33	65-32	55-34
SG&A as a percentage of revenues	30.94%	33.60%	32.14%	30.68%	28.56%	26.72%	24.00%	21.94%	21.42%	21.11%	19.45%	19.53%
SG&A percentage without special restructuring charges		22.83%	24.23%	26.43%								
Cost of Product Sales as a percentage of product sales	58.83%	55.20%	47.05%	46.97%								
Service Expense as a percentage of Service Sales	61.43%	62.29%	60.10%	61.89%								
Cost of Sales as a percentage of revenues	60.06%	58.37%	52.32%	52.50%	48.99%	47.65%	48.08%	56.42%	61.13%	60.51%	61.00%	56.38%
R&D as a percentage of revenues	10.65%	12.59%	11.85%	12.47%	11.97%	11.38%	10.76%	10.72%	10.72%	11.30%	11.05%	9.02%
Cost of Sales + R&D as a percentage of revenues	70.70%	70.96%	64.17%	64.97%	60.96%	59.03%	58.83%	67.14%	71.85%	71.81%	72.05%	65.40%
Revenue Per Employee	152,558	122,417	114,967	104,371	101,288	94,444	84,968	80,148	75,124	65,234	58,521	31,726

Graphs of various expense categories




Revenue Per Employee
160,000
140,000
120,000
100,000
80,000
60,000
40,000
20,000
0
Revenue Per Employee
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
Year

Operating Results-- Fiscal 1994 Third Quarter

	Three Months Ended 2-Apr-94	Three Months Ended 27-Mar-93
Product Sales	$1,749,621,000	$1,767,372,000
Service & Other Revenues	$1,509,168,000	$1,686,304,000
Total Operating Revenues	$3,258,789,000	$3,453,676,000
Cost of Product Sales	$1,210,478,000	$1,049,969,000
Service Expense	$946,800,000	$1,030,728,000
Total Cost of Sales	$2,157,278,000	$2,080,697,000
Research & Engineering	$316,767,000	$350,423,000
Selling, General & Admin.	$954,903,000	$1,050,600,000
Net Interest (Income)/Expense	$7,846,000	$77,000
Loss Before Income Taxes	$(178,005,000)	$(28,121,000)
Provision for Income Taxes	$5,301,000	$2,000,000
Net Loss	$(183,306,000)	$(30,121,000)
Dividends on Preferred Shares	$1,775,000	
Net Loss Applicable to common stock	$(185,081,000)	$(30,121,000)
Weighted Avg. Shares Outstanding	137,897,533	131,553,881
Net Loss per Common Share	$(1.34)	$(0.23)

Operating Results, First 9 Months of Fiscal 1994

	Nine Months Ended 2-Apr-94	Nine Months Ended 27-Mar-93
Product Sales	$4,966,549,000	$5,502,427,000
Service & Other Revenues	$4,561,267,000	$4,954,991,000
Total Operating Revenues	$9,527,816,000	$10,457,418,000
Cost of Product Sales	$3,304,185,000	$3,186,464,000
Service Expense	$2,859,150,000	$3,106,648,000
Total Cost of Sales	$6,163,335,000	$6,293,112,000
Research & Engineering	$962,432,000	$1,160,743,000
Selling, General & Admin.	$2,735,798,000	$3,359,093,000
Net Interest (Income)/Expense	$13,596,000	$(11,004,000)
Loss Before Income Taxes & Cumulative Effect of Change in Accounting Principle	$(347,345,000)	$(344,526,000)
Provision for Income Taxes	$11,332,000	$20,000,000
Loss Before Cumulative Effect of Change in Accounting Principle	$(358,677,000)	$(364,526,000)
Cumulative Effect of Change in Accounting Principle	$20,042,000	
Net Loss	$(338,635,000)	$(364,526,000)
Dividends on Preferred Shares	$1,775,000	
Net Loss Applicable to Common Stock	$(340,410,000)	$(364,526,000)
Weighted Avg Shares Outstanding	136,312,098	129,570,101
Net Loss per Common Share Before Cumulative Effect of Change in Accounting Principle	$(2.64)	$(2.81)
Earnings per Share on Cumulative Effect of Change in Accounting Principle	$0.14	
Net Loss per Common Share	$(2.50)	$(2.81)

Financial Summary -- End of Third Quarter Fiscal 1994

Selected Balance Sheet Items

BALANCE SHEET:	
Cash & Cash Equivalents	$1,263,551,000
Accounts Receivable, Net	$2,925,188,000
A/R Days Sales Outstanding	81
Inventories:	
Raw Materials	$497,340,000
Work in Process	$640,798,000
Finished Goods	$1,026,695,000
Total Inventories	$2,164,833,000
Prepaid Expenses and Deferred Income Taxes	$402,218,000
Total Current Assets	$6,755,790,000
Net Property, Plant & Equipment	$3,136,489,000
Other Assets, Net	$902,822,000
Total Assets	$10,795,101,000
Bank Loans and Current Portion of LTD	$10,620,000
Restructuring Reserve	$276,341,000
Total Current Liabilities	$3,473,509,000
Noncurrent Deferred Income Taxes	$26,369,000
Long-term Debt	$1,017,427,000
Postretirement Benefits	$1,239,573,000
Total Liabilities	$5,756,878,000
Stockholders' Equity	$5,038,223,000
Book Value Per Common Share	$33.73

Cash Flow and Other Selected data

CASH FLOW:	QTR	YTD
Cash Flows from Operating Activities,	$(125,406,000)	$(366,054,000)
Including Deprec. & Amort. of	$160,223,000	$522,941,000
Cash Flows from Investing Activities,	$(144,555,000)	$(475,760,000)
Including Investments in PP&E of	$166,312,000	$514,382,000
Cash Flows from Financing Activities..	$386,255,000	$462,170,000
Net Increase/(Decrease) in Cash and Cash Equivalents	$116,294,000	$(379,644,000)
Non U.S. Revenues	$2,041,303,000	$5,896,648,000
OR	63%	62%
Employee Population: Regular	85,700	
Other	6,300	

Operating Results - Q1 and Q2 of Fiscal 1994

	Q2 FY 1994 Three Months Ended 1-Jan-1994	Q2 FY 1993 Three Months Ended 26-Dec-1992	Q1 FY 1994 Three Months Ended 2-Oct-1993	Q1 FY 1993 Three Months Ended 26-Sep-1992
Product Sales	$1,659,924,000	$1,967,234,000	$1,557,004,000	$1,767,821,000
Service & Other Revenues	$1,594,155,000	$1,722,209,000	$1,457,944,000	$1,546,478,000
Total Operating Revenues	$3,254,079,000	$3,689,443,000	$3,014,948,000	$3,314,299,000
Cost Of Product Sales	$1,112,292,000	$1,116,538,000	$981,415,000	$1,019,957,000
Service Expense	$968,473,000	$1,058,270,000	$943,877,000	$1,017,650,000
Total Cost Of Sales	$2,080,765,000	$2,174,808,000	$1,925,292,000	$2,037,607,000
Research & Engineering	$330,948,000	$404,843,000	$314,717,000	$405,477,000
Selling, General & Admin.	$908,688,000	$1,177,306,000	$872,207,000	$1,131,187,000
Net Interest (Income)/Expense	$3,327,000	$(1,655,000)	$(2,423,000)	$9,426,000
Loss Before Income Taxes and Cumulative Effect Of Change in Accounting Principle	$(69,649,000)	$(65,859,000)	$(99,691,000)	$(250,546,000)
Provision For Income Taxes	$2,495,000	$8,000,000	$3,536,000	$10,000,000
Net Loss Before Cumulative Of Change In Accounting	$(72,144,000)	$(73,859,000)	$(103,227,000)	$(260,546,000)
Cumulative Effect Of Change In Accounting Principle, Net Of Tax			$20,042,000	
Net Loss	$(72,144,000)	$(73,859,000)	$(83,185,000)	$(260,546,000)
Weighted Average Shares	136,028,383	129,154,484	134,169,355	127,718,627
Loss Before Cumulative Effect Of Change In Accounting Principle Per Share	$(0.53)	$(0.57)	$(0.76)	$(2.04)
Cumulative Effect Of Change in Accounting Principle Per share			$0.14	
Net Loss Per Share	$(0.53)	$(0.57)	$(0.62)	$(2.04)

Operating Results - First 6 months Fiscal 1994

	Six Months Ended 1-Jan-1994	Six Months Ended 26-Dec-1992
Product Sales	$3,216,928,000	$3,735,055,000
Service & Other Revenues	$3,052,099,000	$3,268,687,000
Total Operating Revenues	$6,269,027,000	$7,003,742,000
Cost Of Product Sales	$2,093,707,000	$2,136,495,000
Service Expense	$1,912,350,000	$2,075,920,000
Total Cost Of Sales	$4,006,057,000	$4,212,415,000
Research & Engineering	$645,665,000	$810,320,000
Selling, General & Admin.	$1,780,895,000	$2,308,493,000
Net Interest (Income)/Expense	$5,750,000	$(11,081,000)
Loss Before Income Taxes & Cumulative Effect Of Change In Accounting Principle	$(169,340,000)	$(316,405,000)
Provision For Income Taxes	$6,031,000	$18,000,000
Loss Before Cumulative Effect Of Change In Accounting Principle	$(175,371,000)	$(334,405,000)
Cumulative Effect Of Change In Accounting Principle	$20,042,000	
Net Loss	$(155,329,000)	$(334,405,000)
Weighted Average Shares Outstanding	135,519,380	128,578,210
Loss Per Share Before Cumulative Effect Of Change In Accounting Principle	(1.29)	(2.60)
Earnings Per Share On Cumulative Effect Of Change In Accounting Principle	0.14	
Net Loss Per Share	(1.15)	(2.60)