Minicomputers & Pheripherals

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Company	Price 7/30/84	Estimated E.P.S. FY 1984	Estimated E.P.S. FY 1985
Tandem	14	$0.85	$1.20
Stratus Computer	10	0.25	1.50
Norsk Data	33	7.75	2.15
Apple Computer	25	1.10	2.35
TeleVideo	4	0.37	0.45
Convergent Technologies	12	0.55	1.25

In many ways, **Tandem's** third quarter was a "make or break" period for the company, following the disastrous results of the preceeding quarter and the generally disappointing progress which has been made over the past three years. Investors were looking for Tandem to resume a growth rate of at least 35%, particularly given the buoyant economic environment and favorable reaction to its new TXP system. However, the company didn't come through. While results were up sharply over the second quarter, they were below expectations. Revenues expanded 29% to $142 million. As expenses were geared to a 35% sales improvement, operating margins suffered, falling from 12.3% to 10.1%, and earnings per share rose only 10% to $0.23, versus $0.21 in the year-earlier period.

The revenue shortfall was particularly disappointing in light of Tandem's earlier statement that second quarter shipments were close to target but much of it could not be recognized and thus there would be a spillover effect into the third quarter. Clearly, this was not the case. The company's excuse for the shortfall was the fact that it is in a marketing transition, attempting to sell larger and larger configurations which require longer selling cycles. This may well be part of the reason, but other factors were involved too, some of which can be more readily explained, such as the slowdown in banking business due to the financial condition of many of these institutions. Of possibly greatest significance is the fact that management appears to have lost some control over the company.

Fourth quarter revenue growth is expected, at best, to show modest improvement versus the third quarter rate (e.g. perhaps a 30% increase). Margins could be under pressure due to the NSII to TXP trade-in program, which expires at the end of the quarter. While this boosts sales, gross margins suffer. On the plus side, its fourth quarter tax rate should plummet to 20-22% from 40% due to the elimination of the DISC. We have cut our estimate for the year to $0.85 from $1.00. For 1985, we are now looking for $1.20 versus our earlier estimate of $1.70.

While we continue to believe that Tandem has a good product and an attractive market niche, its apparent lack of

Tech Views 8/1/84

control and loss of credibility will prevent the stock from appreciating, in our view.

LES

MIS Week 8/1/84 p43

Tandem's Net Rises

CUPERTINO, Calif.—Tandem Computers Inc. posted net income of $9.25 million, or 23 cents per share, for the third quarter ended June 30.

The third quarter results reflected only a slight rise over the comparable period in fiscal 1983 when net income was $8.44 million, or 21 cents a share.

Revenue for the third fiscal quarter rose 29 percent to $141.92 million, compared with $110.29 million in the same period a year ago.

Tandem president James G. Treybig said the company's "accounts receivable days and inventory turns both improved during the quarter." He also noted that the company added a "significant number of new customers" during the quarter.

Treybig also pointed out that the new "TXP" system accounted for a "majority of systems shipped" in the recent quarter.

For the nine months ended June 30, Tandem reported net income of $21.27 million, or 51 cents a share. Net income for the comparable period a year ago was $22.01 million or 54 cents per share.

The dip in net income for the current nine-month period is attributed to a weak second quarter experienced by Tandem. At the end of its second quarter the company said its second quarter has "historically been weaker than the other three."

Tandem also experienced a false start with its new "NonStop TXP" system around that time because of component problems.

Revenue for the nine months ended June 30, rose 26 percent to $379.53 million compared with $300.43 million in the same period a year ago.

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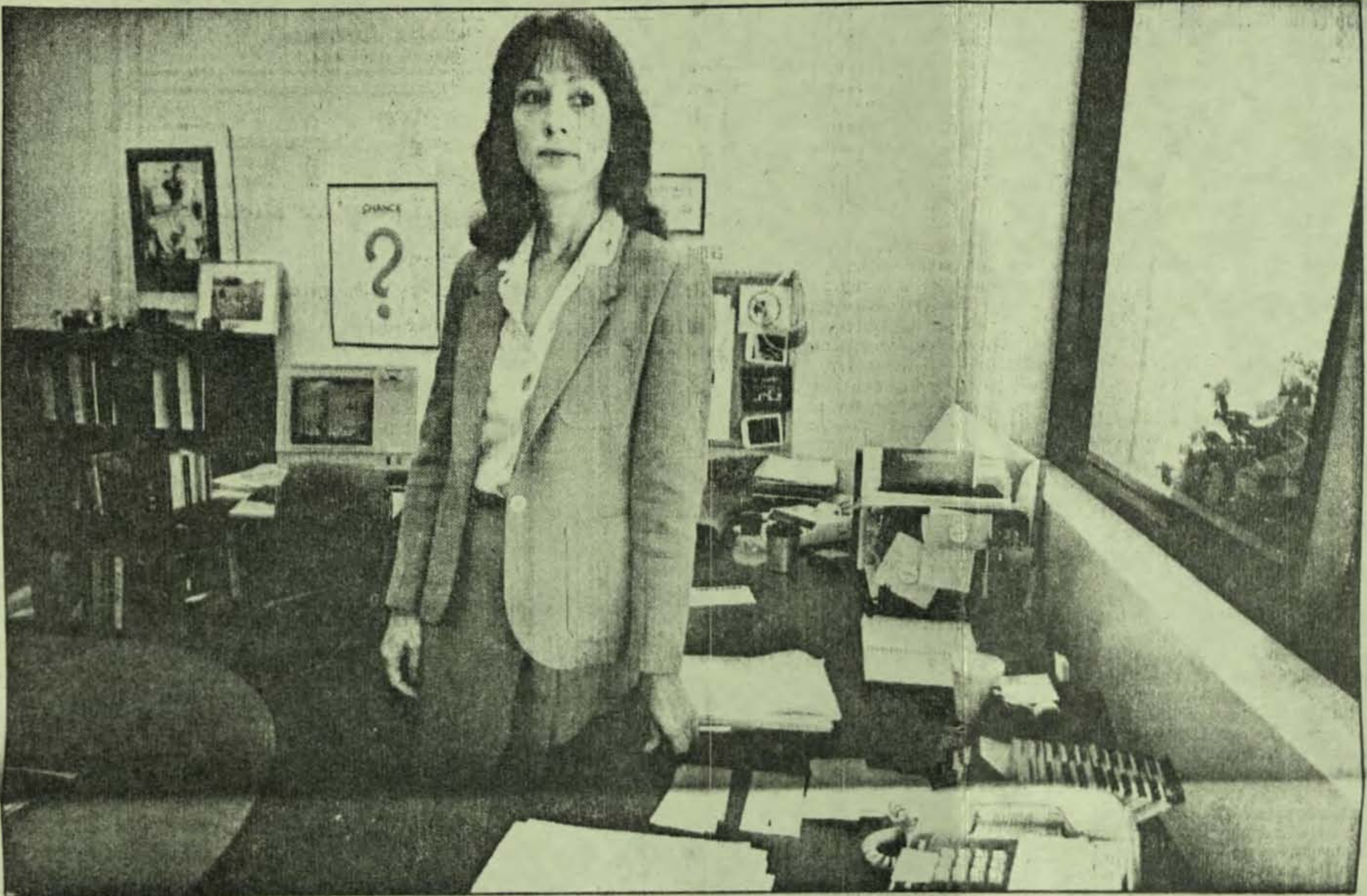

SJ Mercury News 8/7/84 P1F

Len Lahman — Mercury News

Cacey Tangney, Tandem's manager of investor relations, has had to deal with her share of worried stockholders

The fine art of investor relations

Companies use finesse and handholding in dealing with Wall Street

By Dedra Hauser
Business Writer

Last month, Cacey Tangney could have starred in an Excedrin commercial depicting tension headache No. 99.

As manager of investor relations for Tandem Computers Inc. of Cupertino, Tangney had to contend with dozens of major stockholders and Wall Street analysts who were surprised, worried and more than a little upset by the company's lower-than-expected third-quarter financial results and the impact it was having on the stock. The company's stock plummeted 32 percent during the week that the company announced its earnings.

Given the vagaries of the stock market, no company can expect to control the price of its stock. But, as Tandem has concluded, the way a company manages investor relations can make a real difference in the stock market's reaction to company news. "We are trying to get some advice from our investment bankers about what we might have done better (in announcing the third quarter)," Tangney says.

Tangney describes investor relations as an art. Companies practice the art by cultivating relationships with the investment community. Typically, an investor relations manager or staff deals primarily with securities analysts at brokerage firms — the people whose stock recommendations determine the investment decisions of many major investors.

The manager in charge of investor relations has to make sure the company complies with federal securities laws in releasing to the public any significant company information, such as news of quarterly earnings reports, acquisitions and major management changes. In addition, many companies talk regularly with investment specialists, hoping to sell them on the company's strengths.

Investor relations programs would be much more effective if management had a better grasp of what makes Wall Street tick, says Michael Dunmire, who recently joined Convergent Technologies of Santa Clara as investor relations manager after 13 years working in the investment community.

Perhaps the most important thing to understand, he says, is that Wall

Continued on Page 7F

Companies find that investors don't like surprises

Continued from Page 1F

Street doesn't like surprises. Tandem's experience is a case in point.

With a 10 percent increase in earnings on a 29 percent increase in sales, Tandem hadn't expected its third-quarter results to trigger such a selloff in the market. "We underestimated the reaction," Tangney says.

But Wall Street's projections for the quarter, based in part on the outlook Tandem's management had given analysts, were higher than the company's results. Tangney says she was peppered with the same question by most of the analysts and shareholders who called after the earnings were announced: 'Why didn't you let us know it was coming?' "

One way the company could have prepared the investment community for the disappointing earnings was to announce immediately after the quarter was completed that sales and earnings were below its expectations. Companies can't release their quarterly figures until they've been audited, which often takes a month or more. But some companies comment on the quarter as soon as it is finished if their quarterly results are different from Wall Street's projections.

But Tandem's management stuck to its past policy of not commenting on the quarter until the final numbers were ready to be released. "This is something we'll, of course, review," Tangney says.

Companies can avoid overreaction to bad news by keeping analysts informed as soon as problems crop up and by making sure they provide as complete a perspective as possible, Dunmire says.

The investor relations manager at National Semiconductor Co. of Santa Clara calls shareholders and investors as soon as any significant news about the company is released.

"The thing you don't want is (for the investment community) to pick up the paper and see the company's name in the headlines (when they weren't prepared for the headlines). There's nothing more embarrassing," says Patrick Brennan, National Semiconductor's vice president and treasurer.

> "The thing you don't want is (for the investment community) to pick up the paper and see the company's name in the headlines. There's nothing more embarrassing."
>
> — *Patrick Brennan, National Semiconductor*

National has learned which investors or analysts tend to react more strongly to news and makes a point of contacting them quickly when news breaks about National. "Some analysts need a little more handholding," he says.

When someone from Wall Street calls up a company to check on a rumor, the knee-jerk response often is to deny the allegations, says Dunmire of Convergent. But since most rumors contain at least a grain of truth, companies should provide a complete response to the rumor, even if it involves an issue that hasn't been resolved within the company, he says. Convergent hasn't always done that, he admits.

For example, Convergent denied persistent rumors that it would write off its WorkSlate computer only a few weeks before it did just that. In this case, Convergent's stock price rose in response to the announcement, probably because investors saw it as a positive move, he says. "But anytime you reverse positions like that it hurts credibility. As long as the possibility existed that it would be written off, that possibility should have been acknowledged," he says.

Investor relations specialists should realize, he says, that analysts who call up a company often know the answer to their questions, and are calling to hear the company's perspective. "You can't hide anything from Wall Street," he says. "There's enough money on Wall Street to find the answer to any question someone wants to answer."

For example, when Dunmire was a stock analyst, he wanted to find out how much stress a key executive at a Silicon Valley semiconductor company was under as a result of marital problems. Dunmire called up a Bay Area broker who was interested in winning brokerage business from Dunmire. That broker was able to ferret out detailed information about the emotional state of the manager in question.

Ideally, Dunmire says, investor relations managers want to paint a complete picture of their company and the environment in which it operates, so they can put problems and developments in perspective. "To many analysts, problems are either non-existent or they're fatal," he says.

Unfortunately, it's hard for many companies to get the attention of Wall Street, Dunmire says. "It's a very intense environment (in the investment community), and (stock analysts) are required to do immense volumes of work, so very few analysts have the luxury of taking the time they really need to know one particular company."

The best time to catch Wall Street's attention is when a company is announcing financial results or other news of interest to investors, Dunmire says. Apple Computer Co. of Cupertino holds meetings for analysts with its top executives after each quarter's earnings are released, says Dan Eilers, Apple's assistant treasurer. "We give them an opportunity to see the talent behind the company," says Eilers, whose responsibilities include investor relations.

Investor relations managers are usually busiest when there's bad news. Elliot Sopkin, vice president of communications at Advanced Micro Devices Inc. of Sunnyvale, whose job duties include investor relations, says a major shareholder of AMD regularly tells him, "I never claimed to be a fair-weather friend. I'm a foul-weather friend."

Tandem's third-quarter earnings announcement and the resulting drop in its stock price brought out the foul-weather friends in droves. On the day the results were released, Tangney was besieged with phone calls soon after she came to work at 4:30 a.m. The calls poured in for days afterward.

Tandem has drawn some lessons from the hammering of its stock. For example, the company will pay more attention next time to the possible impact that general market conditions can have on the reaction to developments at Tandem. "If it's a crummy market, we'll know there's at least a risk that it (the market) is going to be more reactive to company news," Tangney says.

Many callers complained that Tandem didn't respond to their calls quickly enough. That's a problem that will be corrected next time, Tangney says. But it could have been worse. "There weren't too many screamers," she says.

LEVEL 1 - 1 OF 4 STORIES

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August 2, 1984, Thursday

SECTION: SECTION I; Technology; Pg. 7

LENGTH: 1045 words

HEADLINE: Tandem slows but keeps on running;
TANDEM COMPUTERS MEETS COMPETITION IN FAILSAFE SYSTEMS

BYLINE: BY ALAN CANE

BODY:

FAULT TOLERANCE comes naturally in California, where the earth moves restlessly and regularly, relieving the stresses which build up under the San Andreas and neighbouring Calaveras faults.

It shifted violently earlier this year, shaking the low, flat-roofed buildings which house many of California's "Silicon Valley" electronics companies, among them the Cupertino offices of Tandem Computers.

Tandem executives, however, hardly noticed the tremors, for the ground under their feet was already shaking.

The company was about to announce that revenues for the second quarter of 1983-84 would be below those for the first, the first quarter-to-quarter decline since the company went public in December 1977.

Coupled with the news that telecommunications giant American Telephone and Telegraph (AT & T) was about to invade Tandem's special territory, fault tolerant systems, the announcement was enough to accelerate the fall of its stock price to \$16.25, down from a high of \$40.25 in the previous 12 months.

The stock price has quivered around the \$20 mark since then; significantly better third quarter results, announced last week, were still below analysts' expectations and pushed the price down to just under \$14.

All of this has to be seen in the context of Tandems very special place in the computing world.

It virtually created the modern concept of fault-tolerant computing, taking a long lead in what is now seen as one of the most important technologies in business data processing. For years it had no competitors at all; some measure of the importance the computing world now attaches to fault tolerance can be gauged from the list of companies now offering these systems, mostly start-ups; it includes Status, NoHalt Compuers, Computer Technology, Computer Consoles, Syntres, Formation Inc. Tolerant Systems, Parallel Computers, August Systems and Perkin-Elmer.

What Tandem understood earlier than any of the others, was the desperation which was beginning to grip data processing managers when they pondered the consequences of failure of their computers.

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Most modern companies are completely dependent on their data processing systems. Failure means at best, expense and inconvenience -- at worst, the entire company could be at risk.

The companies most acutely aware of the problem were running large on-line databases, with transaction orientated terminals connected through communications lines -- the banks, financial institutions, retailers, hotels and the leisure business.

Before Tandem, the only answer was "hot standby" -- a duplicate computer system warmed up and ready to go if the original failed. It was expensive, risky and, as many customers discovered to their cost, not too reliable.

Tandem's idea was to duplicate all the essential items in the computer using clever software to move information to healthy parts of the system in the event of a single component failure and to make it possible to connect many processors together to give mssive transaction processing power.

Its original business plan, dated September 1975, notes: "No manufacturer has designed a multiprocessor from the ground up. Tandem will be the first company to offer a fully implemented hardware and software solution. We expect to gain the dominant share of this rapidly emerging market."

It was and it did. From 1977 through to 1983, its revenues grew from $8m to $418m; it now has over 720 customers with a world-wide network of over 60 sales and engineering offices.

Its prestige customrs in the UK include the London clearing banks (the CHAPS network), the London Stock Exchange and GCHQ Cheltenham, the Government defence listening post.

In the U.S. the list includes Wells Fargo Bank, Hughes Aircraft and GTE.

So what is slowing -- if not stopping -- the world's most significant fault tolerant computer company?

To some extent, it seems to be a victim of its own success. Most analysts, and the company itself, believe that its current less-than-sparkling financial performance is an anomaly caused by Tandem's increasing penetration of major companies.

That means its quarterly performance is tied more precisely to the buying cycles of these large companies, so producing low revenue figures in the early part of the year.

Second, it no longer has the fault tolerant market to itself. Indeed, it is even trying to play down its image as the leading fault tolerant manufacturer, arguing that every manufacturer will have to provide fault tolerance in future.

Its claim now is to be the leading manufacturer of high capacity transaction processing systems; the power of the system being a consequence of exploiting all the advantages of a multiprocessor system -- the customer gets fault tolerance as a bonus on top of all his power rather than as the principal reason for buying Tandem.

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But Tandem is also a victim of its own originality. It designed its fault tolerant machines, the NonStop series, back in 1976 when hardware was expensive and software, by comparison, cheap.

The newer companies in the field -- of which the most significant is generally reckoned to be Stratus -- have taken advantage of the cheap and powerful hardware now available to develop computers with comparable power to the Tandem systems but at substantially lower cost. Stratus is already beginning to make significant inroads into financial markets. In the UK, Link, a consortium of building societies and financial institutions, plans to build a network of automated teller machines on Stratus switches.

In the U.S. customers include Merrill Lynch, Lockheed and Bank of America.

Tandem's response has been to develop new systems at the top end of the market -- the TPX family -- and to promise new systems which will directly compete with Stratus' lower-priced offerings.

Stratus sees Tandem as the competition. Its founder and president, William Foster, says: "It is a very successful company with a substantial number of large accounts and that is not going to change."

Tandem has its sights set on IBM. President James Treybig says: "Tandem is the new mainframe -- we have got to stay right here and win. IBM can go to other places. You only beat IBM by being better."

GRAPHIC: Picture, Tandem's "paperless factory" at Austin, Texas

LEVEL 1 - 3 OF 4 STORIES

Copyright © 1984 The Financial Times Limited;
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August 2, 1984, Thursday

SECTION: SECTION I; Technology; Pg. 7

LENGTH: 346 words

HEADLINE: Designing for fault tolerance

BYLINE: EDITED BY ALAN CANE

BODY:

TANDEM'S FAULT tolerant design, when it launched its "NonStop 16" back in 1977, was revolutionary.

The aim was an architecture which would continue to process data successfully despite any single component failure -- a component, in this case, means the central processor, the high speed memory, the input output controller, the input/output data path, the disk memory and the disk controller.

Failure of any of these components in a conventional computer means the application running also fails. To provide fault tolerance, Tandem duplicates all the critical hardware and the software.

Tandem's answer is to link the two systems through a high speed data transfer system with one memory component kept in a state which allows it to assume control if the other memory fails.

The central processor in Tandem systems is built out of conventional microelectronic building blocks -- Schottky technology. Fault tolerance is assured by software techniques -- checkpointing and transaction monitoring -- which inevitably costs the user something in system overhead.

Tandem argues that this is no penalty -- the user can exploit the power of the entire multiprocessor system.

Stratus, designed some five years later, makes use of the fastest, most powerful microprocessor chips commercially available, the Motorola 68000 family. Fault tolerance is built into the hardware, so there is no software overhead.

Basically the system multiplies up the new, low cost hardware to give a fault tolerant system. Two pairs of 68000 processors are fed with identical programs to operate on identical data.

The processors are paired, and the results of each set of computations compared. Only if all four results are identical is the system acknowledged as working correctly. If one differs it can be isolated while the other processors continue to operate.

This check takes place once every 125 nanoseconds or 8m times a second.

It means that Stratus can build a machine which at the top end processes 3m instructions a second -- for roughly £262,000.

Tandem airs gain

CUPERTINO, Calif. — Tandem Computers, Inc. said its profit for the third fiscal quarter, ended June 30, increased to $9.2 million, or 23 cents a share, from $8.4 million, or 21 cents a share, a year earlier.

Revenue for the quarter rose 29% to $141.9 million from $110.2 million a year ago, a spokesman for the company reported.

James G. Treybig, company president, said Tandem "enjoyed a quarter of good revenue growth. We also added a significant number of new customers."

He said the company's Nonstop TXP computer accounted for a majority of the systems shipped during the third quarter.

Computerworld 8/6/84 p80

MIS Week 8/8/84 p1

Bank Finds Computers A Headache

By JULI CORTINO

SAN FRANCISCO—The Bank of America is about 12 to 18 months away from bringing some order to the chaos that now characterizes this major West Coast bank's end-user computing operations.

John Parady, vice president of technology and communications services, held a meeting last week designed to placate some 100 BankAmerica middle managers about the bank's future plans for computerization, MIS Week has learned.

"We're going through a lot of change and a lot of pain right

SEE BANK, PAGE 9

Bank Finds Computer Chaos

CONTINUED FROM PAGE 1

now," said Parady. "We're losing good people—for climate issues and because of salary differential."

Parady assured his frustrated audience that he was aware that BankAmerica's policy of raising annual salaries 5 percent was not competitive. He noted that competitors offer salaries from 8 to 31 percent above those offered by BankAmerica.

"It's a challenge to retain and recruit at this rate," he said. "We can't compete."

Parady said his department is "trying to get a handle" on the salary issue. The bank is also attempting to establish a unified systems architecture to be used throughout BankAmerica, as well as setting up a unified resource allocation structure.

"Right now it's a kluge," said Parady. "We have 51 Tandem NonStop IIs, 42 Tandem NonStop Is, and a half-dozen DEC (Digital Equipment Corp.) 1170s. We have some Prime equipment, some System/34s (from International Business Machines Corp.). We even have some H-P (Hewlett-Packard) 1000s. It's a mess."

According to Parady, "In the past, vendors had free license to find a pocket of acceptance within the bank and install a one-of-a-kind solution. That's changing slowly."

The bank has decided to standardize, internally, on the IBM 308X family for its major host systems. The MVS-XA operating environment has also been adopted by the bank.

Parady also acknowledged that the bank has no overall mechanism for bringing in microcomputers. "We've been 'back-dooring' this area. We've got the cart before the horse. People are buying them because they're status symbols, not because they have a need for personal computing. But, you can't be a 20th century manager and not have a micro on your desk. Micros should fit into an overall applications strategy. Right now, they don't."

According to a BankAmerica insider, the bank has brought in $10 million worth of IBM PCs over the past 18 months. Said the insider, "Now there is funding for $5 million (or 700 units) more. And, they haven't figured out what to do with the first batch."

Parady urged his managers to function as a team and to focus less on empire-building within BankAmerica.

"Users should come to us with a set of requirements, not a preconceived solution," he admonished.

For instance, he noted that the bank's Area Management Group (AMG) had conducted a pilot using Burroughs equipment and intended to install 100 systems by the end of 1984. Parady said his office was able to convince the division to install only five test systems.

According to a BankAmerica insider, Burroughs is competing with IBM to be the vendor of choice for the AMG project. The AMG operation is responsible for consolidating branch services into key regional locations, thereby reducing the volume of services offered at each branch.

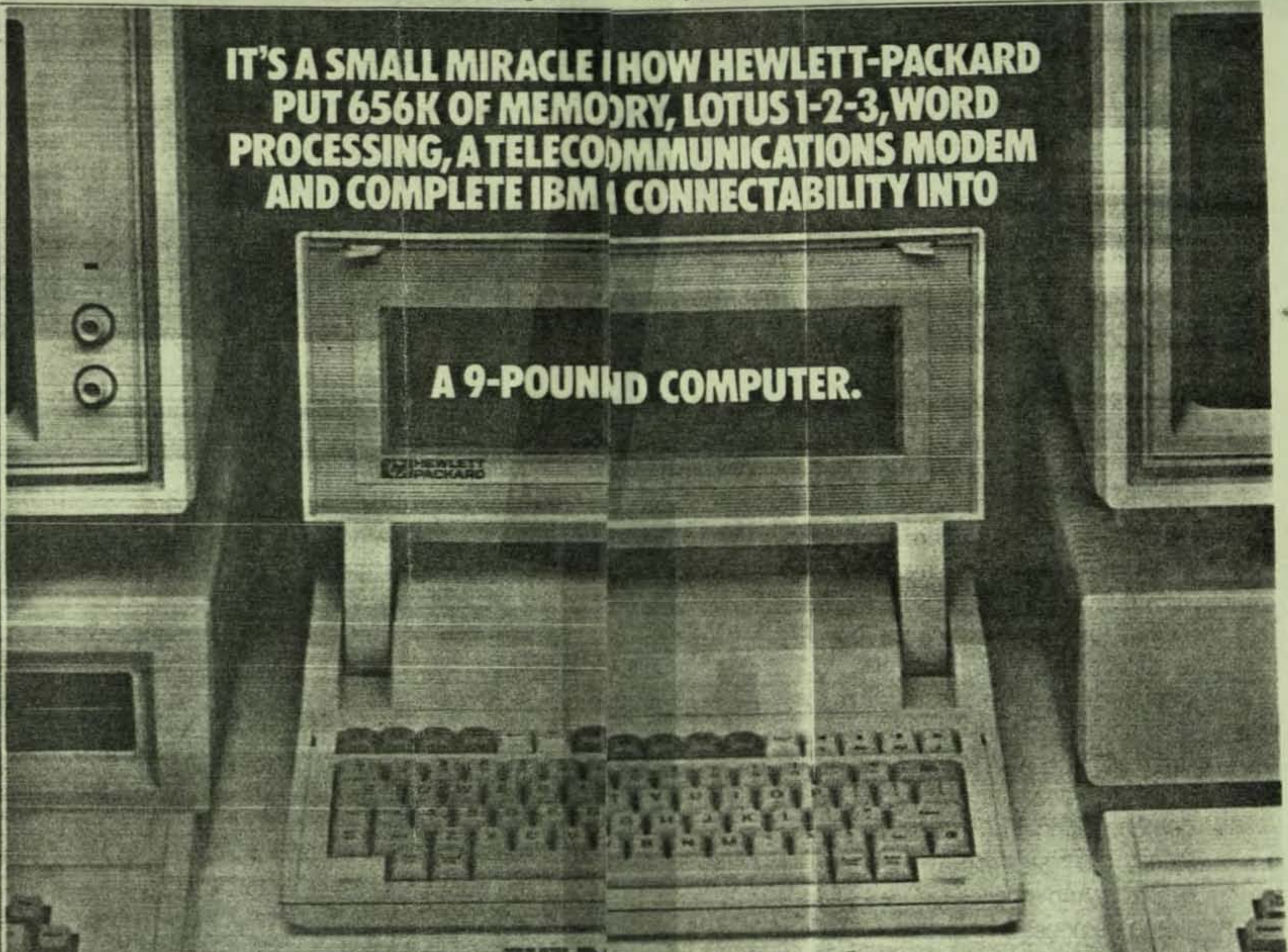
Applications

Parady also noted that BankAmerica's Money Transfer Division is so far along on a Tandem project that it could proceed "even though Tandem doesn't offer full SNA compatibility."

The bank has chosen Rolm as the vendor for some 257 PBXs to be placed throughout the bank's California branches. The Rolm private branch exchanges will replace the Centrex system from AT&T.

Wang has some $20 million worth of equipment within BankAmerica. "Wang's basic strategy is to find pockets outside of the system control area and to install its equipment there," Parady said.

The disarray inside BankAmerica has frustrated many managers—including Parady, who was brought in one year ago. "We are far from accomplishing the goal of being a responsive service organization," he said. "We looked at our organization and saw that 95 percent was react, and I can assure you the other 5 percent wasn't doing planning. The structure we put in place three months ago is only the beginning. A reorganization doesn't itself solve problems. It's the framework. There's a lot more work before us."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August 13, 1984

SECTION: NEWS; Pg. 8

LENGTH: 861 words

HEADLINE: NYSE system bears up under record stock trading

BYLINE: By John Desmond, CW Staff

DATELINE: NEW YORK

BODY:

If the number of shares traded Aug. 3 on the New York Stock Exchange (NYSE) had been traded any day two years ago, the computer center that processes the transactions probably would have been in trouble.

But the timing of the largest single trading day in Big Board history -- capping a rally that began July 30 and culminated with 237 million shares exchanged on Aug. 3 -- was fortunate for the Security Industries Automation Corp. (Siac), which processes the transactions. Siac is nearing completion of a $10 million, two-year effort to increase system capacity to accommodate a 250 million-share day, according to John McGee, vice-president of Siac corporate affairs.

Two years ago, system capacity was 150 million shares traded per day, McGee said. However, the work load for Siac is dictated not so much by the number of shares traded as by the number of individual transactions. Although Aug. 3 set the record for the number of shares traded, more individual transactions occurred last Monday, according to Donald Dueweke, senior vice-president of market operations for the NYSE. Transactions totaled 101,651 on Aug. 3 and 105,976 the next Monday, he said. (The record for transactions/day was set on Oct. 13, 1982, when 107,601 transactions were made, according to an NYSE spokesman.)

Though the number of shares traded on Aug. 3 was prodigious, system capacity was not reached, Dueweke said. Trading volume in messages per second on the Common Message Switch system, the interface between member firms ordering systems and the NYSE, was only 44% of capacity and 51% the following Monday, Dueweke said.

Siac, a subsidiary of the NYSE and the American Stock Exchange, uses volume forecasts to project required CPU message rates. Siac completed its last system upgrade in the nick of time this year, just as the firm did in the summer of 1982, according to Charles McQuade, Siac president and chief executive officer.

Since trading records were set in the summer of 1982 [CW, Aug. 30, 1982], Siac has added an IBM 3083 mainframe, replaced an IBM 4341 mainframe with a 3031 mainframe and has added 50 Tandem Computers, Inc. transaction-oriented minicomputers to the 70 already in place, McQuade said. A number of Tandem fault-tolerant devices are also employed within the overall configuration. That configuration consists of two IBM 370/158s and a 370/148; two IBM 3033s;

one IBM 4341; four Sperry Corp. mainframes: two 1100/82s and two 1100/60s; and nearly 40 Digital Equipment Corp. PDP-11/05, 11/45 and 11/70 minis.

If projections show that the volume is likely to exceed 250,000 transactions in a day, Siac can add more hardware. McGee said the decision was made four years ago to use a modular CPU architecture capable of expansion or even contraction.

Is there a physical limitation to system capacity based on how fast traders can execute orders?

"There doesn't seem to be," McQuade said, adding that the two recent heavy trading days were test enough for limitations. "Two hundred thirty-five million shares is just mind-boggling," he said. He noted that 72 million shares were traded in the first hour, and total trading exceeded the prior record -- set just the previous day -- by 65 million shares.

What happens if the system breaking point is reached? "There's no such thing as that," McQuade said.

For one thing, "more and more big players are out there," McQuade said, referring to the institutional investors that trade huge numbers of shares in one transaction. Block trades of at least 10,000 shares each represented 135 million of the total shares traded Aug. 3, McQuade said. The average number of shares per trade is 1,728 today, vs. half that number about five years ago, according to McGee.

If Siac's market reporting system was down for more than a 10-minute period, McGee said, "There is a high probability that the market would have to cease trading." For that reason, he said, Siac puts "an extremely high premium on recoverability and availability" of the system.

Siac is involved not only in system support, order processing, trading and reporting, but in clearance and settlement for trades involving stocks, bonds, options and financial futures, McGee said. As a result of the record trading on Aug. 3, Siac was extremely busy immediately thereafter settling trades. "Right now, we're just beginning to be hit by what happened," he said last week. "That's a delayed reaction."

From one trader's point of view, the system reacted well to the record-breaking Aug. 3. "Considering that we had the highest volume in history, the system worked with a remarkable degree of efficiency," said Michael Geran of E. F. Hutton & Co. in New York. While the paper ticker lagged some 18 minutes behind in updating prices, the CRT screens posted prices only a few seconds later than usual, Geran said. He noted that both the ticker and the screens usually post prices at the same time.

Asked whether system capacity should be upgraded again in the wake of the recent trading records, Dueweke said, "Not unless market conditions change and we start looking at a push to the 300- to 350-million shares-per-day range."

GRAPHIC: Charts

LEVEL 1 - 2 OF 4 STORIES

Copyright © 1984 The Financial Times Limited;
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August 2, 1984, Thursday

SECTION: SECTION I; Technology; Pg. 7

LENGTH: 190 words

BYLINE: EDITED BY ALAN CANE

BODY:

WILL LOCKE, editorial systems editor of the Los Angeles Times, is one of the personalities of the newspaper business. He thinks fast, speaks slow and carries on his shoulders the knowledge that the Tandem-based computer system he runs can make or break his newspaper.

"We have never lost an edition since the system was installed," he says with the wary scepticism of the professional journalist.

The Times system was installed by Systems Integrators, one of the most experienced systems houses in the business of computerising newspapers.

It was not a solution the Times arrived at easily. The various investigations carried out by the new technology teams extended over some eight years.

The present system based on Systems Integrators "Coyote" editorial terminals and Tandem computers was installed in 1981. Training the journalists had its problems: "Writers would come in, learn enough to do their job and never show up again."

Even with all their preparations, the move to computerisation was tramautic: "It still came as a shock; our credibility was stretched to the limit" Locke says, wincing at the memory.

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Computerworld

August 20, 1984

SECTION: NEWS; Pg. 50

LENGTH: 815 words

HEADLINE: On-line system refines Mobil's credit card operations

DATELINE: KANSAS CITY, Mo.

BODY:

Neither hail nor sleet nor snow nor rain could stop them -- credit card receipts. They would roll in waves across the country, millions of these flimsy pieces of paper. Some would make the journey by mail, others by plane. Some would be picked up by truckers making gas deliveries earlier in the week. They would arrive here, at Mobil Oil Corp.'s data processing center, to be unbundled and fed into the firm's computer system.

It was, on average, a 10-day trek for these little sales tickets. But that was three years ago, when Mobil's credit card program was a paper-based operation.

That situation has changed. A year ago, following a successful pilot project, the company installed an on-line transaction processing system, designed to capture and send credit card purchase information electronically from its service stations to its DP center. At present, approximately 2,500 stations are a part of Mobil's network.

At these stations, attendants record transactions by entering information into a point-of-sale (POS) terminal that is connected to an on-line data base of customer credit information. The data is transmitted to Mobil's DP center, where the card is authorized and the sale registered. Then it is uploaded to the firm's billing system for batch processing.

According to John Rowerdink, who manages the POS system for Mobil, the new system has provided benefits for the company, as well as for its customers.

"The system made our credit card operation run more efficiently, which meant that [in times of high interest rates] we were able to continue to offer the service," Rowerdink said.

It has decreased the number of bad credit sales and has reduced the occurrences of credit fraud, he explained. In addition, it has cut down on the firm's operating expenses by removing the necessity of processing millions of pieces of paper.

But the primary advantage, Rowerdink said, has been the reduction of credit card "float," the time period between purchase and payment. "With this system," he explained,"we capture the purchase information immediately."

At the heart of the system lies a six-processor Nonstop II and TXP system designed by Tandem Computers, Inc., a Cupertino, Calif., firm. The system runs Tandem's Guardian proprietary operating system. Mobil has developed an on-line data base using Encompass, Tandem's relational data base program. A Tandem 6100 communications subsystem manages front-end data communications for the POS terminals.

Currently, Mobil has installed 10 128M-byte disk drives and four 264M-byte drives in its Kansas City center. Each Tandem processor can hold up to 2M bytes of main memory.

Mobil's POS terminals are connected to the DP center by a combination of 1,200 bit/sec and 9,600 bit/sec telephone circuits. Multiplexers combine lines from several stations into the long-distance lines. The terminals operate asynchronously with a poll/select protocol and were designed specifically for the Mobil operation.

One of the advantages of the Tandem system is that processing power can be added, removed and rearranged without reprogramming the system or the application software. As more service stations are put on-line, additional processor modules can be added to the system. "We can start small and expand as we go," Rowerdink explained.

Mobil is currently implementing the system in service stations on the West Coast and in Arizona, Florida, Maryland, Virginia, Texas and the Northeast.

The company has also initiated another service for its customers based on the Tandem system: a debit card service that allows customers to use automated teller machine (ATM) cards to buy gas at Mobil stations. The service is now available in the Washington, D.C., metropolitan area. Mobil is in the process of bringing the service to its California stations, Rowerdink said.

The ATM service operates in a fashion similar to the credit card service. When a customer uses an ATM card to buy gas, the attendant runs the card through the POS terminal. Customers enter their personal identification number (PIN) code. Once the ATM card number, PIN code and all purchase information have been entered, the POS terminal transmits the information to the Tandem system, which sends the data to the bank. The amount of the purchase is then automatically subtracted from the customer's account.

Since Mobil receives the payment for services immediately, the transaction qualifies as a cash payment, so customers are able to take advantage of Mobil's discount program for cash purchases.

Will Mobil continue to expand its network? Originally, the company planned to bring an additional 1,500 stations on-line, but Rowerdink said he was not sure the firm's planned second phase would materialize. Whether the company broadens the network will depend primarily on the cost savings the system brings to Mobil, he explained.

THE NEWSWEEKLY FOR THE COMPUTER COMMUNITY
COMPUTERWORLD
AUGUST 20, 1984
VOL. XVIII, NO. 34

On-line system refines Mobil's credit card operations

KANSAS CITY, Mo. — Neither hail nor sleet nor snow nor rain could stop them — credit card receipts. They would roll in waves across the country, millions of these flimsy pieces of paper. Some would make the journey by mail, others by plane. Some would be picked up by truckers making gas deliveries earlier in the week. They would arrive here, at Mobil Oil Corp.'s data processing center, to be unbundled and fed into the firm's computer system.

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Tandem Computers slashes prices

SJ Mercury News 8/21/84 p 1C

Tandem Computers Inc. of Cupertino announced 12 percent to 24 percent price cuts on two of its three computer systems.

The reductions are even greater when new volume discounts are added.

"I'm very impressed by this, it's a big deal," said Skip Bushee, executive vice president of InfoCorp., a Cupertino market researcher.

Tandem is responding to competition by Stratus Computers of Natick, Mass., and other manufacturers of low-end, or less expensive, models of fault-tolerant mainframe computers, Bushee said.

Bushee didn't consider the price cuts as a response to Tandem's lower-than-expected third-quarter results.

However, Omri Serlin, head of ITOM International, a Los Altos consultant, see Tandem's action as "save-the-year mood."

"The cuts are to stimulate demand," Serlin said. "Tandem has been slow to respond to (competition in) the low-end."

The cuts are on Tandem's NonStop 1+ and NonStop II machines.

Tandem Computers Information Center

WORKSTATION ALERT
(formerly Computer Graphics for Management;
Data & Graphics for Management)

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Route to:

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Jim Davis - loc 1	Kim Worsencroft - loc 100
Marilyn Miller - loc 1	Roger Brandt - loc 103

Please return to the Information Center loc 1, bldg 3.

James C. Treybig
announces new price structure.

Prices cut by Tandem

Times Tribune staff

In an effort to attract a broader range of customers and combat new competition, Tandem Computers Inc. in Cupertino dropped prices on its computers and related products up to 38 percent for large-volume purchases.

Tandem systems now start at $55,000 for volume purchases of its NonStop 1+ system that completes 1.4 million instructions per second.

"The new prices are part of our plan to broaden our installed based at the low-end by providing the highest performance and the lowest cost," said James C. Treybig, president and chief executive officer.

Tandem produces computers used in transaction processing, where information is entered into a computer and immediately updated from many separate locations.

For systems sold in small numbers, or singly, Tandem's cuts averaged between 12 percent and 24 percent.

Analysts described the cuts as a move on Tandem's part to stimulate demand.

Peninsula Times Tribune 8/21/84 p B8

Tandem Computers Information Center

TELEPHONE NEWS

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Roger Brandt - loc 103
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Tandem Starts Low-End Push

By Jacques Welter

Tandem Computers Inc. will introduce a new, more aggressive low-end marketing strategy today, including new base configurations and price cuts of up to 30 percent on its NonStop 1+ and NonStop II minicomputer lines, a company executive told *Information Systems News.*

In addition, the Cupertino, Calif., firm is expected to follow-up these moves with a series of low-end product announcements later this year, including a new minicomputer, personal computer emulation and an I/O controller,

Continued on Page 6

Information System News
8/20/84 p1

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man's responsibilities, the company said.

sions with much promise but also of failing to bring it — ago.

Tandem To Redefine Roles Of NonStop II, NonStop 1+ CPUs

Continued from Page 1

sources close to the company said. The company is also expected to announce a second low-end minicomputer in mid-1985.

Tandem will drop the price of the NonStop 1+ from $126,000 to $89,000 in single quantity purchases and from $89,000 to $55,000 in volume purchases, said Gerald Peterson, vice president of international marketing. The new price for the NonStop II will be $129,500, a drop of $65,500 from the old price, Peterson added. Peterson admitted the price cuts were to make the company more competitive in the crowded fault-tolerant marketplace.

"We [Tandem] feel we have a superior product in terms of performance," Peterson said, "but our competitors have been beating us with price. These reductions will make up for that deficiency."

The new base configurations for both NonStop computers will feature one fewer disk drive and controller than previous configurations. As in previous models, each controller in the new configuration supports eight disk drives, a company spokeswoman said. The new configuration for the NonStop 1+, the spokeswoman said, will feature four processors, 4.4 Mbytes of main memory. It will sell for $105,000 for single quantity or $70,000 for volume purchases.

Tandem will also be redefining the role for both NonStop computers, Peterson said. The NonStop 1+ will be targeted for two markets, he said. For the large user, the computer will be targeted for specific end user applications in a networking environment, he said.

The second target area will be with value-added remarketers (VARs) and OEMs. With the price cuts, Peterson said, the NonStop 1+ will be an ideal product for repackagers seeking a fault-tolerant computer for their market segments.

The 2-year-old NonStop II, Peterson said, will be the entry-level computer for large users. Peterson said the NonStop II will fit into network environments with the company's 1-year-old, high-end TXP. In addition, the NonStop II supports SNA, is software compatible with the TXP and users can upgrade to the TXP from the NonStop II when they outgrow the system.

He said most large users are looking for two or three computers to fulfill different functions in their network, and that the TXP only fulfilled one network component requirement. "The TXP has been tremendously successful, but we have realized one product will not fit all areas," he said.

Craig Symons, an analyst with Gartner Group Inc., Stamford, Conn., said the price cuts are an attempt to bolster low-end sales.

He said companies such as Stratus Computer Inc., Natick, Mass., have been taking some sales from Tandem at the low-end on a price basis. Stratus sells its current low-end system for about $140,000.

Omri Serlin, president of ITOM International Corp., Los Altos, Calif., also said Stratus had been taking sales from Tandem. Stratus' low end, the FT-200, offers performance of 1 MIPS for less than half the price of the Tandem TXP and $55,000 less than the old price for the NonStop II.

"The NonStop 1+ hasn't been a 'world beater' product," Serlin said. "The 1+ is really a stop-gap measure, and Tandem needs a better low-end offering."

In addition to dropping the low-end prices, several sources close to the company said the price cuts are clearing the way for new low-end product introductions. One source said Tandem will introduce two new low-end minicomputers. One, code named Checkmate, will be priced about $100,000 and will probably replace the NonStop 1+. Checkmate is due in early January. The second will be priced at about $50,000 and will be announced sometime in mid-1985.

The Checkmate's operating system will be embedded in firmware, thus reducing the software overhead for the system, a second source said. The Checkmate, unlike the NonStop 1+, will also have full communications and compatibility with a TXP processor housed in the same cabinet, a third source added.

The other minicomputer for introduction later next year, however, will use a different architecture than any of Tandem's previous fault-tolerant offerings, said Steve Smith of Paine Webber Inc., New York. While Smith said he is not sure of what type of design, he did say the minicomputer will be 32-bit architecture and will be targeted at the extreme low-end fault-tolerant market.

In addition, Tandem is expected to unveil both IBM Personal Computer emulation for its terminals and an I/O controller for the TXP series in late December or early January, sources close to the company said.

Tandem cuts prices on low-end and mid-range systems

By Jeffry Beeler
CW West Coast Bureau

CUPERTINO, Calif. — In a product move aimed at medium-scale processor users in the regional offices of large corporations, Tandem Computers, Inc. today reconfigured and trimmed the prices for several of its low-end and mid-range packaged systems.

The firm also added another configuration option to its line of Non-Stop I+ packaged systems and announced an upgrade kit that reportedly transforms Non-Stop I+ and Non-Stop II processors into Tandem's top-of-the-line TXP mainframe. In addition, the company cut the main memory prices for its Non-Stop II and TXP machines by nearly a third.

Today's price cuts apply to three varieties of Tandem packaged systems:

- Non-Stop I+ configurations that expand in two-processor increments.
- Non-Stop I+ configurations that expand in four-CPU increments.
- Non-Stop II configurations that expand in two-processor increments.

In the wake of Tandem's latest repricings, a two-processor Non-Stop I+ system that used to sell for $126,000 per CPU now costs $89,000 per machine, according to Steve Schmidt, the company's vice-president of strategic planning.

If a user expands his configuration beyond 20 Non-Stop I+ pairs, the price for each additional two-processor building block drops still further to $55,000 per CPU. In the past, each two-processor increment beyond the 20-pair limit cost $99,000 per machine, Schmidt said.

On the Non-Stop II side, Tandem has lowered the per-CPU price of a basic two-mainframe system from $195,000 to $129,500, he added.

Coinciding with Tandem's price cuts are several minor configuration changes to the entry-level versions of both the Non-Stop I+ and Non-Stop II packaged systems. Until today, a dual Non-Stop I+ or Non-Stop II package typically incorporated two disk units.

Under the revised pricing scheme, however, the same basic configurations now come with only one disk system, according to a Tandem spokeswoman. But because entry-level Non-Stop I+ and Non-Stop II packaged systems are often used solely for development purposes rather than for production applications, one disk module is all that many users need, at least at the outset.

In the past, if Tandem had configured its packaged systems with just one disk unit alone, a basic Non-Stop I+ offering would have sold for $101,150 per processor, compared with $170,150 per machine for a comparably equipped Non-Stop II configuration, Schmidt said.

Packages of four

Today's announcement also reported another configuration change to the firm's packaged systems line: For the first time, Tandem is now making its Non-Stop I+ machines available in packages of four processors as well as in pairs, the spokeswoman said.

For any Non-Stop I+ configuration consisting of 20 or fewer CPUs, each four-processor set is priced at $105,000 per machine. Thereafter, the price of every extra expansion package drops to $70,000 per mainframe, Schmidt said.

In further product-related moves, Tandem also trimmed the price of its 2M-byte Non-Stop II and TXP memory modules from $22,000 to $15,000 and priced its just announced upgrade kits at $70,000 to $90,000 per processor.

Tandem is headquartered at 19333 Vallco Pkwy., Cupertino, Calif. 95014.

Tandem's focus on mainframe sales intact despite latest pricing moves

CUPERTINO, Calif. — Although the latest price and configuration changes announced by Tandem Computers, Inc. today reflect a renewed emphasis on the low end of the firm's product line, the main focus of the company's business reportedly remains unchanged.

Tandem will continue to address the on-line transaction processing needs of large commercial accounts, which typically require two classes of mainframes — large ones of corporate computing hubs and medium-size ones for satellite locations — according to Steve Schmidt, Tandem's vice-president of strategic planning.

During the past few months, most of Tandem's product announcements have come at the high end of its processor line, which is geared primarily to large corporate data centers. With today's price and packaging revisions to the Non-Stop I+ and Non-Stop II, the vendor has reportedly reaffirmed its intention to serve major organizations in their outlying offices as well as at their headquarter sites.

Tandem's decision to pare its Non-Stop I+ and Non-Stop II prices will purportedly ease entrance barriers to the low end of the firm's processor line. In addition, the action is expected to stimulate product demand among field locations that might otherwise opt for medium-scale systems such as IBM's Series/1 and 8100, according to company Marketing Vice-President Jerry Peterson.

For Tandem itself, the price cuts will also reportedly correct a growing price and performance imbalance between the firm's entry-level Non-Stop I+ and its TXP. Such an imbalance might eventually have caused the company problems by hindering sales of its low-end systems to divisional or regional locations.

Art Galleries

THINGS TO DO

members, Saturday through Sept. 16. Reception, 7 to 9 p.m. Friday, Sunnyvale Community Center, 550 E. Remington Drive.

EWERT'S—"Gestures in Color," photography by Ed Shvartzman, through August, Ewert's Photo Gallery, 2090 Duane Ave., Santa Clara.

SUN—Pen and ink drawings of historical homes around the Santa Clara Valley and Bay Area by Kathleen Swick, through Tuesday, Sun Gallery, Vallco Village, Wolfe and Homestead roads, Cupertino.

TANDEM—Watercolor, tapestry and sculpture by faculty and graduate students from San Jose State University, through August, Tandem Computers, 19333 Vallco Parkway, Cupertino.

JALBERT—"Santa Cruz Fine Art," featuring work by Bill Bohannon, Cheryl Cal-

CAMPBELL—Paintings and monotypes by Charles Eckart, through Sept. 15. Charles Campbell Gallery, 647 Chestnut St., San Francisco.

CAMERAWORK—"El Salvador: The Work of Thirty Photographers," through Sept. 8. San Francisco Camerawork, 70 12th St.

CHOWNING—Sculpture by Margaret Keelan and wall sculpture by Art Nelson, through Sept. 6, Joseph Chowning Gallery, 1717 17th St., San Francisco.

DE SARTHE—New gallery features Picasso, Renoir, Montezin, Cassatt and Modigliani, through August, Pascal de Sarthe Gallery, 315 Sutter St., San Francisco.

FULLER GOLDEEN—"Baseball Card Portraits," of the Oakland A's by Bay Area artists including Robert Arneson, John Battenberg, Richard McLean, Mel Ramos, Raymond Saunders and William T. Wiley; "50 Artists/50 States," contemporary painting and sculpture by artists from every state in the union, both through Saturday, Fuller Goldeen Gallery, 228 Grant Ave., San Francisco.

GHENT—Collage and sculpture by Pam Dixon, through August, Gregory Ghent Gallery, 420 Sutter St., San Francisco.

Thiebaud and boxes by Ro Berg, through Sept. 12, Jeremy Stone Gallery, 126 Post St., San Francisco.

BRUCE VELICK—Paintings by Stan Fullerton, through August, Bruce Velick Gallery, 55 Grant Ave., San Francisco.

VISION—Black and white photographs by Henry Gilpin, Hans Hammarskiold and Suzanne Olmsted, through Sept. 8, Vision Gallery, 1151 Mission St., San Francisco.

VORPAL—Oils by Piet Bekaert, through Sunday. Pastel paintings of urban and

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7:15, 9:30
INDIANA JONES AND THE TEMPLE OF DOOM
Tonight at:
7:30, 9:45

OAKS 3
CUPERTINO 446-1134
DRESSER 5:15, 9:15
CARMEN 7:25
STAR TREK III 7:50
PHILADELPHIA EXPERIMENT 5:45, 9:45
YOUNG DOCTORS IN LOVE 7:55
BACHELOR PARTY 5:50, 9:40

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acquire Amiga.
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try.

The suit continues, Atari is suffering and will continue to suffer irreparable injury as a result of the pending use of the circuits by Atari's competitors.

Tandem Cuts NonStop Prices

CUPERTINO, Calif.—Tandem Computers Inc. has taken a stab at increasing its installed base of computers, while simultaneously paving the way for the company's powerful NonStop TXP system, by reducing prices on entry-level processors.

The aggressive pricing structure applies to Tandem's NonStop 1-Plus and NonStop II systems. Disk and memory prices have also been cut.

The NonStop 1-Plus systems, with 1.4 million instructions per second (mips) capability, are lowered in price by 12 percent, bringing the price down to $89,000. A new volume-purchase schedule offers discounts of up to 38 percent, which brings package prices down to $55,000 for this two-processor configuration.

The NonStop 1-Plus system, with 2.8 mips, has been reduced in price by 32 percent, to $105,000. The new volume-purchase program brings package prices down to $70,000 for this four-processor configuration.

The NonStop II system package, with two processors and four megabytes of memory, is reduced in price by 24 percent. This brings the package price down to $129,000.

Tandem is also offering a trade-in program that gives users the opportunity to move from the NonStop 1-Plus to a NonStop II or TXP, or from a NonStop II to a TXP for 60 to 80 percent of the list price for the higher-priced systems.

According to Tandem, the new prices will not further erode the company's already narrow profit margins. The company maintains that customers are being encouraged to upgrade their systems, which will generate more revenue. And Tandem said it recently implemented measures to control costs.

International Data Corp., in a study done for Tandem, notes that "in lowering the cost of its entry-level systems, Tandem has made it easier for users to develop a transaction application without worrying if all sites that need systems will be able to cost-justify them.

—Juli Cortino

Xerox Establishes AI Business Unit

PASADENA, Calif.—Xerox Corp. announced it has established an Artificial Intelligence Systems Business Unit with headquarters here.

Xerox has been a major supplier of artificial intelligence hardware and software since 1981. The formation of the new business unit is in response to what the company believes will be a significant increase in the artificial intelligence marketplace during the next two to five years.

Gary Moskovitz has been named manager of the new unit and will report directly to Louis Karagianis, general manager, Xerox Special Information Systems. Before joining Xerox in April, Moskovitz was marketing director for new systems development at Mattel Electronics.

8/29/84

Tandem restricts hiring, travel and faces thinner profitability

By MIKE BRENNAN

In the face of rising expenses and some sales problems, Tandem Computers President Jimmy Treybig said last week the Cupertino computer maker has swung into a belt-tightening program.

The tightening-up, begun about two weeks ago, coincides with price cuts, up to 32 percent, announced last week for Tandem's NonStop 1-plus and NonStop II mainframe computers and some computer accessories.

Among its moves, the company imposed restrictions on hiring and travel for employees.

Tandem also announced that owners of both machines can trade them in and get credits from 60- to 80-percent toward the purchase of the more expensive TXP computer introduced last year.

The price cuts may hurt Tandem's profits in the fourth quarter ending Sept. 30, Treybig said.

Securities analysts who follow Tandem said slow sales for some of the company's products will compound the belt tightening moves and price cuts—all of which may produce flat to down earnings for the next three quarters.

> *"Through the rest of the calendar year and into the first quarter of next year, profits will be under pressure."*

"Through the rest of the calendar year and into the first quarter of next year, profits will be under pressure," said Craig Symons, a financial analyst for the Gartner Group, a Stamford, Conn., market research company. "The TXP is taking longer to sell than the company expected, NonStop II sales have dried up and the NonStop I is getting hurt by the start-ups."

Aharon Orlansky, a securities analyst with Sutro & Co., a San Francisco brokerage, agreed.

"During the next quarter or two, profits could be impacted, but the company could benefit in increased volume," he said. "Later on when TXP sales increase, it will make up for this."

In the third quarter ended June 30, Tandem reported profits per share of 23 cents, compared with 21 cents in the same quarter the year before.

Treybig said the price cuts could put profits under pressure, but since they were implemented only two weeks ago, it's still too early to tell.

"We'll have a better feeling in the next two weeks," he said.

The belt-tightening moves, which include new restrictions on travel, hiring and wage increases, are to combat higher expenses incurred by the hiring of more than 600 people in the first half of the year.

Many of the new employees are busy developing products that will be introduced starting in October, Treybig said. New product introductions will then occur every other month well into next year, he said.

Industry sources said Tandem is developing at least two major new products that are aimed at both the medium and low end of the market.

One, code-named Checkmate, is a medium range mainframe computer that will use gate array logic devices.

The other product, reportedly code-named Dynamite, is a low-end minicomputer that fits under a desk, much as the NCR Corp. Tower, sources said.

Treybig said the belt tightening moves "will make sure that our revenues begin catching up with our employment. We hired people faster than general revenues. Now we're trying to hold the people count down."

The price cuts on the low end of Tandem's product line aren't in response to competitive pressures from start-up companies, Treybig said, but pressure from IBM. The price cuts also should make Tandem's entire product line more attractive to the company's very large corporate customers, such as banks and financial institutions, he said.

The price cuts are aimed at stimulating demand, and beating back the start-up companies competing with Tandem, such as Stratus Computer Inc., said Omri Serlin, president of ITOM International, a Los Gatos consulting company.

"Tandem executives call the low end of the market the microcomputer marketplace, referring to Stratus—that typifies the attitude Tandem has," he said. "Tandem claims it is a mainframe company and its main competitor is IBM. Now it has woke up. The low end of the market is more important than they thought."

Treybig, in an interview, did concede that Tandem needs to be more aggressive on low-end marketing.

Another objective of this strategy, Serline said, is to generate enough sales in the fourth quarter to raise the company's annual growth rate above 30 percent—a benchmark the company strives to achieve.

Treybig said achieving the 30 percent goal has nothing to do with the price cuts.

"We do hope growth will step up, but cutting pricing doesn't increase revenues in the short term," he said. "We wouldn't feel less successful if we grew at a 29½ percent rate. We've grown at a 65 percent rate during the past two years."

Ted Costello, an analyst with Dean Witter Reynolds Inc. in Palo Alto, said Tandem is trying to get into shape before the fiscal year ends. This quarter alone, he said, the company has added 39 new customers—a reflection that the average selling time for the TXP has increased.

"The on-line transaction processing market is still vital," he said.

Don Wolf Has High Expectations.

He Banks With Bank of Los Gatos.

When Don Wolf left his [illegible] agement career to open his computer store in Los Gatos, he had high expectations. That was two and one-half years ago. Since that time he's been looking for a bank with the *characteristics he expects – such as local* decision making, honesty, flexibility, and friendly, responsive people. That's why he opened an account with Bank of Los Gatos, N.A. the very day they opened.

Don Wolf knows the road to Wolf Computer's success was paved with superior services. He gives his customers prompt assistance, honest and frank answers, and service to fit each individual's needs. That's the kind of service he expects from his bank, and Bank of Los Gatos, N.A. delivers.

Three members of the Wolf family (Don, Anita, and Tom) invest much of their time making Wolf Computer a strong Los Gatos business. They invest the rest of their time with family, community, and charitable activities. In fact, they often pilot their own airplane for the Flying Doctors to provide much needed medical help to remote areas of Mexico.

Don invests a lot in his work, his family, and his community. He knows Bank of Los Gatos shares his high expectations.

At Bank of Los Gatos, N.A. we're proud to have Don Wolf as a customer. All of our customers are special individuals, and we offer them the kind of special services they expect, such as courier service, personal computer usage, and discount brokerage services. Just to name a few.

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Evening edition

★★★★ San Jose Mercury News ■ Wednesday, August 29, 1984 3D

Congress urged to ease taxes on stock options

By David Sylvester
Business Writer

What is the tick-tock in the mechanism of Silicon Valley's industrial success?

Stock options, stock options.

But the smooth working of the mechanism is gummed up by complicated laws and taxes on the stock options, a group of Silicon Valley business people told a congressional economic committee Tuesday.

At the final hearing on entrepreneurial activity in Silicon Valley, the Joint Economic Committee heard wide-ranging testimony on how Silicon Valley has developed over the past decades and suggestions on how government can help the process. The committee is examining the area's success as part of a series of nine hearings, including two on Thursday and Friday in the Route 128 industrial area near Boston, Mass.

Venture capitalists and entrepreneurs described how early investments in unproven ideas can help develop new companies. But that process depends on providing financial incentives to entrepreneurs in the form of inexpensive stock options in the new companies, they told the committee.

Yet special limits and taxes have robbed the options of some of their attraction, several entrepreneurs said.

"I honestly don't understand the government's policy toward stock options," said James Treybig, president of Tandem Computers Inc. of Cupertino.

Tandem hopes to give workers an incentive to help improve company performance by selling stock to every employee, including assembly workers, at prices lower than the going rate on the stock market. Yet assembly workers often must sell their stock right away to pay federal tax they owe under the preference tax provisions, Treybig said. "I don't see why we want to discourage ownership by those people," he said.

The preference tax on incentive stock options is an attempt by Congress to broaden the tax base. It taxes the profits that employees gain on stock options based on the difference between what the company charged them for the stock and what the stock is worth on the open market.

The tax is due even before the employee actually sells the stock purchased from the company under the stock option.

Congress has limited the amount of stock an employee can purchase from a company to $100,000 a year.

The limit, which was intended to prevent a small group of company founders from giving themselves too much stock, has hurt larger companies more than new start-ups.

Sandra Kurtzig, chairman of Ask Computers Systems Inc. of Los Altos, told the committee that founders can receive a substantial amount of stock under the $100,000 limit when the company is young and charging a penny a share. But as the company grows and the stock is worth more, the limit cuts down the number of shares employees and officers can receive.

Limits on stock options are criticized

By David Sylvester
Business Writer

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> — *James Treybig, president of Tandem Computers*

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Continued on Page 4D

SJ Mercury News 8/29/84 p1D

Limits on stock options criticized

Continued from Page 1D

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She suggested abolishing the limit altogether, saying it made it difficult to recruit top officers of companies.

LEVEL 1 - 1 OF 1 STORY

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AUGUST 30, 1984, THURSDAY, AM CYCLE

LENGTH: 160 words

HEADLINE: FRENCH FIRM WINS NORWEGIAN NATIONAL VIDEOTEX CONTRACT

DATELINE: PARIS, AUG 30

KEYWORD: VIDEOTEX

BODY:

THE FRENCH DATA PROCESSING GROUP CAP GEMINI SOGETI (CGS) SAID TODAY IT HAS WON A KEY CONTRACT FROM THE NORWEGIAN TELECOMMUNICATIONS ADMINISTRATION FOR THE DESIGN AND INSTALLATION OF A PUBLIC VIDEOTEX SYSTEM.

THE NORWEGIAN CONTRACT IS THE FIRST FRENCH EXPORT SUCCESS IN EUROPE FOR VIDEOTEX SYSTEMS, WHICH ENABLE TELEPHONE SUBSCRIBERS TO CALL UP DATA ON A TELEVISION SCREEN. IT WAS WON IN THE FACE OF COMPETITION FROM THE U.S. COMPUTER GIANT IBM AND THE FRENCH STATE-OWNED COMPUTER GROUP, BULL.

CGS AS MAIN CONTRACTOR AND ITS NORWEGIAN SUBSIDIARY, DATA LOGIC, WILL SUPPLY THE SOFTWARE AND TANDEM COMPUTERS WILL SUPPLY THE HARDWARE. THE CONTRACT IS WORTH 14 MILLION FRANCS (1.6 MILLION DOLLARS), SPLIT 50/50 BETWEEN SOFTWARE AND HARDWARE.

THE FRENCH FIRM IS ALSO THE MAIN CONTRACTOR FOR FRANCE'S ELECTRONIC TELEPHONE DIRECTORY, THE WORLD'S LARGEST VIDEOTEX SYSTEM, TO BE OFFERED TO 30 MILLION SUBSCRIBERS WITH HOME OR OFFICE TERMINALS OVER THE NEXT DECADE.

LEVEL 1 - 1 OF 4 STORIES

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Business Week

August 20, 1984

SECTION: CORPORATE SCOREBOARD; Pg. 81

Note: This table may be divided, and additional information on a particular entry may appear on more than one screen.

LENGTH: 1004 words

HEADLINE: SECOND QUARTER 1984

BODY:

COMPANY	SALES				PROFITS		
	2nd quarter 1984 $ mil.	Change from 1983 %	6 months 1984 $ mil.	Change from 1983 %	2nd quarter 1984 $ mil.	Change from 1983 %	6 months 1984 $ mil.
22 OFFICE EQUIPMENT, COMPUTERS							
AM International (5)	153.7	8	298.0	7	2.9	-16	4.3
Amdahl	196.8	9	371.4	5	4.9	-44	9.1
Apple Computer (3)	422.1	58	722.2	46	18.3	-24	27.4
Bell & Howell	176.4	4	342.1	5	7.7	5	12.7
Burroughs	** 1233.7	18	2333.1	14	57.3	35	100.3
Coleco Industries	166.6	32	352.7	15	5.1	-43	9.6
Computervision	133.6	42	255.3	39	10.9	36	21.6
Control Data	1256.3	10	2444.6	12	23.4	-40	55.1
Data General (3)	277.1	47	525.5	40	16.1	270	28.7
Datapoint (5)	155.0	14	295.8	9	8.0	413	16.5
Dataproducts (9)	121.5	51	248.0	54	8.8	198	19.4
Diebold	120.3	10	238.3	11	14.1	30	28.1
Hewlett-Packard (2)	1519.0	30	2797.0	26	141.0	29	236.0
Honeywell	1486.7	7	2879.0	6	74.3	27	113.9
Intergraph	98.8	80	177.5	77	16.5	152	26.8
International Business Machines	11199.0	17	20784.0	16	1623.0	21	2825.0
Mohawk Data Sciences (8)	97.4	2	204.0	10	-59.7	NM	-59.2
NCR	998.8	7	1860.2	9	76.2	11	121.7
Nashua	146.1	4	298.8	4	6.2	115	12.1
Pitney-Bowes	425.5	8	846.8	10	31.8	13	61.5
Prime Computer	161.4	32	307.0	27	12.8	101	23.0
ROLM (6)	196.1	44	371.6	42	11.8	22	22.0
Seagate Technology (6)	100.5	117	201.6	153	11.5	57	23.0
Sperry (9)	1187.1	6	2665.9	10	20.1	-7	101.5
Standard Register	** 102.8	15	204.1	16	5.8	21	11.4
Storage Technology	247.1	4	426.6	-7	-4.9	NM	-21.6
Tandem Computers							

(3)	141.9	29	253.2	23	9.2	10	11.2
Tandon (3)	106.3	28	211.9	38	10.4	22	20.9
Telex (9)	** 97.1	37	191.6	31	10.8	33	20.8
Wang Laboratories (6)	713.8	51	1257.3	45	73.7	33	123.5
Xerox	2257.9	0	4394.7	1	95.5	-38	221.6
INDUSTRY COMPOSITE	25696.3	16	48759.9	15	2343.4	13	4228.0
ALL-INDUSTRY COMPOSITE	701.8	12	139.0	12	36.6	28	72.1

COMPANY	PROFITS	MARGINS				
	Change from 1983 %	2nd quarter 1984 %	2nd quarter 1983 %	Return on common equity 12 months ending 6-30	Price-earnings ratio 7-31	12 months' earnings per share
22 OFFICE EQUIPMENT, COMPUTERS						
AM International (5)	-25	1.9	2.5	NM	3	0.78
Amdahl	-34	2.5	4.9	10.2	12	0.85
Apple Computer (3)	-43	4.3	9.1	9.6	43	0.63
Bell & Howell	10	4.4	4.3	10.7	12	2.26
Burroughs	30	4.6	4.1	9.8	10	4.99
Coleco Industries	-62	3.1	7.2	-24.7	NM	-1.46
Computervision	37	8.1	8.5	17.9	25	1.44
Control Data	-24	1.9	3.4	7.9	7	3.73
Data General (3)	207	5.8	2.3	9.7	23	1.90
Datapoint (5)	392	5.1	1.1	7.4	15	1.28
Dataproducts (9)	171	7.2	3.6	15.3	11	1.53
Diebold	32	11.7	10.0	22.4	12	6.43
Hewlett-Packard (2)	22	9.3	9.3	15.0	20	1.84
Honeywell	41	5.0	4.2	11.3	9	5.68
Intergraph	144	16.7	11.9	27.9	27	1.76
International Business Machines	22	14.5	14.0	24.9	11	9.82
Mohawk Data Sciences (8)	NM	NM	3.0	-31.9	NM	-3.65
NCR	18	7.6	7.4	14.9	8	2.84
Nashua	139	4.2	2.0	13.0	8	3.18
Pitney-Bowes	20	7.5	7.2	21.6	9	3.26
Prime Computer	54	8.0	5.2	14.6	18	0.85
ROLM (6)	20	6.0	7.0	7.2	27	1.49
Seagate Technology (6)	117	11.4	15.7	27.4	9	0.95
Sperry (9)	30	1.7	1.9	7.1	10	3.77
Standard Register	19	5.6	5.4	16.4	10	3.35
Storage Technology	NM	NM	0.6	-7.1	NM	-1.00
Tandem Computers (3)	-25	6.5	7.7	8.9	21	0.72
Tandon (3)	28	9.8	10.3	13.7	13	0.63
Telex (9)	32	11.1	11.4	26.3	11	2.66
Wang Laboratories						

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(6)	34	10.3	11.8	17.9	17	1.52
Xerox	-21	4.2	6.8	8.5	9	3.76
INDUSTRY COMPOSITE	16	9.1	9.3	17.7	15	4.43
ALL-INDUSTRY COMPOSITE	38	5.2	4.5	13.3	12	3.46

(1) Second quarter ending May 31. (2) Second quarter ending Apr. 30. (3) Third quarter and most recent six months ending June 30. (4) Third quarter and most recent six months ending May 31. (5) Third quarter and most recent six months ending Apr. 30. (6) Fourth quarter and most recent six months ending June 30. (7) Fourth quarter and most recent six months ending May 31. (8) Fourth quarter and most recent six months ending Apr. 30. (9) First quarter and most recent six months ending June 30. (10) First quarter and most recent six months ending May 31. (11) First quarter and most recent six months ending Apr. 30. * Sales include excise taxes. ** Sales include other income. *** Sales include excise taxes and other income. + Revenues from major subsidiaries not included in consolidated sales. ++ Net income includes tax-loss carryforward, reported as extraordinary item. Earnings per share are for latest 12 months, not necessarily for end of most recent fiscal year. They include all common stock equivalents but exclude extraordinary items. NA=not available. NM=not meaningful. DATA: STANDARD & POOR'S COMPUSTAT SERVICES INC.

GLOSSARY

Sales: Includes all sales and other operating revenues. For banks, includes all operating revenues.

Profits: Net income before extraordinary items. For banks, profits are net income after security gains or losses.

Margins: Net income from continuing operations before extraordinary items as percent of sales.

Return on common equity: Ratio of net income available for common stockholders (most recent 12 months) to latest available common equity, which includes common stock, capital surplus, and retained earnings.

Price-earnings ratio: Based on July 31 common stock price and corporate earnings before extraordinary items for most recent 12-month period.

Earnings per share: For most recent 12-month period. Includes all common-stock equivalents.

SMALL
COMPUTER
SYSTEMS

File: Companies
C-906-235.1
Date: August 29, 1984

Title:

Price and Product Moves to Maintain Growth at Tandem

Summary:

Tandem showed revenue gains below the industry average and even less impressive income gains in F3Q84. New pricing on NonStop is in effect, and new products are expected in 1984 and 1985.

Six months ago Tandem indicated that many of its problems were behind it and it was ready for a return to 35 percent growth. But during F3Q84 Tandem reported a healthy, yet nevertheless disappointing revenue increase of 28.8 percent over F3Q83 and a 12.3 percent increase in net income to a level which still lags that of the first quarter.

Again, sales cycle longer than expected

Tandem once again stated that its new focus on sales of high-end systems to major accounts has resulted in a lengthening of the sales cycle beyond its initial expectations. Therefore, business that was expected to close in the third quarter did not. This explanation was also offered at the end of the second quarter and, at this point, it is too early to tell whether this business will eventually be closed or whether the competition at the high end (most notably from IBM) is proving to be more formidable than Tandem originally expected.

Personnel turnover

Also being blamed for the revenue shortfall is a higher-than-expected turnover rate among the sales force. This statement has merit considering the fact that the nucleus of Tandem's U.K. sales operation did defect during the quarter, with most of the personnel going to competitor Stratus Computer causing the U.K. operation to fall short of its quota. This could continue to be a problem for Tandem with some of the newer fault-tolerant start-ups actively recruiting salespeople.

New pricing and products expected

We suspect that some of these newer start-ups, and particularly Stratus, are beginning to eat into Tandem's low-end business. The new TXP product has been relatively successful. But one consequence of this relative success at the low end is that NonStop 1+ and NonStop II have looked comparatively poor in price/performance -- thus hurting the low-end order rates. As a result, on August 20, Tandem announced significant price cuts on its low-end models, and put in a program of price credits towards TXP purchases.

A NonStop 1+ packaged system has been cut by 12 percent (to $89,000) and is further affected by new end user quantity discount schedules which lower list price

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by up to 38 percent. A larger packaged system (four processors instead of two) is priced at $105,000, a 32 percent reduction over prior prices. NonStop II packages are also reduced by up to 24 percent. Memory prices have been cut by 32 percent -- down from $22,000 to $15,000 for a 2-Mbyte board. This price action is, in effect, recognition that the high-end market alone is not all that easy to stimulate or penetrate, and that low-end coverage is also essential. Until the newer low-end products are available, competitive current prices are important. The inevitable consequence, however, is lower gross margins and continued pressure on earning.

We expect announcement of a new low-end product in 1984. This new product, referred to as "Checkmate," would be in the $100,000 range and essentially replace the NonStop 1+ product. Reports indicate that Checkmate would have a significant portion of the operating system implemented in firmware to improve performance and would have a TXP processor in the same cabinet.

In mid-1985, Tandem plans to introduce a second low-end processor that could be in the $50,000 range. This processor, an under-the-desk version, would be the first 32-bit implementation for Tandem, a hurdle that had to be taken sooner or later in order to remain competitive. This product would then serve as basis for eventual replacement of the TXP processor line. The change is expected to be relatively transparent for the user, although certainly not for Tandem. The transition from 16-bit to 32-bit is never easy, especially with the heavy machine-dependent software that Tandem has developed for its initial products.

At this point Tandem appears to have lost its momentum and status as a high-growth player in the technology field. We would expect Tandem to show a 30 percent growth rate in F1985, but see little chance of increasing that rate over the long term. New products, pricing and marketing programs, all effective, will be necessary just to maintain this level of growth.

TANDEM Five-Year Projections
($ in Millions)

						Possible 5-Year	
	F83A	F84E	% Change	F85E	% Change	CGR	F88E
Revenues ($)	418.3	530.5	26.8%	693.0	30.6%	30%	1553.1
Pretax Margins (%)	12.1	10.4		13.2			15.0
Tax Rate (%)	39.0	38.0		42.0			40.0
Net Income	31.0	35.1	13.2%	52.5	49.6%	35%	139.8

Fiscal Year Ends September

Electronic News 9/3/84 p26

Tandem Reduces Packaged Sys., Peripherals Prices

CUPERTINO, Calif. — Tandem Computers, Inc., has instituted sweeping price cuts on packaged systems and some peripherals in an effort to become more competitive with start-ups at the low-end of the transaction processing market and to stimulate customer migration to its high-end TXP systems.

The latest moves include reduction between 12 and 30 per cent on volume discounts covering two NonStop 1+ packaged systems, a 24 per cent reduction in a NonStop II configuration and the introduction of an upgrade discount schedule for TXP upgrades.

Tandem also reduced its two-megabyte memory board from $22,000 to $15,000, its 264-megabyte disk drive package by 6 per cent to $37,000 and its 128-megabyte drive by 7 per cent to $28,000.

The price cuts at the low-end of the Tandem line, intended mainly to boost the company's sales through OEM and VAR channels and to broaden its installed customer base, mean a 1.4 MPIS, entry-level NonStop 1+ system with 2.2 megabytes of memory, 238 megabytes of disk storage, a tape drive and support for 17 terminals, plus software, can be bought on a maximum 38 per cent discount basis for $55,000. The new volume-based discount schedule starts with a 20-system order. The same package of the NonStop 1+ on a single-unit basis lists for $89,000, a reduction of 12 per cent.

In addition, Tandem introduced credits for upgrades to the high-end TXP system from the NonStop 1+ and NonStop II ranging from 60 to 80 per cent. The upgrade credits replace a previous upgrade plan between the Nonstop 1+ and Nonstop II families.

Tandem president James Treybig said the low-end volume discount price cuts are intended to make Tandem more competitive against its low-end start-up challengers such as Parallel Computer and Tolerant Systems as well as to counteract aggressive efforts by IBM to penetrate VAR and OEM channels.

Greater low-end volumes also could boost revenues from upgrades to the TXP system if users are attracted by the credits on the big system that accrue on the basis of how much of the NonStop equipment they buy. There has been no price change, however, to the TXP itself since it was introduced last year.

Mr. Treybig said he believes reduced profit margins at the low end of the product line would be offset by greater low-end volume and by stimulated upgrade revenues.

A second, Nonstop 1+ four-processor, 2.8-MIP packaged system had its prices out 32-per cent to $105,000 in single quantities and to $70,000 on the volume discount schedule.

The unit-based volume discounts do not apply to the new NonStop II systems, but the price was cut by 24 per cent to $129,500 on a 2-processor packaged system which includes 4 megabytes of memory, a 128-megabyte disk drive, tape drive, an operations service processor and software. Tandem said previous dollar-based volume discounts continue to apply to all of its products.

Electronic News 9/3/84 p71

Tandem Computer, Inc. — Thomas J. Perkins, chairman, acquired (in the open market) 10,000 shares at $14.75 to $15.75 each, increasing the total direct ownership of the Thomas J. Perkins, Inc., retirement plan to 510,468 shares.

Electronic News 9/3/84 p24

Tandem, Cap Get $1.6M Norway Pact

PARIS (FNS) — Cap Gemini Sogeti, France's largest data processing group, said last week it has won a $1.6 million contract together with Tandem Computers to design and install a public videotext system for the Norwegian Telecommunications, Authority.

About half the value of the contract goes to CGS, which is to supply software through its Norwegian subsidiary Data Logic, and the other half to Tandem Computers for hardware.

IBM, LM Ericsson and the state owned French computer group Bull were among other reported bidders for the tender.

Tandem Computers Information Center

SEYBOLD REPORT ON PROFESSIONAL COMPUTING

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Paul McJones - loc 100

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Nonstop Challenges In Fault-Tolerant Market

By Omri Serlin

SPECIAL REPORT

FAULT TOLERANT SYSTEMS

The euphoria of 1980-1983, during which some two dozen start-ups and some well-established companies entered the market for fault-tolerant, on-line transaction processing systems (FT/OLTP), has been replaced recently with the somber realization that selling FT systems is a hard "push" rather than the easy "pull" that entrepreneurs, venture capitalists and some market researchers had anticipated.

With the notable exception of Tandem Computers Inc., Cupertino, Calif., and Stratus Computer Inc., Natick, Mass., no other FT/OLTP suppliers have, as yet, managed the total transition from the development stage to full production.

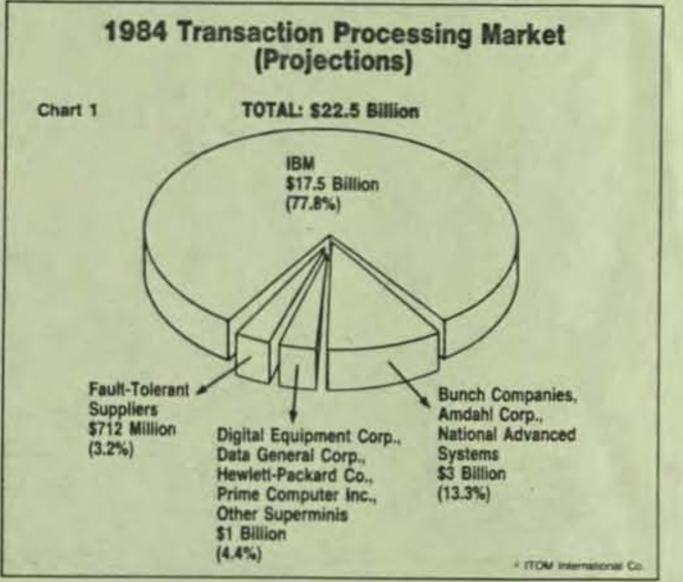
Just about all new entrants have experienced significant product delays, and many are having a difficult time trying to raise much-needed capital for completing product development and establishing manufacturing and marketing functions.

The size of the FT/OLTP marketplace has been grossly exaggerated, especially by market researchers who failed to grasp the difference between potential and realizable markets.

The potential market for FT systems in OLTP and related applications continues to be huge (see chart 1) because the clear trend to on-line processing is creating a need for nonstop computing. The actual penetration by current FT/OLTP suppliers, however, has been miniscule (see chart 2) and is likely to continue to be insignificant in relative terms.

One of the key factors limiting the acceptance of current FT systems is that they generally focus on the easy parts of the problem and tend to ignore the more difficult, and often more important, aspects.

Of course, there are variations between individual systems, and these are hotly debated among the proponents of the various approaches—"hardware" vs. "software" fault tolerance, tightly coupled vs. loosely coupled architecture, etc.



1984 Transaction Processing Market (Projections)

Chart 1

© ITOM International Co.

But in a general sense, just about all FT systems offer reasonably robust fault-detection and recovery mechanisms in two areas: process execution and data storage. The FT requirements of these two aspects are well understood and are relatively easy to achieve.

Unfortunately, processor failures and disk crashes are no longer the key problems preventing nonstop operation. There is mounting evidence that "operator errors" and problems with remote communications lines are far more significant factors in downtime. Neither of these problems is effectively addressed in any of today's FT systems.

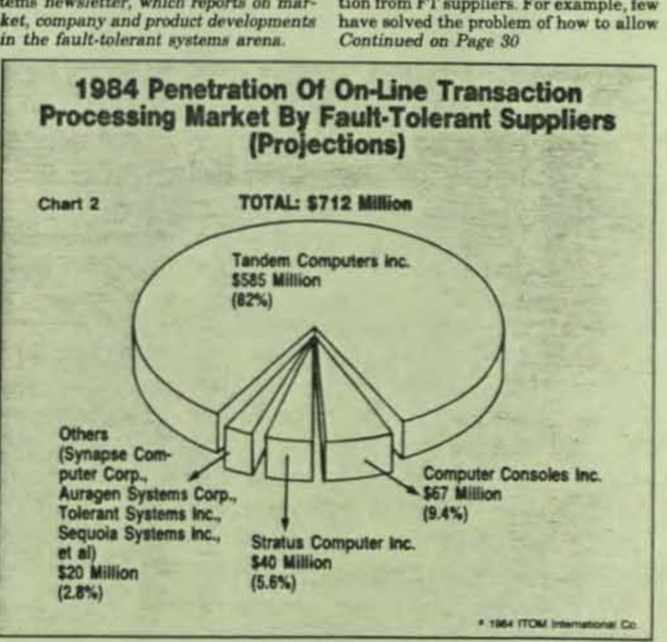
Furthermore, as the reliability of basic electronic and electro-mechanical components increases, power disruptions are becoming relatively more important in causing failures.

Yet few FT suppliers are providing power-fail protection in their systems. The general attitude seems to be that the provision of reliable power—such as an uninterruptible power system (UPS)—is the responsibility of the customer's facility-management department.

Some very important operational factors are not receiving sufficient attention from FT suppliers. For example, few have solved the problem of how to allow

Continued on Page 30

Omri Serlin heads ITOM International Co., a research and consulting firm in Los Altos, Calif. He writes the FT Systems *newsletter, which reports on market, company and product developments in the fault-tolerant systems arena.*



1984 Penetration Of On-Line Transaction Processing Market By Fault-Tolerant Suppliers (Projections)

Chart 2

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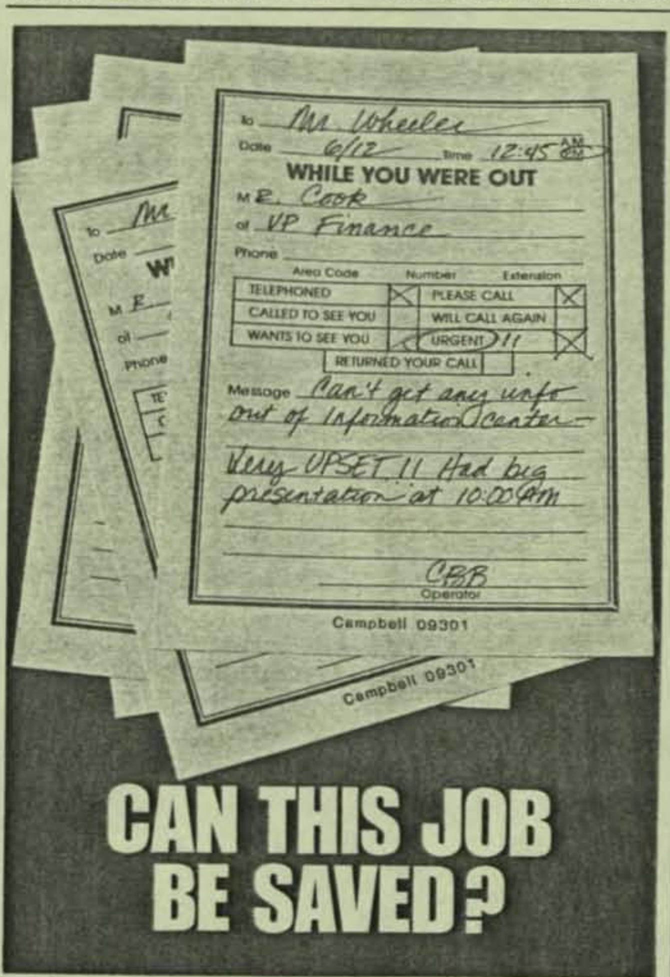

To Mr Wheeler
Date 6/12 time 12:45 [✓ AM] PM
WHILE YOU WERE OUT
M R. Cook
of VP Finance
Phone
Area Code Number Extension
TELEPHONED ☒ PLEASE CALL ☒
CALLED TO SEE YOU ☐ WILL CALL AGAIN ☐
WANTS TO SEE YOU ☐ [✓ URGENT] !! ☒
RETURNED YOUR CALL ☐
Message Can't get any info out of Information Center — Very UPSET !! Had big presentation at 10:00 AM
CBB
Operator
Campbell 09301

Circle Reader Service No. 006

Users Find 'Fault Tolerance' A Relative Term

By Jean S. Bozman

Fault tolerance is a relative term end users told *Information Systems News*. For some, a short time period for system recovery is acceptable, while for others nothing less than nonstop processing will do.

Fault tolerance is a phrase that is thrown around, said one Dallas user, "but nobody knows exactly what it means. A single hardware failure may not crash a system, but vital data may be lost during an incomplete transaction. And, in any case, software failures are more often the causes of user downtime than hardware failures."

Because fault-tolerant systems vary so greatly in real-time transaction processing, some users have gone to great lengths to test the limits of systems they plan to purchase. One company, a New York investment firm, tested a Stratus Computer Inc. system by seeing how many printed boards could be removed without a system failure.

"We found that the Stratus really does tolerate a lot of stress," said an information systems manager at the New York firm. "We started pulling printed-circuit boards at random, and the only way we got it to stop was to pull out enough CPU boards to make it non-functional. However, the moment we replaced the CPU boards, it was off and running again."

That kind of real-time transaction processing—the kind used in process control, banking and financial applications—puts at a premium the 100-percent availability of the computer.

For many applications, subsecond or several-second recovery time is sufficient, users and vendors agreed.

"In an office situation, where you have a lot of people sitting at terminals, users will tolerate a several-second delay for recovery far better than a bank that is doing hundreds of financial transactions each minute," said one engineer at AT&T who did not wish to be named. "Engineering environments demand immediate response, as do telecommunications applications."

Tolerable waiting times vary widely, vendors said. "The amount of acceptable recovery time is application-dependent," said Shirley Henry, director of marketing at Tolerant Systems Inc., San Jose, Calif. "The level of protection is selectable by programming."

To achieve this, Tolerant Systems relies on a software solution, allowing an error-detector buried in the "kernel" of its enhanced Unix operating system to isolate hardware or software failures that result in an incomplete transaction, bypassing them until repairs can be made. Then, the system reconfigures around the problem, with recovery time in a second or two.

"Our system, which is made up of system building blocks based on the National Semiconductor [Corp.] 16032 and 32032 chips, will not allow a partial transaction to take place," Henry said. "If a stoppage occurs, the computer will return to a previous copy of the data base and reconstruct the transaction from the beginning." The integrity of the data base in a system such as Tolerant's is preserved. However, a certain amount of time is needed before the user can then access the data base.

Hardware-based, fault-tolerant systems offer an additional advantage, analysts point out—the data base was never disturbed by the failure of one of the CPUs or its components.

Information systems managers should be analyzing what they really want in a fault-tolerant system, said the AT&T engineer. "When such a decision-maker buys fault tolerance, he's really buying faith," the engineer said. "He knows there will inevitably be hardware failures. But the real question is will the machine keep running even when those failures occur?"

Power Problems

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Fault-Tolerant Solutions Vary With Vendor

By Paul E. Schindler Jr.

Every commercial fault-tolerant computer system uses some combination of both hardware and software to ensure that the systems will crash less often than conventional computer systems when component failures occur.

Still, the various fault-tolerant systems suppliers fall at various places along a spectrum that runs between hardware solutions and software solutions, vendors and industry analysts said. Most vendors combine the two approaches to some degree.

At the hardware end of the spectrum are those who believe that fault tolerance should rely on CPU redundancy. On the other end are those who said it should rely on software to isolate component or software failures.

Senior analyst Joan de Regt of International Resource Development Inc., a Norwalk, Conn., marketing research firm, said vendors depending primarily on hardware for fault tolerance include August Systems Inc., Tigard, Ore., which uses a triple-CPU checking system; Stratus Computer Inc., Natick, Mass., which has four CPUs checking each transaction; and AT&T, which relies on self-checking VLSI chips.

"Hardware-based systems are more fault tolerant than the software-based systems because you can immediately redirect traffic to the working components," said de Regt.

Hardware solutions, said Shirley Henry, director of marketing at Tolerant Systems Inc., San Jose, Calif., are best when absolute system integrity at the instruction level is needed. "If a human life is at stake, use redundant hardware," she said. However, Henry said it was "fair to say we are primarily using software" to achieve fault tolerance.

She, and others who build software-based systems, believe that such systems are more easily expandable than hardware-based systems, since they rely on reconfiguration rather than duplication of components.

Software solutions may still be virtually instantaneous in recovery time, but usually several seconds are needed to reconfigure the system, industry analysts said.

Among those offering software solutions are Tandem Computers Inc., Cupertino, Calif., the founder of the fault-tolerant marketplace; Auragen Systems Corp., Englewood Cliffs, N.J.; Computer Consoles Inc., Rochester, N.Y.; Parallel Computers, Santa Cruz, Calif.; Sequoia Systems Inc., Marlboro, Mass.; Synapse Computer Corp., Milpitas, Calif.; and Tolerant Systems.

Many of these software-dependent, fault-tolerant systems are based on Motorola's MC 68000 32-bit chip, and have Unix-compatible or enhanced Unix operating systems.

Tandem, however, combines software fault tolerance with a duplicate CPU for backup operation.

Tolerant, like fault-tolerant vendor Synapse, has broken its CPU into segments of logic and memory that can distribute a computation around a failure.

Tandem, the market leader with more than $500 million in sales this year, relies on both software fault tolerance, which is customized for each user, and on hardware redundancy provided by a backup CPU.

De Regt said it was her opinion that Tandem's philosophy of software-dependent fault tolerance made sense when the firm was founded in the mid-70s, "at a time when hardware costs were high and software was less expensive."

Ever since, however, hardware costs have dropped and software costs have increased, she said, "so the balance has shifted," making hardware solutions to fault tolerance more effective.

Charles Lecht, president of Lecht Sciences Inc., a New York software house, had a less even-handed approach to the question than de Regt. "Redundant processors are the only way to go," he said. "All of them running the same program, all of them able to take over each other's workload.

SPECIAL REPORT

FAULT TOLERANT SYSTEMS

"Of course, software will always be a factor," Lecht said. "But if you think of software as the driver and hardware as the car, all the drivers in the world will not help you if there is no car for them to drive. You cannot do it all in software."

The philosophical leader of the hardware fault-tolerant camp, analysts agree, is Stratus. Peter Kastner, manager of Stratus' corporate business development, said his 4-year-old firm believes that hardware fault tolerance has "definite advantages" over software-based systems.

Competitors argue that redundant hardware systems such as Stratus—which has four sets of logic executing the same instructions simultaneously—has a cost disadvantage. But Kastner said chips amount to only 2 percent of the selling price of a typical system. The clear advantage is that any malfunctioning chip—the one that produces a different answer than the others—is immediately isolated from the system for repairs. Moreover, he said, hardware faults are far more infrequent than software faults.

Kastner summed up the Stratus philosophy as "hardware redundancy which is controlled by hardware, rather than by software," and argued that his firm's software techniques, including automatic rebooting in case of system failure, use fewer CPU cycles than similar techniques used by software-oriented competitors.

Toward the hardware end of

Continued on Page 30

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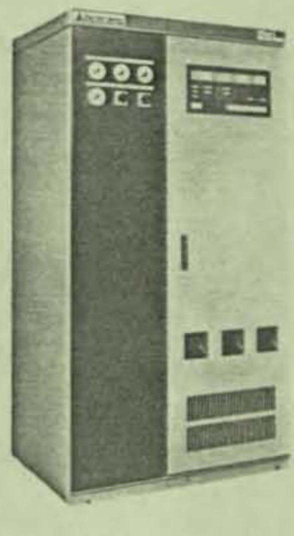

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FT Vendors Facing Difficulty Righting 'Soft' Software Errors

Continued from Page 22

new versions of the operating system to be installed, without disrupting ongoing operations.

Yet without such a facility, the system can be hardly considered "non-stop." In many cases, the checkpointing (state saving) of the data base, required for protection against disk failures, cannot be accomplished without terminating, or slowing down, the on-line workload.

Some systems do not even provide for on-line repair; such systems cannot be regarded as FT systems at all.

Probably the most difficult issue is that of "soft" software errors, loosely defined as the type of "bugs" in either the system or user code, which do not come to light except under an array of unusual coincidences.

In on-line systems, communications with local and remote terminals often create random sequences that could cause such "bunching" of unusual events.

All these (and other) problems significantly detract from the completeness of the FT story as told by the current practitioners.

Thus, it is not surprising that when the prospective customer is faced with choosing between a "kludgey" solution from his conventional supplier and an elegant, but incomplete (and incompatible), FT system from a relative newcomer without a track record, more often than not the conventional supplier wins.

For example, IBM has been successful in selling its Airline Control Program (ACP) as a high-availability transaction system in the banking and brokerage industries, despite the many severe limitations inherent in the product; NCR Corp., Dayton, Ohio, is now offering its "Cluster" hardware and Instant Ready software; and the recent VMS Version 4 from Digital Equipment Corp., Maynard, Mass., implements several high-availability features to support its VAXcluster approach.

FT suppliers are responding to the compatibility issue in two ways. Those that hope to place their systems in IBM environments, such as Tandem, are implementing high-level SNA compatibility.

Those aiming at DEC and other non-IBM environments—Auragen Systems Corp. Fort Lee, N.J., Sequoia Systems Inc., Marlboro, Mass., Tolerant Systems Inc., San Jose, Calif.—are providing Unix compatibility. These companies are hoping that the growing acceptance of Unix as a standard will allow them easier entry.

One of the more interesting recent developments is the increasing activity in the area of multi-microprocessor based systems, which offer selected FT features. Arete Systems Corp., San Jose, Calif., EnMasse Computer Corp., Acton, Mass., Parallel Computers Inc., Santa Cruz, Calif., Sequent Computer Systems Inc., Portland, Ore., and several others are basing their strategies on the idea that most applications currently addressed by "true" FT suppliers could be satisfied with less-than-full fault tolerance, provided the price is right.

Much attention has been focused on AT&T's recent entry into the fault-tolerant arena with its relatively old 3B20D duplexed system. However, the lack of expandability and of commercial transaction software limits its attraction to defense, telecommunications and other specialized applications.

However, a potentially significant development ensuing from the 3B20 program is the set of modifications to Unix, recently implemented by AT&T Bell Laboratories, that allow it to run on the dual-processor 3B20A model. These modifications, which are expected to eventually show up in Unix System V, are general enough to allow Unix to be used on other multiple processor configurations.

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Leading Competitors In The Fault Tolerant Market

Company Name And Model No.	Base Memory And Processor Chip	Recovery Time And Method (Hardware) (Software)	Performance In MIPS (Approx.)	Price
AT&T Information Systems, 3B20D	5 Mbytes, Proprietary Chip	Subsecond, Hardware And Software	1 MIPS	$340,000
August Systems Inc. CS-306	512K bytes Intel Corp. 8086	N.A. Hardware And Software	N.A.	$150,000
Auragen Systems Corp. System 4000	4 Mbytes Motorola MC68000	1-5 Seconds, Software	1.5 MIPS	$185,000
Computer Consoles Inc. Power 5, Power 6 Series	2 Mbytes, Proprietary Chip	1-10 Seconds, Hardware	2 MIPS	$167,000
Parallel Computers, Parallel 300	2 Mbytes, Motorola MC68000	2-3 Seconds, Hardware And Software	7 MIPS	$74,900
Sequoia Systems Inc. N.A.	N.A. Motorola MC68000	N.A. Hardware And Software	2.5 MIPS	$250,000
Stratus Computer Inc. FT-200	2 Mbytes, Motorola MC68000	Subsecond, Hardware	1 MIPS	$140,000
Synapse Computer Corp. 1015-A	8 Mbytes, Motorola MC68000	3-5 Minutes* Hardware And Software	1.5 MIPS	$340,000
Tandem Computer Inc. TXP	4 Mbytes Proprietary Chip	2-4 Seconds, Hardware And Software	4 MIPS	$298,000
Tolerant Systems Inc. Eternity Series 5000	2 Mbytes National Semiconductor 32032	1-4 Seconds, Software	1.7-2 MIPS	$145,000

All figures supplied by companies. Recovery times are application dependent.

*Recovery time is based on complete application level recovery and data base integrity.

AT&T's 3B Fault Tolerance Fuses Hardware, Software

Continued from Page 24

the spectrum, but less militant than Stratus, is AT&T Technologies, formerly the Western Electric Co. subsidiary of AT&T. Paul Teetor, an engineer with AT&T Bell Laboratories in Naperville, Ill., said that while AT&T's 3B20D processor does offer hardware redundancy, "our strength is the fusion of hardware and software."

Teetor admitted that "hardware redundancy is the backbone of our system," but said it would not offer the benefits it does without use of a special version of the Unix operating system known as Unix Real Time Reliable or Unix RTR.

When AT&T announced commercial availability of the 3B20D last March, Teetor said, it said a typical system operating 24 hours a day, 365 days a year would only be down eight minutes a year. When the 3B20D was being designed, tested and used within AT&T's phone system, it was responsible for keeping the phone system's 800 numbers and AT&T credit-card verification services up and running.

Previously written Unix programs will run under Unix RTR on the 3B20D without modification, Teetor said, and they will be more reliable because they are running on a more reliable operating system or can be modified to take advantage of the system's special fault-tolerant features.

"Our whole goal is to lose the minimum amount of information during a failure," he said. As a result, the AT&T system, unlike Stratus, does not immediately have an automatic reboot feature. Instead, it first tries to restart the process, using a combination of hardware and software to prevent entry into infinite loops.

Hardware systems are criticized for the difficulty in expanding them, due to the need for hardware overhead to provide redundancy. By contrast, software systems are more readily expandable, since the amount of software needed does not grow as quickly as does system size.

Tandem, which relies on both software fault tolerance and CPU duplication, prefers to think of fault tolerance as "a feature, not a market," according to Jerry Held, Tandem's director of strategic planning.

Held also said that Tandem's self-view is not that of a fault-tolerant system provider, but rather a provider of systems for "on-line transaction processing," for which fault tolerance is but one requirement.

His company, founded in 1970, is the market leader, with more than 80 percent of the market.

Held said he prefers to look at a different spectrum, "not from hardware to software, but from availability to expandability." Most systems fall at one end or the other of this scale, he said, while Tandem is firmly placed in the middle, "offering the best combination of both."

Single-processor redundant systems such as Stratus and AT&T would be at the 100 percent-availability end of the scale, he suggested, while Synapse has stressed expandability over 100 percent uptime.

But, while saying that Tandem systems offer "a tremendous amount of hardware fault tolerance," Held was willing to say that "a number of our features are based in software." He said Tandem has examined the concept of redundant hardware, but concluded that "it is not optimum."

Hardware solutions, Held said, "only solve half the problem. We believe multiprocessor systems are the key to most customer problems." Such systems are easier to put together with software than with hardware, he said.

While the cost of hardware components is dropping, Held said, the number of components in a system is rising. "Hardware cost is not going to zero," he said. "Redundant systems tend to double hardware costs. In two systems, with equally mature technologies, the more cost-effective design will be software-oriented."

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Continued from Page 24

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Tandem, Competitors

LEVEL 1 - 1 OF 4 STORIES

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August 2, 1984, Thursday

SECTION: SECTION I; Technology; Pg. 7

LENGTH: 1045 words

HEADLINE: Tandem slows but keeps on running;
TANDEM COMPUTERS MEETS COMPETITION IN FAILSAFE SYSTEMS

BYLINE: BY ALAN CANE

BODY:

FAULT TOLERANCE comes naturally in California, where the earth moves restlessly and regularly, relieving the stresses which build up under the San Andreas and neighbouring Calaveras faults.

It shifted violently earlier this year, shaking the low, flat-roofed buildings which house many of California's "Silicon Valley" electronics companies, among them the Cupertino offices of Tandem Computers.

Tandem executives, however, hardly noticed the tremors, for the ground under their feet was already shaking.

The company was about to announce that revenues for the second quarter of 1983-84 would be below those for the first, the first quarter-to-quarter decline since the company went public in December 1977.

Coupled with the news that telecommunications giant American Telephone and Telegraph (AT & T) was about to invade Tandem's special territory, fault tolerant systems, the announcement was enough to accelerate the fall of its stock price to $16.25, down from a high of $40.25 in the previous 12 months.

The stock price has quivered around the $20 mark since then; significantly better third quarter results, announced last week, were still below analysts' expectations and pushed the price down to just under $14.

All of this has to be seen in the context of Tandems very special place in the computing world.

It virtually created the modern concept of fault-tolerant computing, taking a long lead in what is now seen as one of the most important technologies in business data processing. For years it had no competitors at all; some measure of the importance the computing world now attaches to fault tolerance can be gauged from the list of companies now offering these systems, mostly start-ups; it includes Status, NoHalt Compuers, Computer Technology, Computer Consoles, Syntres, Formation Inc. Tolerant Systems, Parallel Computers, August Systems and Perkin-Elmer.

What Tandem understood earlier than any of the others, was the desperation which was beginning to grip data processing managers when they pondered the consequences of failure of their computers.

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Most modern companies are completely dependent on their data processing systems. Failure means at best, expense and inconvenience -- at worst, the entire company could be at risk.

The companies most acutely aware of the problem were running large on-line databases, with transaction orientated terminals connected through communications lines -- the banks, financial institutions, retailers, hotels and the leisure business.

Before Tandem, the only answer was "hot standby" -- a duplicate computer system warmed up and ready to go if the original failed. It was expensive, risky and, as many customers discovered to their cost, not too reliable.

Tandem's idea was to duplicate all the essential items in the computer using clever software to move information to healthy parts of the system in the event of a single component failure and to make it possible to connect many processors together to give mssive transaction processing power.

Its original business plan, dated September 1975, notes: "No manufacturer has designed a multiprocessor from the ground up. Tandem will be the first company to offer a fully implemented hardware and software solution. We expect to gain the dominant share of this rapidly emerging market."

It was and it did. From 1977 through to 1983, its revenues grew from $8m to $418m; it now has over 720 customers with a world-wide network of over 60 sales and engineering offices.

Its prestige customrs in the UK include the London clearing banks (the CHAPS network), the London Stock Exchange and GCHQ Cheltenham, the Government defence listening post.

In the U.S. the list includes Wells Fargo Bank, Hughes Aircraft and GTE.

So what is slowing -- if not stopping -- the world's most significant fault tolerant computer company?

To some extent, it seems to be a victim of its own success. Most analysts, and the company itself, believe that its current less-than-sparkling financial performance is an anomaly caused by Tandem's increasing penetration of major companies.

That means its quarterly performance is tied more precisely to the buying cycles of these large companies, so producing low revenue figures in the early part of the year.

Second, it no longer has the fault tolerant market to itself. Indeed, it is even trying to play down its image as the leading fault tolerant manufacturer, arguing that every manufacturer will have to provide fault tolerance in future.

Its claim now is to be the leading manufacturer of high capacity transaction processing systems; the power of the system being a consequence of exploiting all the advantages of a multiprocessor system -- the customer gets fault tolerance as a bonus on top of all his power rather than as the principal reason for buying Tandem.

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But Tandem is also a victim of its own originality. It designed its fault tolerant machines, the NonStop series, back in 1976 when hardware was expensive and software, by comparison, cheap.

The newer companies in the field -- of which the most significant is generally reckoned to be Stratus -- have taken advantage of the cheap and powerful hardware now available to develop computers with comparable power to the Tandem systems but at substantially lower cost. Stratus is already beginning to make significant inroads into financial markets. In the UK, Link, a consortium of building societies and financial institutions, plans to build a network of automated teller machines on Stratus switches.

In the U.S. customers include Merrill Lynch, Lockheed and Bank of America.

Tandem's response has been to develop new systems at the top end of the market -- the TPX family -- and to promise new systems which will directly compete with Stratus' lower-priced offerings.

Stratus sees Tandem as the competition. Its founder and president, William Foster, says: "It is a very successful company with a substantial number of large accounts and that is not going to change."

Tandem has its sights set on IBM. President James Treybig says: "Tandem is the new mainframe -- we have got to stay right here and win. IBM can go to other places. You only beat IBM by being better."

GRAPHIC: Picture, Tandem's "paperless factory" at Austin, Texas

Tandem, competitors

LEVEL 1 - 3 OF 4 STORIES

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August 2, 1984, Thursday

SECTION: SECTION I; Technology; Pg. 7

LENGTH: 346 words

HEADLINE: Designing for fault tolerance

BYLINE: EDITED BY ALAN CANE

BODY:

TANDEM'S FAULT tolerant design, when it launched its "NonStop 16" back in 1977, was revolutionary.

The aim was an architecture which would continue to process data successfully despite any single component failure -- a component, in this case, means the central processor, the high speed memory, the input output controller, the input/output data path, the disk memory and the disk controller.

Failure of any of these components in a conventional computer means the application running also fails. To provide fault tolerance, Tandem duplicates all the critical hardware and the software.

Tandem's answer is to link the two systems through a high speed data transfer system with one memory component kept in a state which allows it to assume control if the other memory fails.

The central processor in Tandem systems is built out of conventional microelectronic building blocks -- Schottky technology. Fault tolerance is assured by software techniques -- checkpointing and transaction monitoring -- which inevitably costs the user something in system overhead.

Tandem argues that this is no penalty -- the user can exploit the power of the entire multiprocessor system.

Stratus, designed some five years later, makes use of the fastest, most powerful microprocessor chips commercially available, the Motorola 68000 family. Fault tolerance is built into the hardware, so there is no software overhead.

Basically the system multiplies up the new, low cost hardware to give a fault tolerant system. Two pairs of 68000 processors are fed with identical programs to operate on identical data.

The processors are paired, and the results of each set of computations compared. Only if all four results are identical is the system acknowledged as working correctly. If one differs it can be isolated while the other processors continue to operate.

This check takes place once every 125 nanoseconds or 8m times a second.

It means that Stratus can build a machine which at the top end processes 3m instructions a second -- for roughly £262,000.

Tandem & compet.

OTHER VENDORS' MAINFRAMES

By Tom Henkel
CW Staff

Industry watchers have long predicted that mainframe vendors will have to depart from their aging systems architectures in order to meet users' demands for increased performance.

Two of the so-called Bunch companies — Burroughs Corp. and Control Data Corp. — took steps to do just that in the past year.

Burroughs unveiled a mid-range processor called the A9 [CW, Jan. 23]. Additional models of the A line, according to W. Michael Blumenthal, chairman and chief executive officer of Burroughs, will eventually replace the firm's entire B series of processors.

The A9 incorporates three logical processors that allow the system to execute up to three internal operations at once. The A9 is currently available in three models, all aimed at the same performance range as IBM's upper-end 4300 processor lineup. Blumenthal said that both high- and low-end models of A series processors will be introduced over the next year or so.

In perhaps one of the most unique product announcements in the past few years, CDC replaced its Cyber 170 series of mainframes with the Cyber 180 line [CW, April 30]. Included in the sweeping announcement were a high-end Cyber 180 Model 990; three low-end processors — Models 810 and 830 and a dual-processor 830; and an enhanced version of CDC's NOS operating system.

Honeywell, Inc. replaced three members of its DPS 7 line, not with higher performance machines [CW, April 23], but with an E series of processors that are less expensive — aimed at making the migration from the firm's older Level 62 mainframes easier.

NCR Corp. did not make any additions to its high-end product lineup, but it did eliminate two processors, the V-8565-II and V-8585-II. NCR also lowered the purchase prices of its mainframe processor line.

Digital Equipment Corp.'s Decsystem-10 and Decsystem-20 processors are still listed in this year's Hardware Roundup because DEC contends that it is still marketing those processors to end users. In fact, DEC announced two new models of the Decsystem line in a move that many industry watchers saw as an appeasement to the firm's installed base. Only the latest two models of the aging mainframe line are listed. A year ago, DEC outraged Decsystem users by canceling plans to develop a high-end successor to the Decsystem line. Instead, DEC announced its future high-end migration path would be through its VAX-11 line of superminicomputers.

Lastly, two transaction-oriented systems, manufactured by Tandem Computers, Inc. and Synapse Computer Corp., have been included in the mainframe section of the Hardware Roundup. While architecturally the two systems appear to be more closely related to superminicomputers, both vendors contend that the majority of their business is competing with mainframe vendors, particularly IBM.

TANDEM COMPUTERS, INC.

System / Characteristics	Nonstop TXP
Relative Performance[1]	210-1,227
Mips[2]	4-32
Memory size in bytes (Minimum-Maximum)	4M-128M
Purchase Price (Memory Size)	$322,000 (4M)
Lease Price (Lease Term)	None
Machine Cycle Time (Nsec)	83.3
Channels[3] (Minimum-Maximum)	32-256
Cache (Buffer) size	128K-1M
Bus Architecture?	No
Price per 1M byte of main memory[4]	$11,000

1. CW estimates based on vendor-supplied information. Relative performance ratings are based on an IBM 370/158-3 equaling 45. These numbers are designed to put the processor into perspective with other systems; they do not constitute a buyer's guide. Actual performance can vary with the application, peripherals and software.
2. Vendor claims.
3. The available number of processor I/O ports.
4. Available only in 2M-byte increments costing $22,000.

SYNAPSE COMPUTER CORP.

System / Characteristics	Synapse N+1
Relative Performance[1]	155-868
Mips[2]	2.8-14
Memory size in bytes (Minimum-Maximum)	6M-16M
Purchase Price[3] (Memory Size)	$169,000 (6M)
Lease Price (Lease Term)	None
Machine Cycle Time (Nsec)	100
Channels (Minimum-Maximum)	2-14
Cache (Buffer) size[4]	16K
Bus Architecture?	Yes
Price per 1M byte of main memory	$14,000

1. CW estimates based on vendor-supplied information. Relative performance ratings are based on an IBM 370/158-3 equaling 45. These numbers are designed to put the processor into perspective with other systems; they do not constitute a buyer's guide. Actual performance can vary with the application, peripherals and software.
2. CW estimates.
3. For a five-processor system configured for a transaction processing work load, the relative performance figure is 155. The vendor said up to 28 processors can be used. In a 28-processor configuration, the relative performance would be 868.
4. Per CPU.

HONEYWELL, INC.

System / Characteristics	DPS 8/47	DPS 8/49	DPS 8/52	DPS 8/62	DRS 8/70	DPS 88/81	DPS 88/82
Relative Performance[1]	41-72	61-208	61-220	62-236	101-395	329	470
Mips[2]	.73-1.2	1.1-4.5	1.1-4.9	1.2-5.9	1.8-7.2	7.2	13
Memory size in bytes (Minimum-Maximum)	4M-32M	4M-32M	4M-32M	4M-32M	4M-64M	16M-64M	16M-28M
Purchase Price[3] (Memory Size)	$153,000 (2M)	$253,000 (2M)	$450,000 (2M)	$550,000 (2M)	$700,000 (2M)	$2,850,000 (16M)	$4,050,000 (32M)
Lease Price (Lease Term)	$7,400 (4 Year)	$10,000 (4 Year)	$21,062 (5 Year)	$26,304 (5 Year)	[illegible] (5 Year)	$81,200 (4 Year)	$141,000 (4 Year)
Machine Cycle Time (Nsec)	Not Available	Not Available	Not Available	Not Available	Not Available	Not Available	Not Available
Channels (Minimum-Maximum)	20	20	54	54	108	10-40	10-40
Cache (Buffer) size	32K	32K	32K	32K	32K	64K	128K
Bus Architecture?	No	No	No	No	No	No	No
Price per 1M byte of main memory	$7,500	$7,500	$20,000	$20,000	$20,000	$20,000	$20,000

1. CW estimates based on vendor-supplied information. Relative performance ratings are based on an IBM 370/158-3 equaling 45. These numbers are designed to put the processor into perspective with other systems; they do not constitute a buyer's guide. All systems are not alike; they use different operating systems, instruction sets and architectures and, therefore, cannot be directly compared. In addition, actual relative performance may vary with the application, peripherals and software.
2. CW estimates.
3. For the processor only. Each of the models in the DPS 8 line can accommodate multiple processors.

HONEYWELL, INC.

System / Characteristics	DPS 6/40	DPS 6/45	DPS 6/75	DPS 6/95	DPS 7/35E	DPS 7/65E
Relative Performance[1]	25	25	44	116	25	76
Mips[2]	.4	.4	.7	1.8	.5[3]	1.36[3]
Memory size in bytes (Minimum-Maximum)	512K-2M	512K-2M	512K-2M	2M-16M	1M-4M	1M-4M
Purchase Price[4] (Memory Size)	$37,330 (512K)	$49,900 (512K)	$59,150 (1M)	$104,900 (2M)	$85,200[5] (1M)	$215,700[5] (2M)
Lease Price (Lease Term)	$781 (5 Year)	$918 (5 Year)	$1,237 (5 Year)	$2,194 (5 Year)	$2,988 (5 Year)	$7,759 (5 Year)
Machine Cycle Time (Nsec)	250	250	200	125	330	140
Channels (Minimum-Maximum)	4-28	4-32	4-96	8-128	2-8	4-8
Cache (Buffer) size	None	None	8K	8K	None	None
Bus Architecture?	Yes	Yes	Yes	Yes	No	No
Price per 1M byte of main memory	$9,000	$9,000	$9,000	$8,000	$10,000	$10,000

1. CW estimates based on vendor-supplied information. Relative performance ratings are based on an IBM 370/158-3 equaling 45. These numbers are designed to put the processor into perspective with other systems; they do not constitute a buyer's guide. Actual performance can vary with the application, peripherals and software.
2. Vendor claims.
3. CW estimates.
4. Includes processor, console, 80M-byte disk drive, 5-1/4 in. diskette drive and 5-1/4 in. diskette drive. The DPS 6/45 purchase price also includes Honeywell's System Control Facility.
5. Includes a unit record processor, console, keyboard, remote maintenance adapter and a diskette unit. The DPS 7/35E configuration includes two I/O channels; the DPS 7/65 includes four I/O channels.

DIGITAL EQUIPMENT CORP.

System / Characteristics	Decsystem-10 1095	Decsystem-10 2065
Relative Performance[1]	86	86
Mips[2]	1.5	1.5
Memory size in bytes (Minimum-Maximum)	8M-32M	8M-32M
Purchase Price[3] (Memory Size)	$425,000 (8M)	$405,000 (8M)
Lease Price (Lease Term)	None	None
Machine Cycle Time (Nsec)	133	133
Channels (Minimum-Maximum)	3-12	3-12
Cache (Buffer) size	18K	18K
Bus Architecture?	No	No
Price per 1M byte of main memory[4]	$7,000	$7,000

1. CW estimates based on vendor-supplied information. Relative performance ratings are based on an IBM 370/158-3 equaling 45. These numbers are designed to put the processor into perspective with other systems; they do not constitute a buyer's guide. All systems are not alike: they use different operating systems, instruction sets and architectures and, therefore, cannot be directly compared. In addition, actual relative performance may vary with the application, peripherals and software.
2. Vendor claims.
3. Includes processor, console, power supply, a minimum tape and disk configuration and all prerequisites.
4. An abstract price for 1M byte of main memory. Main memory is available in 1M word, or 8M-byte increments.

Tandem & competitors

①

Nonstop Challenges In Fault-Tolerant Market

By Omri Serlin

SPECIAL REPORT

FAULT TOLERANT SYSTEMS

The euphoria of 1980-1983, during which some two dozen start-ups and some well-established companies entered the market for fault-tolerant, on-line transaction processing systems (FT/OLTP), has been replaced recently with the somber realization that selling FT systems is a hard "push" rather than the easy "pull" that entrepreneurs, venture capitalists and some market researchers had anticipated.

With the notable exception of Tandem Computers Inc., Cupertino, Calif., and Stratus Computer Inc., Natick, Mass., no other FT/OLTP suppliers have, as yet, managed the total transition from the development stage to full production.

Just about all new entrants have experienced significant product delays, and many are having a difficult time trying to raise much-needed capital for completing product development and establishing manufacturing and marketing functions.

The size of the FT/OLTP marketplace has been grossly exaggerated, especially by market researchers who failed to grasp the difference between potential and realizable markets.

The potential market for FT systems in OLTP and related applications continues to be huge (see chart 1) because the clear trend to on-line processing is creating a need for nonstop computing. The actual penetration by current FT/OLTP suppliers, however, has been miniscule (see chart 2) and is likely to continue to be insignificant in relative terms.

One of the key factors limiting the acceptance of current FT systems is that they generally focus on the easy parts of the problem and tend to ignore the more difficult, and often more important, aspects.

Of course, there are variations between individual systems, and these are hotly debated among the proponents of the various approaches—"hardware" vs. "software" fault tolerance, tightly coupled vs. loosely coupled architecture, etc.

But in a general sense, just about all FT systems offer reasonably robust fault-detection and recovery mechanisms in two areas: process execution and data storage. The FT requirements of these two aspects are well understood and are relatively easy to achieve.

Unfortunately, processor failures and disk crashes are no longer the key problems preventing nonstop operation. There is mounting evidence that "operator errors" and problems with remote communications lines are far more significant factors in downtime. Neither of these problems is effectively addressed in any of today's FT systems.

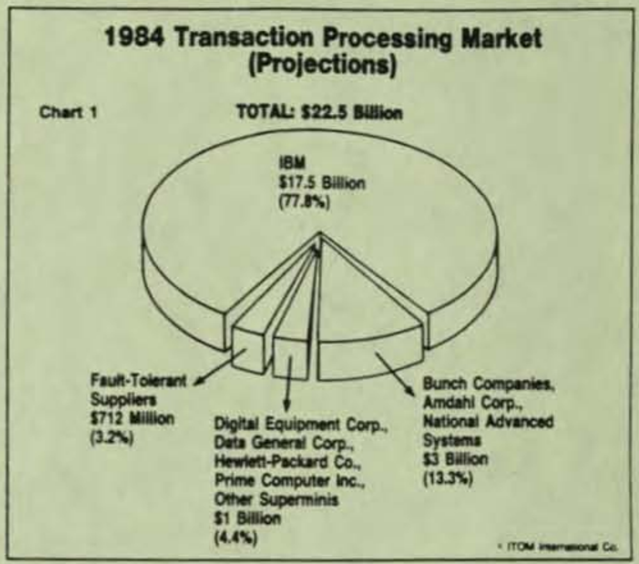
Furthermore, as the reliability of basic electronic and electro-mechanical components increases, power disruptions are becoming relatively more important in causing failures.

Yet few FT suppliers are providing power-fail protection in their systems. The general attitude seems to be that the provision of reliable power—such as an uninterruptible power system (UPS)—is the responsibility of the customer's facility-management department.

Some very important operational factors are not receiving sufficient attention from FT suppliers. For example, few have solved the problem of how to allow

Continued on Page 30

Omri Serlin heads ITOM International Co., a research and consulting firm in Los Altos, Calif. He writes the FT Systems *newsletter, which reports on market, company and product developments in the fault-tolerant systems arena.*



1984 Transaction Processing Market (Projections)

Chart 1

TOTAL: $22.5 Billion

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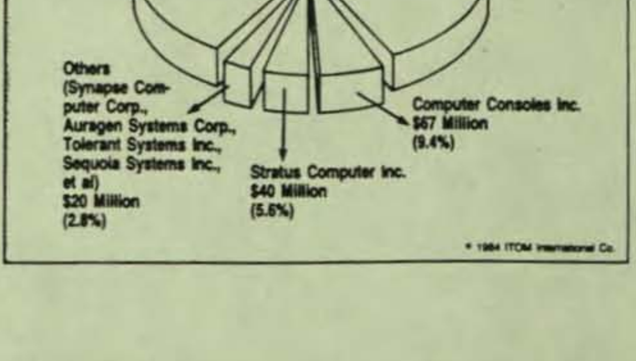

1984 Penetration Of On-Line Transaction Processing Market By Fault-Tolerant Suppliers (Projections)

Chart 2

TOTAL: $712 Million

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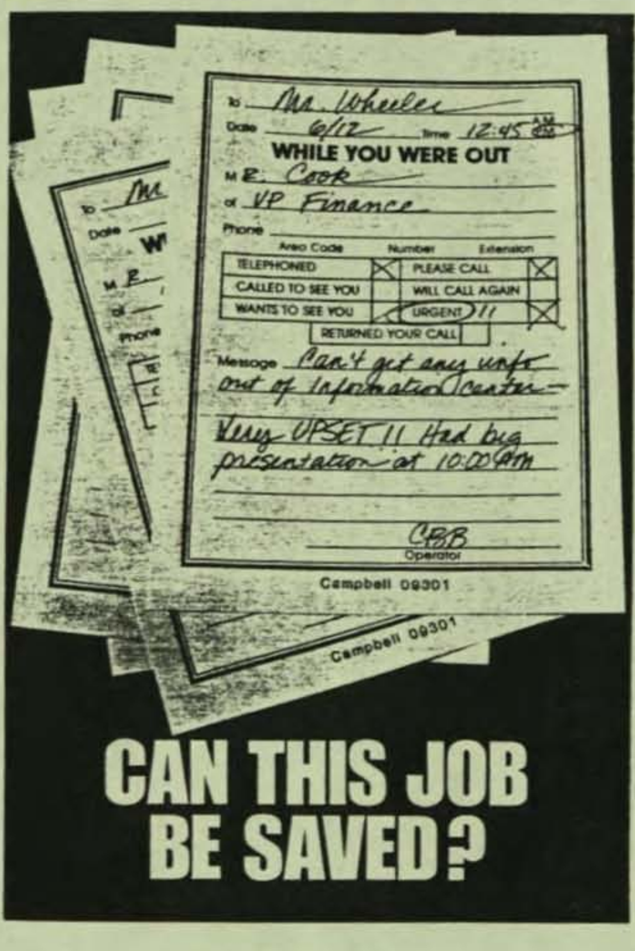

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Users Find 'Fault Tolerance' A Relative Term

By Jean S. Bozman

Fault tolerance is a relative term end users told *Information Systems News*. For some, a short time period for system recovery is acceptable, while for others nothing less than nonstop processing will do.

Fault tolerance is a phrase that is thrown around, said one Dallas user, "but nobody knows exactly what it means. A single hardware failure may not crash a system, but vital data may be lost during an incomplete transaction. And, in any case, software failures are more often the causes of user downtime than hardware failures."

Because fault-tolerant systems vary so greatly in real-time transaction processing, some users have gone to great lengths to test the limits of systems they plan to purchase. One company, a New York investment firm, tested a Stratus Computer Inc. system by seeing how many printed boards could be removed without a system failure.

"We found that the Stratus really does tolerate a lot of stress," said an information systems manager at the New York firm. "We started pulling printed-circuit boards at random, and the only way we got it to stop was to pull out enough CPU boards to make it non-functional. However, the moment we replaced the CPU boards, it was off and running again."

That kind of real-time transaction processing—the kind used in process control, banking and financial applications—puts at a premium the 100-percent availability of the computer.

For many applications, subsecond or several-second recovery time is sufficient, users and vendors agreed.

"In an office situation, where you have a lot of people sitting at terminals, users will tolerate a several-second delay for recovery far better than a bank that is doing hundreds of financial transactions each minute," said one engineer at AT&T who did not wish to be named. "Engineering environments demand immediate response, as do telecommunications applications."

Tolerable waiting times vary widely, vendors said. "The amount of acceptable recovery time is application-dependent," said Shirley Henry, director of marketing at Tolerant Systems Inc., San Jose, Calif. "The level of protection is selectable by programming."

To achieve this, Tolerant Systems relies on a software solution, allowing an error-detector buried in the "kernel" of its enhanced Unix operating system to isolate hardware or software failures that result in an incomplete transaction, bypassing them until repairs can be made. Then, the system reconfigures around the problem, with recovery time in a second or two.

"Our system, which is made up of system building blocks based on the National Semiconductor [Corp.] 16032 and 32032 chips, will not allow a partial transaction to take place," Henry said. "If a stoppage occurs, the computer will return to a previous copy of the data base and reconstruct the transaction from the beginning." The integrity of the data base in a system such as Tolerant's is preserved. However, a certain amount of time is needed before the user can then access the data base.

Hardware-based, fault-tolerant systems offer an additional advantage, analysts point out—the data base was never disturbed by the failure of one of the CPUs or its components.

Information systems managers should be analyzing what they really want in a fault-tolerant system, said the AT&T engineer. "When such a decision-maker buys fault tolerance, he's really buying faith," the engineer said. "He knows there will inevitably be hardware failures. But the real question is will the machine keep running even when those failures occur?"

Power Problems

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③ Fault-Tolerant Solutions Vary With Vendor

By Paul E. Schindler Jr.

Every commercial fault-tolerant computer system uses some combination of both hardware and software to ensure that the systems will crash less often than conventional computer systems when component failures occur.

Still, the various fault-tolerant systems suppliers fall at various places along a spectrum that runs between hardware solutions and software solutions, vendors and industry analysts said. Most vendors combine the two approaches to some degree.

At the hardware end of the spectrum are those who believe that fault tolerance should rely on CPU redundancy. On the other end are those who said it should rely on software to isolate component or software failures.

Senior analyst Joan de Regt of International Resource Development Inc., a Norwalk, Conn., marketing research firm, said vendors depending primarily on hardware for fault tolerance include August Systems Inc., Tigard, Ore., which uses a triple-CPU checking system; Stratus Computer Inc., Natick, Mass., which has four CPUs checking each transaction; and AT&T, which relies on self-checking VLSI chips.

"Hardware-based systems are more fault tolerant than the software-based systems because you can immediately redirect traffic to the working components," said de Regt.

Hardware solutions, said Shirley Henry, director of marketing at Tolerant Systems Inc., San Jose, Calif., are best when absolute system integrity at the instruction level is needed. "If a human life is at stake, use redundant hardware," she said. However, Henry said it was "fair to say we are primarily using software" to achieve fault tolerance.

She, and others who build software-based systems, believe that such systems are more easily expandable than hardware-based systems, since they rely on reconfiguration rather than duplication of components.

Software solutions may still be virtually instantaneous in recovery time, but usually several seconds are needed to reconfigure the system, industry analysts said.

Among those offering software solutions are Tandem Computers Inc., Cupertino, Calif., the founder of the fault-tolerant marketplace; Auragen Systems Corp., Englewood Cliffs, N.J.; Computer Consoles Inc., Rochester, N.Y.; Parallel Computers, Santa Cruz, Calif.; Sequoia Systems Inc., Marlboro, Mass.; Synapse Computer Corp., Milpitas, Calif.; and Tolerant Systems.

Many of these software-dependent, fault-tolerant systems are based on Motorola's MC 68000 32-bit chip, and have Unix-compatible or enhanced Unix operating systems.

Tandem, however, combines software fault tolerance with a duplicate CPU for backup operation.

Tolerant, like fault-tolerant vendor Synapse, has broken its CPU into segments of logic and memory that can distribute a computation around a failure.

Tandem, the market leader with more than $500 million in sales this year, relies on both software fault tolerance, which is customized for each user, and on hardware redundancy provided by a backup CPU.

De Regt said it was her opinion that Tandem's philosophy of software-dependent fault tolerance made sense when the firm was founded in the mid-70s, "at a time when hardware costs were high and software was less expensive."

Ever since, however, hardware costs have dropped and software costs have increased, she said, "so the balance has shifted," making hardware solutions to fault tolerance more effective.

Charles Lecht, president of Lecht Sciences Inc., a New York software house, had a less even-handed approach to the question than de Regt. "Redundant processors are the only way to go," he said. "All of them running the same program, all of them able to take over each other's workload.

SPECIAL REPORT

FAULT TOLERANT SYSTEMS

"Of course, software will always be a factor," Lecht said. "But if you think of software as the driver and hardware as the car, all the drivers in the world will not help you if there is no car for them to drive. You cannot do it all in software."

The philosophical leader of the hardware fault-tolerant camp, analysts agree, is Stratus. Peter Kastner, manager of Stratus' corporate business development, said his 4-year-old firm believes that hardware fault tolerance has "definite advantages" over software-based systems.

Competitors argue that redundant hardware systems such as Stratus—which has four sets of logic executing the same instructions simultaneously—has a cost disadvantage. But Kastner said chips amount to only 2 percent of the selling price of a typical system. The clear advantage is that any malfunctioning chip—the one that produces a different answer than the others—is immediately isolated from the system for repairs. Moreover, he said, hardware faults are far more infrequent than software faults.

Kastner summed up the Stratus philosophy as "hardware redundancy which is controlled by hardware, rather than by software," and argued that his firm's software techniques, including automatic rebooting in case of system failure, use fewer CPU cycles than similar techniques used by software-oriented competitors.

Toward the hardware end of

Continued on Page 30

Is your Fault Tolerant Computer Really Fault Tolerant?

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FT Vendors Facing Difficulty Righting 'Soft' Software Errors

Continued from Page 22

new versions of the operating system to be installed, without disrupting ongoing operations.

Yet without such a facility, the system can be hardly considered "non-stop." In many cases, the checkpointing (state saving) of the data base, required for protection against disk failures, cannot be accomplished without terminating, or slowing down, the on-line workload.

Some systems do not even provide for on-line repair; such systems cannot be regarded as FT systems at all.

Probably the most difficult issue is that of "soft" software errors, loosely defined as the type of "bugs" in either the system or user code, which do not come to light except under an array of unusual coincidences.

In on-line systems, communications with local and remote terminals often create random sequences that could cause such "bunching" of unusual events.

All these (and other) problems significantly detract from the completeness of the FT story as told by the current practitioners.

Thus, it is not surprising that when the prospective customer is faced with choosing between a "kludgey" solution from his conventional supplier and an elegant, but incomplete (and incompatible), FT system from a relative newcomer without a track record, more often than not the conventional supplier wins.

For example, IBM has been successful in selling its Airline Control Program (ACP) as a high-availability transaction system in the banking and brokerage industries, despite the many severe limitations inherent in the product; NCR Corp., Dayton, Ohio, is now offering its "Cluster" hardware and Instant Ready software; and the recent VMS Version 4 from Digital Equipment Corp., Maynard, Mass., implements several high-availability features to support its VAXcluster approach.

> Probably the most difficult issue is that of 'soft' software errors, loosely defined as the type of 'bugs' in either the system or user code, which do not come to light except under an array of unusual coincidences.

FT suppliers are responding to the compatibility issue in two ways. Those that hope to place their systems in IBM environments, such as Tandem, are implementing high-level SNA compatibility.

Those aiming at DEC and other non-IBM environments—Auragen Systems Corp. Fort Lee, N.J., Sequoia Systems Inc., Marlboro, Mass., Tolerant Systems Inc., San Jose, Calif.—are providing Unix compatibility. These companies are hoping that the growing acceptance of Unix as a standard will allow them easier entry.

One of the more interesting recent developments is the increasing activity in the area of multi-microprocessor based systems, which offer selected FT features. Arete Systems Corp., San Jose, Calif., EnMasse Computer Corp., Acton, Mass., Parallel Computers Inc., Santa Cruz, Calif., Sequent Computer Systems Inc., Portland, Ore., and several others are basing their strategies on the idea that most applications currently addressed by "true" FT suppliers could be satisfied with less-than-full fault tolerance, provided the price is right.

Much attention has been focused on AT&T's recent entry into the fault-tolerant arena with its relatively old 3B20D duplexed system. However, the lack of expandability and of commercial transaction software limits its attraction to defense, telecommunications and other specialized applications.

However, a potentially significant development ensuing from the 3B20 program is the set of modifications to Unix, recently implemented by AT&T Bell Laboratories, that allow it to run on the dual-processor 3B20A model. These modifications, which are expected to eventually show up in Unix System V, are general enough to allow Unix to be used on other multiple processor configurations.

Leading Competitors In The Fault Tolerant Market

Company Name And Model No.	Base Memory And Processor Chip	Recovery Time And Method (Hardware) (Software)	Performance In MIPS (Approx.)	Price
AT&T Information Systems 3B20D	5 Mbytes Proprietary Chip	Subsecond Hardware And Software	1 MIPS	$340,000
August Systems Inc. CS-300	512K bytes Intel Corp. 8086	N.A. Hardware And Software	N.A.	$150,000
Auragen Systems Corp. System 4000	4 Mbytes Motorola MC68000	1-8 Seconds Software	1.5 MIPS	[illegible]
Computer Consoles Inc. Power 5 Power 5 Series	2 Mbytes Proprietary Chip	1-30 Seconds Hardware	2 MIPS	[illegible]
Parallel Computers Parallel 300	2 Mbytes Motorola MC68000	2-3 Seconds Hardware And Software	[illegible] MIPS	[illegible]
Sequoia Systems Inc. [illegible]	N.A. Motorola MC68000	N.A. Hardware And Software	[illegible] MIPS	[illegible]
Stratus Computer Inc. FT-200	[illegible]	Subsecond Hardware	1 MIPS	[illegible]
Synapse Computer Corp. [illegible]	[illegible] Motorola MC68000	2-5 Minutes Hardware And Software	1.5 MIPS	[illegible]
Tandem Computers Inc. TXP	4 Mbytes Proprietary Chip	2-4 Seconds Hardware And Software	1 MIPS	[illegible]
Tolerant Systems Inc. Eternity Series 300	2 Mbytes National Semiconductor 32032	1-4 Seconds Software	1.5-2 MIPS	[illegible]

All figures supplied by companies. Recovery times are application dependent.

*Recovery time is based on complete application level recovery and data base integrity.

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AT&T's 3B Fault Tolerance Fuses Hardware, Software

Continued from Page 24

the spectrum, but less militant than Stratus, is AT&T Technologies, formerly the Western Electric Co. subsidiary of AT&T. Paul Teetor, an engineer with AT&T Bell Laboratories in Naperville, Ill., said that while AT&T's 3B20D processor does offer hardware redundancy, "our strength is the fusion of hardware and software."

Teetor admitted that "hardware redundancy is the backbone of our system," but said it would not offer the benefits it does without use of a special version of the Unix operating system known as Unix Real Time Reliable or Unix RTR.

When AT&T announced commercial availability of the 3B20D last March, Teetor said, it said a typical system operating 24 hours a day, 365 days a year would only be down eight minutes a year. When the 3B20D was being designed, tested and used within AT&T's phone system, it was responsible for keeping the phone system's 800 numbers and AT&T credit-card verification services up and running.

Previously written Unix programs will run under Unix RTR on the 3B20D without modification, Teetor said, and they will be more reliable because they are running on a more reliable operating system or can be modified to take advantage of the system's special fault-tolerant features.

"Our whole goal is to lose the minimum amount of information during a failure," he said. As a result, the AT&T system, unlike Stratus, does not immediately have an automatic reboot feature. Instead, it first tries to restart the process, using a combination of hardware and software to prevent entry into infinite loops.

Hardware systems are criticized for the difficulty in expanding them, due to the need for hardware overhead to provide redundancy. By contrast, software systems are more readily expandable, since the amount of software needed does not grow as quickly as does system size.

Tandem, which relies on both software fault tolerance and CPU duplication, prefers to think of fault tolerance as "a feature, not a market," according to Jerry Held, Tandem's director of strategic planning.

Held also said that Tandem's self-view is not that of a fault-tolerant system provider, but rather a provider of systems for "on-line transaction processing," for which fault tolerance is but one requirement.

His company, founded in 1970, is the market leader, with more than 80 percent of the market.

Held said he prefers to look at a different spectrum, "not from hardware to software, but from availability to expandability." Most systems fall at one end or the other of this scale, he said, while Tandem is firmly placed in the middle, "offering the best combination of both."

Single-processor redundant systems such as Stratus and AT&T would be at the 100 percent-availability end of the scale, he suggested, while Synapse has stressed expandability over 100 percent uptime.

But, while saying that Tandem systems offer "a tremendous amount of hardware fault tolerance," Held was willing to say that "a number of our features are based in software." He said Tandem has examined the concept of redundant hardware, but concluded that "it is not optimum."

Hardware solutions, Held said, "only solve half the problem. We believe multiprocessor systems are the key to most customer problems." Such systems are easier to put together with software than with hardware, he said.

While the cost of hardware components is dropping, Held said, the number of components in a system is rising. "Hardware cost is not going to zero," he said. "Redundant systems tend to double hardware costs. In two systems, with equally mature technologies, the more cost-effective design will be software-oriented."

system or user code, which ... except under an array of unusual coincidences.

under an array of unusual coincidences.

In on-line systems, communications with local and remote terminals often create random sequences that could cause such "bunching" of unusual events.

All these (and other) problems significantly detract from the completeness of the FT story as told by the current practitioners.

Thus, it is not surprising that when the prospective customer is faced with choosing between a "kludgey" solution transaction system in the banking and brokerage industries, despite the many severe limitations inherent in the product; NCR Corp., Dayton, Ohio, is now offering its "Cluster" hardware and Instant Ready software; and the recent VMS Version 4 from Digital Equipment Corp., Maynard, Mass., implements several high-availability fea-

IBM environments—Auragen Systems Corp. Fort Lee, N.J., Sequoia Systems Inc., Marlboro, Mass., Tolerant Systems Inc., San Jose, Calif.—are providing Unix compatibility. These companies are hoping that the growing acceptance of Unix as a standard will allow them easier entry.

One of the more interesting recent de-

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Leading Competitors In The Fault Tolerant Market

Company Name And Model No.	Base Memory And Processor Chip	Recovery Time And Method (Hardware) (Software)	Performance In MIPS (Approx.)	Price
AT&T Information Systems, 3B20D	5 Mbytes; Proprietary Chip	Subsecond; Hardware And Software	1 MIPS	$340,000
August Systems Inc. CP-300	512K bytes; Intel Corp. 8086	N.A. Hardware And Software	N.A.	$150,000
Auragen Systems Corp. System 4000	4 Mbytes; Motorola MC68000	1-8 Seconds; Software	1.5 MIPS	$138,000
Computer Consoles Inc. Power 5, Power 6 Series	2 Mbytes; Proprietary Chip	1-10 Seconds; Hardware	2 MIPS	$187,000
Parallel Computers, Parallel 300	2 Mbytes; Motorola MC68000	2-9 Seconds; Hardware And Software	7 MIPS	$74,900
Sequoia Systems Inc. N.A.	N.A. Motorola MC68000	N.A. Hardware And Software	2.5 MIPS	$250,000
Stratus Computer Inc. FT-200	2 Mbytes; Motorola MC68000	Subsecond; Hardware	1 MIPS	$148,000
Synapse Computer Corp. N+1-6	6 Mbytes; [illegible]	3-5 Minutes*; Hardware And Software	1.5 MIPS	$346,000
Tandem Computer Inc. TXP	[illegible]	2-4 Seconds; Hardware And Software	4 MIPS	$298,000
Tolerant Systems Inc. Eternity Series 5000	2 Mbytes; National Semiconductor 32032	1-4 Seconds; Software	1.5-2 MIPS	$145,000

All figures supplied by companies. Recovery times are application dependent.

*Recovery time is based on complete application level recovery and data base integrity.

AT&T's 3B Fault Fuses Hardware,

Continued from Page 24

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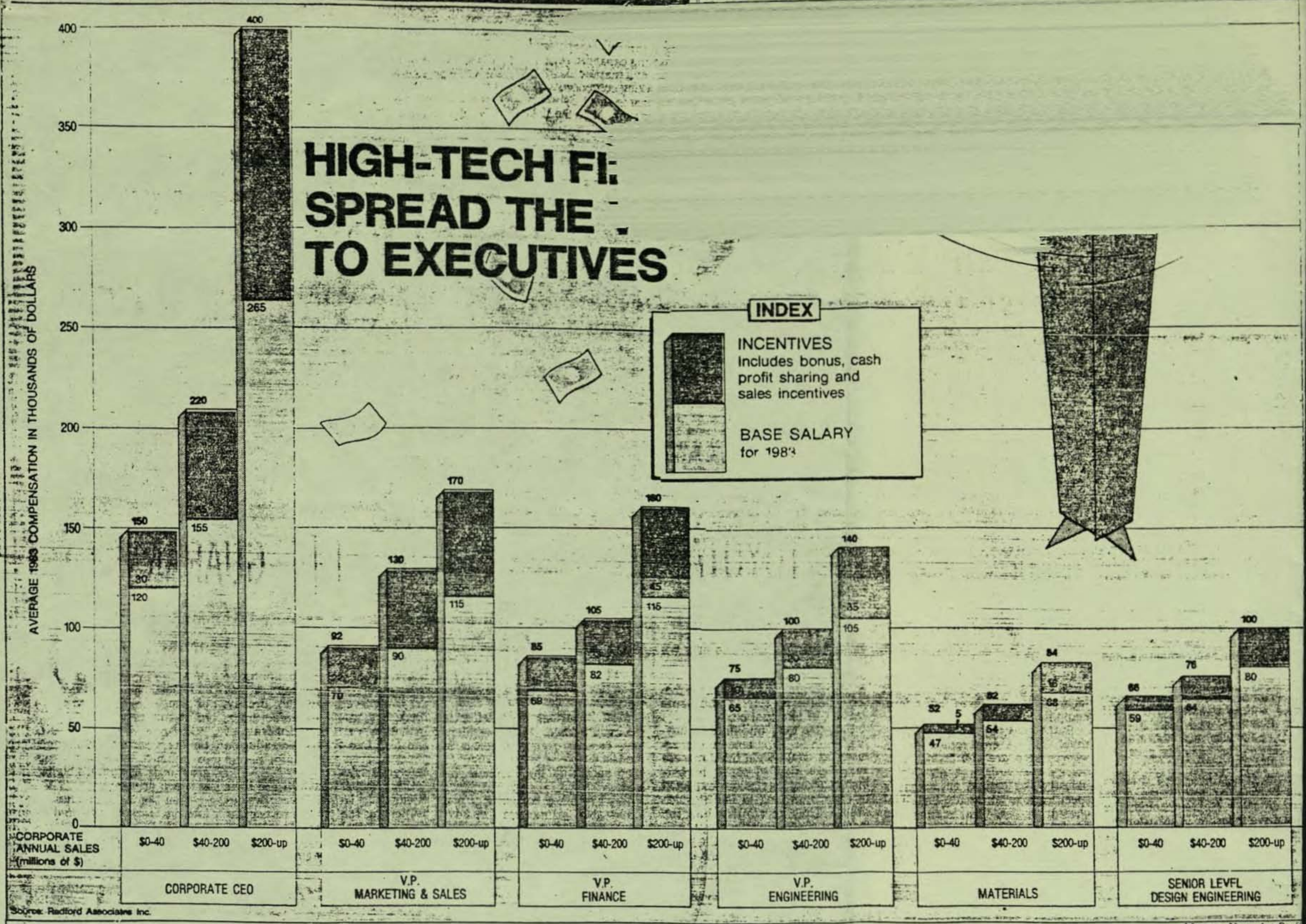
HIGH-TECH FI SPREAD THE TO EXECUTIVES



Source: Radford Associates Inc.

Mercury News Art Staff

By Dedra Hauser
Business Writer

WHEN David Anderson left IBM in 1981 to join a start-up, his goal was financial independence in five to seven years

The start-up was eventually scrubbed, but Anderson's ambition wasn't. So early this year, he went to work for Trilogy Ltd. of Cupertino as a vice president of computer development.

That's two strikes for Anderson. Trilogy abandoned its original plans to develop a new supercomputer and super-chip. As a result, the value of Anderson's Trilogy stock options has dwindled.

And yet hope springs eternal. Anderson is still at Trilogy. But the 50-year-old is considering a job offer at a start-up that would require him to take a 30 percent pay cut. This is the first time he would accept a pay cut to join a company.

Because so many of Silicon Valley's managers and executives share Anderson's penchant for financial risk taking, established high-tech companies have gone to great lengths to develop compensation practices that attract and retain this kind of manager. These companies don't always succeed, because it's tough to compete against start-up companies offering low-priced stock.

But that doesn't stop them from trying. The keen competition for good managers has fostered a pay-for-performance philosophy that pervades most Silicon Valley companies. High-tech firms have designed salary, bonus and stock packages to motivate and reward individual achievement and to allow managers to share corporate profits.

At times during the late 1970s and early 1980s, the competition for scarce management talent sparked compensation wars that drove pay scales through the roof and pushed job turnover rates to a crisis level. As a result, companies have begun to shy away from engaging in bidding contests to attract or retain managers, experts say.

"Companies have stopped acting like they're bidding for O.J. Simpson all the time, although there's always the exception," says Michele Hughes, a partner in the San Francisco office of the executive search firm Ward Howell International Inc.

Besides, most senior executives can't be bought by money alone. "Guys making above $100,000 think altogether differently (than middle managers)," says John Velcamp, an executive search professional whose Santa Clara firm bears his name.

Continued on Page 4D

Spreading high-tech wealth

Continued from Page 1D

"They're thinking long term and they have their reputation and prestige to think of, so $10,000 one way or another won't make a difference. They're much more interested in a growth experience."

Nonetheless, high-tech companies are developing salary, bonus and stock packages that enable good performers to earn substantially more than their peers at high-tech companies and their counterparts in other industries. At Hewlett-Packard Co. of Palo Alto, for example, salaries paid to different managers who have the same job title can vary by as much as 35 percent based on contribution to the company, says Charlie Marshall, manager of management compensation at H-P.

Companies in most industries tie the compensation of their top executives to some measure of company and individual performance. What distinguishes high-tech companies is that they extend this compensation approach to managers at all levels of the company.

Many also have programs to reward employees who aren't managers but are deemed key individual contributors to the company. One of the more unusual awards was one given by Monolithic Memories Inc. of Santa Clara a few years ago. Monolithic gave a Porsche to an engineer to recognize his role in a crucial project at the semiconductor company.

Handing out Porsches is rare, but incentive and bonus programs for individual contributors are growing in popularity among high-tech companies, says Michael Spratt, the San Jose general manager of Hay Management Consultants.

In keeping with their entrepreneurial spirit, high-tech companies also tie a bigger chunk of managers' income to the achievement of company objectives than in most other industries.

Excluding stock options, about a quarter of the income paid to high-tech managers is in the form of bonuses, compared with about 15 percent in other industries, says Jay Schuster, author of a book on high-tech management compensation and a principal in the human resources consulting firm of Sibson & Co. For many top executives, as much as half their compensation is based on company performance.

As a result, the income of high-tech managers, particularly those in top management, can be volatile. The total cash compensation of 260 high-tech companies surveyed by Radford Associates Inc. of Santa Clara showed that senior management pay only increased 3 percent in 1982 but jumped nearly 13 percent the following year. The swing was even greater for chief executive officers: Their pay increased 15 percent in 1983 after being cut 4 percent in 1982.

This means that managers have to carefully evaluate the business prospects of the companies they join, since their income is often closely tied to the fortunes of their employers.

In most cases, managers do best when their companies do well, but ailing companies sometimes have to pay substantially more than healthy companies to attract managers. David Caplan says he "made a lot of money" during the less than one year he spent as executive vice president and acting president at troubled Fortune Systems Corp. of Redwood City. "They were prepared to spend a lot of money (to attract me), and they did."

Caplan wouldn't disclose his total compensation at Fortune, but public documents show that he was paid $190,000 during his first six months at the company, he says. The pay at Fortune was a lot more than the compensation at his previous job with Perkin-Elmer Corp. of Norwalk, Conn., and more than he's earning at his current job as vice president and general manager of Convergent Technologies' data systems division in Sunnyvale, he says.

Because the high-tech industry is relatively young and volatile, there are few hard-and-fast rules that can be used to figure out where the best and worst-paying management jobs are.

A hot specialty one year may lose favor the following year. And companies guard information about their pay practices as closely as they protect their most prized trade secrets because they don't want their competitors to know what it would take to raid their management ranks. Companies only publicly disclose compensation data for the five best-paid executives, information required by the federal government.

Information from salary surveys shows the averages but masks the many special cases that distinguish Silicon Valley pay practices. And compensation surveys don't measure what executives receive from stock options, which can represent a substantial chunk of managers' incomes.

Radford's compensation survey shows that while bigger companies tend to pay more for the same job than small ones, there are many exceptions to this rule.

Mayfield Fund, a Menlo Park venture capital firm, surveyed compensation at its own portfolio companies and found "no common trends," says Mayfield partner Bill Unger. "Compensation at these companies is very personalized."

As in most industries, sales and marketing managers often have the greatest earnings potential because their pay is so closely tied to performance, says Don York, vice president at Radford.

Sales managers in computer firms, especially those that sell to end-users, have been earning more than their counterparts in other high-tech companies recently, he says. For example, a second-level sales manager at a large local computer company earned $600,000 in salary and bonuses last year, more than the company's chief executive officer.

Some companies, such as National Semiconductor Corp. of Santa Clara, are known for paying above-average salaries. "National pays very well, but you earn it," says executive search specialist Velcamp. Because National managers tend to work hard, their higher-than-average pay scale is often called "suffer money," he says.

Compensation experts and executive search professionals say managers at Amdahl Corp. of Sunnyvale, Fairchild Camera & Instrument Corp. of Mountain View and H-P often make less than their counterparts at other companies. Spokesmen for Fairchild and H-P said this is untrue, and Amdahl declined to comment.

But an executive search professional who requested anonymity says that many H-P managers look at more than cash when they measure their compensation. When you offer an H-P manager another job at a substantial pay increase, he says, "they'll add up their parking space, their major medical and their three doughnuts every morning at H-P."

The prevalence of stock options or outright stock grants as a major component of management compensation at high-tech companies makes it difficult to compare pay scales of different companies. Although potentially the most lucrative source of income for many managers, the value of options is subject to the performance of the company, the whims of the stock market and the investment decisions of individual managers.

Take the case of Harry Fekkes, who was ranked by Sales and Marketing Management Magazine this month as one of the 10 best-paid sales and marketing executives nationwide in 1983. Fekkes was senior vice president of sales and marketing at Verbatim Corp. of Sunnyvale last year but has since become vice president of sales and field organization for Inmac of Santa Clara.

It wasn't his 1983 cash compensation of $124,474 at Verbatim that earned Fekkes his top ranking. It was the stock options he converted into Verbatim stock when the stock was worth $352,526, giving him a large potential profit.

Options, which can be structured in a number of different ways, give holders the right to buy stock at a set price. Option holders make a profit if they sell the stock at a price higher than the "exercise" price at which they convert the options.

Employees can only convert options they're granted into stock over a period of time, often spread out over four years, and they have to remain with the company to convert them. As a result, options are called "golden handcuffs," since they motivate employees to stay with a company until the options can be exercised.

Fekkes didn't sell the stock when he exercised his options. Since then, the value of Verbatim's stock has dropped by more than two-thirds, which would make it unprofitable for him to sell it, he says.

"I'm a lot less enamored by stock options than I used to be, since they may not end up being worth very much," Fekkes says. "I'm much more motivated by a cash bonus program that is more directly tied to my own performance."

Because the sex appeal of high-tech stock has diminished in many quarters, some Silicon Valley companies are turning to cash bonus and profit sharing programs, according to compensation experts. Public companies have found that cash bonuses are one way they can hope to compete against start-up companies, who typically offer stock but not much cash. Executive search specialist Velcamp says a local semiconductor company is introducing a cash bonus program that could result in bonus awards larger than a manager's salary.

Intel Corp. of Santa Clara has a stock option program that has been very lucrative for some of its executives. The company uses salary increases to reward individual performance. It also has developed a complex bonus formula that rewards managers for both divisional and corporate performance.

Intel distributed $8.5 million in bonuses early this year to 584 employees, primarily managers but also employees considered to be key contributors. The size of each employee's bonus was based on his or her salary, and the awards were based on 1983 performance.

Intel announces a target bonus each year and sets objectives for the corporation and each operation that have to be met to receive the bonus. "This year we also added a quality index that is another criterion for receiving the bonus," says Sandra Scarsella, manager of domestic compensation.

H-P, on the other hand, has a profit-sharing plan distributed to all employees but no management bonus plan.

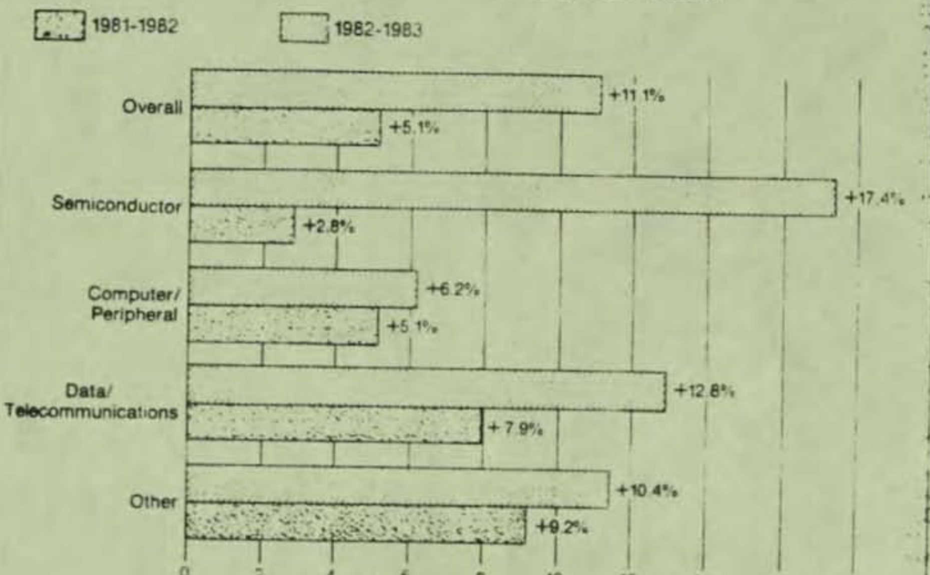
"When you have bonuses and incentives given to individuals or certain groups, it's hard to sustain the team spirit and the collaboration needed to get products out," says Marshall, manager of management compensation.

But whether companies use stock options, bonuses or profit sharing, the implication for managers is the same: To maximize their income, managers have to take the perspective of investors and pick a company that's going to be a winner. This is particularly important at younger companies whose performance and stock market price tends to be more volatile.

"A lot of companies in this valley do a better job at compensation planning than business planning," says Fekkes of Inmac. And when companies don't set realistic business goals, managers don't receive that portion of their pay tied to meeting those goals, he says. "You have to do your homework on what are real business opportunities and what are pie in the sky opportunities."

But money is just one of the factors Fekkes weighs in selecting a job. "I look for a job that will assist me in becoming a broader executive ... I want to grow to become a CEO (chief executive officer."

TRENDS IN TOTAL CASH COMPENSATION



SENIOR MANAGEMENT

	'82-'83	'81-'82
CEO	+15.0%	-4.0%
V.P. Operations	+12.4%	+8.3%
V.P. Mktg. & Sales	+19.7%	-2.0%

MIDDLE MANAGEMENT

	'82-'83	'81-'82
Controller	+7.3%	+7.3%
Materials	+10.4%	+4.0%
2nd Level Design Eng. Mgr.	+11.5%	+5.2%

Source: Radford Associates Inc.

Payday and the bottom line: How they compare

Firm	CEO	'83 Cash Compensation for CEO	Change from '82	'83 Profit (millions)	Change from '82
Advanced Micro Devices Inc.	W.J. Sanders III	$947,794	+64%	$21	+134%
Apple Computer Inc.	*John Sculley	$1,830,329	+297%	$76.7	+25%
Ask Computer Systems Inc.	Sandra L. Kurtzig	$178,740	NA	$3.9	+67%
Convergent Technologies	Allen H. Michels	$165,256	-15%	$14.9	+25%
Dysan Corp.	*William L. Harry	$189,906	-20%	$48.9	+443%
Hewlett-Packard Co.	John A. Young	$729,193	+22%	$432	+13%
Intel Corp.	Gordon E. Moore	$493,262	+73%	$116.1	+286%
Monolithic Memories Inc.	Irwin Federman	$226,923	+51%	$10.2	263%
National Semiconductor Corp.	Charles Sporck	$219,291	+14%	$14.2**	$10.7 mln**
Raychem Corp.	Paul M. Cook	$300,000	+25%	$30.5	-18%
Rolm Corp.	M. Kenneth Oshman	$419,620	+25%	$35.5	+19%
Tandem Computers Inc.	James G. Treybig	$178,269	-6%	$30.8	+3%
Varian Associates Inc.	Thomas D. Sege	$548,601	+20%	$44.9	+69%

*Firm had different president in 1982
**Loss

SMALL
COMPUTER
SYSTEMS

File: Companies
C-906-235.1
Date: August 29, 1984

Title: Price and Product Moves to Maintain Growth at Tandem

Summary: Tandem showed revenue gains below the industry average and even less impressive income gains in F3Q84. New pricing on NonStop is in effect, and new products are expected in 1984 and 1985.

Six months ago Tandem indicated that many of its problems were behind it and it was ready for a return to 35 percent growth. But during F3Q84 Tandem reported a healthy, yet nevertheless disappointing revenue increase of 28.8 percent over F3Q83 and a 12.3 percent increase in net income to a level which still lags that of the first quarter.

Again, sales cycle longer than expected

Tandem once again stated that its new focus on sales of high-end systems to major accounts has resulted in a lengthening of the sales cycle beyond its initial expectations. Therefore, business that was expected to close in the third quarter did not. This explanation was also offered at the end of the second quarter and, at this point, it is too early to tell whether this business will eventually be closed or whether the competition at the high end (most notably from IBM) is proving to be more formidable than Tandem originally expected.

Personnel turnover

Also being blamed for the revenue shortfall is a higher-than-expected turnover rate among the sales force. This statement has merit considering the fact that the nucleus of Tandem's U.K. sales operation did defect during the quarter, with most of the personnel going to competitor Stratus Computer causing the U.K. operation to fall short of its quota. This could continue to be a problem for Tandem with some of the newer fault-tolerant start-ups actively recruiting salespeople.

New pricing and products expected

We suspect that some of these newer start-ups, and particularly Stratus, are beginning to eat into Tandem's low-end business. The new TXP product has been relatively successful. But one consequence of this relative success at the low end is that NonStop 1+ and NonStop II have looked comparatively poor in price/performance -- thus hurting the low-end order rates. As a result, on August 20, Tandem announced significant price cuts on its low-end models, and put in a program of price credits towards TXP purchases.

A NonStop 1+ packaged system has been cut by 12 percent (to $89,000) and is further affected by new end user quantity discount schedules which lower list price

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by up to 38 percent. A larger packaged system (four processors instead of two) is priced at $105,000, a 32 percent reduction over prior prices. NonStop II packages are also reduced by up to 24 percent. Memory prices have been cut by 32 percent -- down from $22,000 to $15,000 for a 2-Mbyte board. This price action is, in effect, recognition that the high-end market alone is not all that easy to stimulate or penetrate, and that low-end coverage is also essential. Until the newer low-end products are available, competitive current prices are important. The inevitable consequence, however, is lower gross margins and continued pressure on earning.

We expect announcement of a new low-end product in 1984. This new product, referred to as "Checkmate," would be in the $100,000 range and essentially replace the NonStop 1+ product. Reports indicate that Checkmate would have a significant portion of the operating system implemented in firmware to improve performance and would have a TXP processor in the same cabinet.

In mid-1985, Tandem plans to introduce a second low-end processor that could be in the $50,000 range. This processor, an under-the-desk version, would be the first 32-bit implementation for Tandem, a hurdle that had to be taken sooner or later in order to remain competitive. This product would then serve as basis for eventual replacement of the TXP processor line. The change is expected to be relatively transparent for the user, although certainly not for Tandem. The transition from 16-bit to 32-bit is never easy, especially with the heavy machine-dependent software that Tandem has developed for its initial products.

At this point Tandem appears to have lost its momentum and status as a high-growth player in the technology field. We would expect Tandem to show a 30 percent growth rate in F1985, but see little chance of increasing that rate over the long term. New products, pricing and marketing programs, all effective, will be necessary just to maintain this level of growth.

TANDEM Five-Year Projections
($ in Millions)

	F83A	F84E	% Change	F85E	% Change	Possible 5-Year CGR	F88E
Revenues ($)	418.3	530.5	26.8%	693.0	30.6%	30%	1553.1
Pretax Margins (%)	12.1	10.4		13.2			15.0
Tax Rate (%)	39.0	38.0		42.0			40.0
Net Income	31.0	35.1	13.2%	52.5	49.6%	35%	139.8

Fiscal Year Ends September

LEVEL 1 - 1 OF 4 STORIES

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Business Week

August 20, 1984

SECTION: CORPORATE SCOREBOARD; Pg. 81

Note: This table may be divided, and additional information on a particular entry may appear on more than one screen.

LENGTH: 1004 words

HEADLINE: SECOND QUARTER 1984

BODY:

COMPANY	SALES				PROFITS		
	2nd quarter 1984 $ mil.	Change from 1983 %	6 months 1984 $ mil.	Change from 1983 %	2nd quarter 1984 $ mil.	Change from 1983 %	6 months 1984 $ mil.
22 OFFICE EQUIPMENT, COMPUTERS							
AM International (5)	153.7	8	298.0	7	2.9	-16	4.3
Amdahl	196.8	9	371.4	5	4.9	-44	9.1
Apple Computer (3)	422.1	58	722.2	46	18.3	-24	27.4
Bell & Howell	176.4	4	342.1	5	7.7	5	12.7
Burroughs	** 1233.7	18	2333.1	14	57.3	35	100.3
Coleco Industries	166.6	32	352.7	15	5.1	-43	9.6
Computervision	133.6	42	255.3	39	10.9	36	21.6
Control Data	1256.3	10	2444.6	12	23.4	-40	55.1
Data General (3)	277.1	47	525.5	40	16.1	270	28.7
Datapoint (5)	155.0	14	295.8	9	8.0	413	16.5
Dataproducts (9)	121.5	51	248.0	54	8.8	198	19.4
Diebold	120.3	10	238.3	11	14.1	30	28.1
Hewlett-Packard (2)	1519.0	30	2797.0	26	141.0	29	236.0
Honeywell	1486.7	7	2879.0	6	74.3	27	113.9
Intergraph	98.8	80	177.5	77	16.5	152	26.8
International Business Machines	11199.0	17	20784.0	16	1623.0	21	2825.0
Mohawk Data Sciences (8)	97.4	2	204.0	10	-59.7	NM	-59.2
NCR	998.8	7	1860.2	9	76.2	11	121.7
Nashua	146.1	4	298.8	4	6.2	115	12.1
Pitney-Bowes	425.5	8	846.8	10	31.8	13	61.5
Prime Computer	161.4	32	307.0	27	12.8	101	23.0
ROLM (6)	196.1	44	371.6	42	11.8	22	22.0
Seagate Technology (6)	100.5	117	201.6	153	11.5	57	23.0
Sperry (9)	1187.1	6	2665.9	10	20.1	-7	101.5
Standard Register	** 102.8	15	204.1	16	5.8	21	11.4
Storage Technology	247.1	4	426.6	-7	-4.9	NM	-21.6
Tandem Computers							

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(3)	141.9	29	253.2	23	9.2	10	11.2
Tandon (3)	106.3	28	211.9	38	10.4	22	20.9
Telex (9)	** 97.1	37	191.6	31	10.8	33	20.8
Wang Laboratories (6)	713.8	51	1257.3	45	73.7	33	123.5
Xerox	2257.9	0	4394.7	1	95.5	-38	221.6
INDUSTRY COMPOSITE	25696.3	16	48759.9	15	2343.4	13	4228.0
ALL-INDUSTRY COMPOSITE	701.8	12	139.0	12	36.6	28	72.1

COMPANY	PROFITS	MARGINS				
	Change from 1983 %	2nd quarter 1984 %	2nd quarter 1983 %	Return on common equity 12 months ending 6-30	Price-earnings ratio 7-31	12 months' earnings per share
22 OFFICE EQUIPMENT, COMPUTERS						
AM International (5)	-25	1.9	2.5	NM	3	0.78
Amdahl	-34	2.5	4.9	10.2	12	0.85
Apple Computer (3)	-43	4.3	9.1	9.6	43	0.63
Bell & Howell	10	4.4	4.3	10.7	12	2.26
Burroughs	30	4.6	4.1	9.8	10	4.99
Coleco Industries	-62	3.1	7.2	-24.7	NM	-1.46
Computervision	37	8.1	8.5	17.9	25	1.44
Control Data	-24	1.9	3.4	7.9	7	3.73
Data General (3)	207	5.8	2.3	9.7	23	1.90
Datapoint (5)	392	5.1	1.1	7.4	15	1.28
Dataproducts (9)	171	7.2	3.6	15.3	11	1.53
Diebold	32	11.7	10.0	22.4	12	6.43
Hewlett-Packard (2)	22	9.3	9.3	15.0	20	1.84
Honeywell	41	5.0	4.2	11.3	9	5.68
Intergraph	144	16.7	11.9	27.9	27	1.76
International Business Machines	22	14.5	14.0	24.9	11	9.82
Mohawk Data Sciences (8)	NM	NM	3.0	-31.9	NM	-3.65
NCR	18	7.6	7.4	14.9	8	2.84
Nashua	139	4.2	2.0	13.0	8	3.18
Pitney-Bowes	20	7.5	7.2	21.6	9	3.26
Prime Computer	54	8.0	5.2	14.6	18	0.85
ROLM (6)	20	6.0	7.0	7.2	27	1.49
Seagate Technology (6)	117	11.4	15.7	27.4	9	0.95
Sperry (9)	30	1.7	1.9	7.1	10	3.77
Standard Register	19	5.6	5.4	16.4	10	3.35
Storage Technology	NM	NM	0.6	-7.1	NM	-1.00
Tandem Computers (3)	-25	6.5	7.7	8.9	21	0.72
Tandon (3)	28	9.8	10.3	13.7	13	0.63
Telex (9)	32	11.1	11.4	26.3	11	2.66
Wang Laboratories						

(6)	34	10.3	11.8	17.9	17	1.52
Xerox	-21	4.2	6.8	8.5	9	3.76
INDUSTRY COMPOSITE	16	9.1	9.3	17.7	15	4.43
ALL-INDUSTRY COMPOSITE	38	5.2	4.5	13.3	12	3.46

(1) Second quarter ending May 31. (2) Second quarter ending Apr. 30. (3) Third quarter and most recent six months ending June 30. (4) Third quarter and most recent six months ending May 31. (5) Third quarter and most recent six months ending Apr. 30. (6) Fourth quarter and most recent six months ending June 30. (7) Fourth quarter and most recent six months ending May 31. (8) Fourth quarter and most recent six months ending Apr. 30. (9) First quarter and most recent six months ending June 30. (10) First quarter and most recent six months ending May 31. (11) First quarter and most recent six months ending Apr. 30. * Sales include excise taxes. ** Sales include other income. *** Sales include excise taxes and other income. + Revenues from major subsidiaries not included in consolidated sales. ++ Net income includes tax-loss carryforward, reported as extraordinary item. Earnings per share are for latest 12 months, not necessarily for end of most recent fiscal year. They include all common stock equivalents but exclude extraordinary items. NA=not available. NM=not meaningful. DATA: STANDARD & POOR'S COMPUSTAT SERVICES INC.

GLOSSARY

Sales: Includes all sales and other operating revenues. For banks, includes all operating revenues.

Profits: Net income before extraordinary items. For banks, profits are net income after security gains or losses.

Margins: Net income from continuing operations before extraordinary items as percent of sales.

Return on common equity: Ratio of net income available for common stockholders (most recent 12 months) to latest available common equity, which includes common stock, capital surplus, and retained earnings.

Price-earnings ratio: Based on July 31 common stock price and corporate earnings before extraordinary items for most recent 12-month period.

Earnings per share: For most recent 12-month period. Includes all common-stock equivalents.

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August 21, 1984

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