

Interactive Computing

PRESS REVIEW

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The Whiz

Seymour Cray Shows Computer World How To Build Big Machines

His Super-Computers Lead
Industry in Speed, Cost,
But Market Is Minuscule

Waiting for 'Deep Thought'

By HARLAN S. BYRNE

Staff Reporter of THE WALL STREET JOURNAL

It could be a stark, modern sculpture from the Museum of Modern Art: a six-foot-high, circular structure of ominous black panels and shining steel supports and surrounded by upholstered benches.

But behind those black panels is hidden the dense circuitry that makes up the world's most powerful and most expensive computer, the \$8 million Cray 1, a machine that performs at the lightning speed of 100 million calculations a second. In the three years since it first went on the market, the Cray 1 super-computer has become the preeminent tool of scientific computing.

The 10 Cray 1s that have been delivered are making top-secret calculations at two U.S. weapons-research laboratories, providing complex calculations for petroleum and engineering companies at a Kansas City data-processing service and working on weather-forecasting problems for the European Centre for Medium Range Weather Forecasts in England. At the National Center for Atmospheric Research in Boulder, Colo., the 300 scientists who must bid for their Cray 1's time have admirably christened it with a sign hanging alongside that reads, "Deep Thought."

But this machine that exhibits such ver-

satility is not the product of International Business Machines Corp. or of any other leading computer company. It is basically the product of the mind of one man: Seymour Cray, an athletic, 53-year-old scientist-turned-entrepreneur who compares the designing of a computer with composing music.

Mr. Cray is something of an enigma in the computer industry. In 1972 he left his lucrative job as Control Data Corp.'s senior vice president and top designer to form Cray Research Inc., a company that makes computers for only a tiny fraction of the market. "Frankly, I get more satisfaction in designing computers that will help scientists look for the rational explanation of problems," he says.

Mr. Cray is clearly an individualist. His home, his research laboratory and the company's assembly plant are in Chippewa Falls, Wis., an isolated town of 15,000 people, about 100 miles east of the company's Minneapolis headquarters. He shuns social functions, club memberships and business suits, turns up for work around midday in slacks and sports shirt and works until late into the night.

He is a man who has a reputation as a recluse—he admits to the habit of ignoring telephone calls—but he delights in skiing and sailing. He is said to write off people who don't quickly live up to his standards, but at the same time he delegates critical design tasks to subordinates and then leaves them alone. And although some computer-industry people describe him as hard to get along with and uncommunicative he meets every month for an informal chat with his assembly-line workers.

Attracting Investors

But above all Mr. Cray has a magic name in the computer industry. So much so that when he formed his company he was



quickly able to raise \$8.6 million in working capital from the sale of stock and notes without a single computer order on the books. Among the investors was Control Data, his former employer.

When Cray Research went public in 1976, its offering of 600,000 shares quickly raised \$10 million. To protect themselves, the underwriters of the offering made the company take out a \$3.5 million life-insurance policy on Mr. Cray as chairman and chief executive. "I'm sure we've been selling a lot of people with faith in me as an individual," says Mr. Cray.

It would seem this faith has been well placed. As recently as 1976, Cray Research had a loss of \$1.6 million on revenues of less than \$1 million. By 1977, the company was showing a profit of \$2 million, and last year it earned \$3.6 million on revenues of \$17.2 million.

Mr. Cray says his company's success justifies his belief that there is a need for a large-capacity computer. The field has been largely barren over the past 20 years, partly because the highly complex technology has not proven very reliable but also because the super-computer's use is so specialized that industry estimates are that it probably accounts for less than 5% of the annual dollar volume from all computers. In fact, Cray Research officials estimate that their computer has perhaps fewer than 100 potential customers in the world.

IBM's Failure

The giants of the computing business, notably IBM, have preferred to stay with the other 95% of the market: the machines that handle payrolls and bank statements and that dispense airline tickets and stock-market information. IBM did introduce a super-computer about 15 years ago, but pulled it off the market after complaints about its reliability. Texas Instruments Inc. and Burroughs Corp. also have made super-computers in the past with only limited success. Today, the Cray 1's only competition is from Control Data's new Cyber 203, which re-

The Whiz: Seymour Cray Builds World's Most Powerful Computers

Continued From First Page

cently beat out the Cray 1 in bidding on an Air Force contract.

Exactly what a super-computer is and how it differs from the other machines that keep the wheels of business and government turning is not easily defined. One thing that separates the super-computer is its high speed and the amount of data that can be entered at one time. The Cray 1 has perhaps 20 to 100 times the capacity of general computers, and it is so fast that it takes only 50 billionths of a second for an element of data to enter or to leave its memory.

But a super-computer is not simply a very large computer because, unlike other machines whose purpose is to keep track of facts, its design is specifically aimed at problem-solving.

One way it can do this is through the simulation of an event, such as a spaceflight or a nuclear explosion. The computer is given a program based on "educated guesses" of what would be experienced in real life, and through this the machine can examine an experiment or a project in detail even before it is begun. As a result, prototypes can be made more advanced, a month of weather can be "seen" in the space of an hour and even biomedical experiments can be carried out with the computer simulating the human effects.

Thus the function of the super-computer is to solve new kinds of problems, particularly through the simulation of physical phenomena for weather forecasting, aircraft design, nuclear research and seismic analysis. Some nuclear scientists say that the ability to simulate nuclear explosions with computers was almost a precondition of the signing of the 1963 test-ban treaty. They believe that still greater computing power will be necessary to enforce a new comprehensive test-ban treaty with the Soviets.

But to do this means great speed to accommodate the enormous amount of data fed into the computer. The time it takes to solve a problem in a computer is greatly affected by the length of the wires connecting the circuitry: The shorter the wires, the greater the computer's speed. Mr. Cray shortened the length of the wires connecting the Cray 1's 3,400 printed circuit boards by making the frame of the computer circular, thus increasing the compactness of the circuitry. Because greater compactness means greater concentration of heat, the Cray 1 is cooled by a special under-the-floor refrigerant system.

The first Cray 1 was acquired by the Energy Department in March 1976, for nuclear-weapons research at the Los Alamos Scientific Laboratory in New Mexico. Since then, another has been bought by the Energy De-

partment for its Lawrence Livermore Laboratory in California.

One of the main purposes of the Cray 1 at the Livermore laboratory is to work on the countless complex problems involved in the development of nuclear fusion as an energy source. Basically, the hope is to contain the power of the hydrogen bomb within a reactor. One vital area of this research is to simulate the action of the incredibly hot hydrogen gas, or plasma, within the fusion reactor. So complicated has this become that it exhausted the capacity of the laboratory's other computers, says John Killeen, director of Livermore's fusion computer center.

With the Cray 1, the laboratory is able to simulate the behavior of plasma in three dimensions, he says. "Cray 1 is going to help us shorten the time we can reach our nuclear-fusion goals."

Also enthusiastic about the machine is Jean La Brousse, computer director at the European Centre for Medium Range Weather Forecasts in England. By mid-1980, the center expects to begin issuing detailed seven to 10-day forecasts that will be of critical importance to North Sea oil drillers and to European building contractors and farmers. "Without the Cray 1 we couldn't produce these forecasts," says Mr. La Brousse.

First Sale to Industry

Although publicly funded research projects are considered to be the major market for super-computers, Cray Research is beginning to get inquiries from industry. Last September, United Computing Systems of Kansas City, a data-processing service owned by United Telecommunications Inc., became the first company to buy a Cray 1. A second Cray 1 will be delivered later this year. G. J. Lorenz, president of United Computing, says that the company's petroleum and engineering customers "should get results four or five times faster than they have been getting them."

This year Cray Research will deliver seven computers, and Mr. Cray is aiming to step up to a rate of one a month within three years. But he insists that he will resist the temptation to expand into the market for general computers. He just doesn't want the company to get too big, he says. "We've gotten on a narrow track because I've chosen to concentrate our technical expertise in this one area."

Smallness and a concentration on the pure science of computers has always been Mr. Cray's aim. Until 1957 he was the key designer at Sperry Rand Corp.'s Univac di-

vision. Then, with a group of other Sperry Rand employees, he helped form Control Data. "At Univac I couldn't stand administrative work so I left," he says.

At Control Data he led the development of the Model 1604, one of the earliest transistorized computers. Then came the Model 6600, the first commercially successful super-computer and a mainstay of atomic-energy and other scientific research laboratories.

Control Data was so enamored with Mr. Cray that the company built him his own laboratory within walking distance of his home in Chippewa Falls. There his group developed the Model 7600, a super-computer that was introduced in 1969.

But, explains Mr. Cray, "Control Data got too big for me. When I left, I knew I would form a small company of my own." For a few years, Control Data was putting more emphasis on commercial customers and less on scientific machines. But now, with the Cyber 203, it is trying to catch up with Cray Research. But "we still think we're three years ahead," says John Rollwagen, president of Cray Research.

Although Mr. Cray has shunned administrative work in the past, now that he heads his own company he appears to be relishing it. "The more I'm getting involved in things I don't like, the more I seem to be enjoying them," he says. He even helps sell his computers by taking time to confer with customers about their needs. And although he would appear to have little interest in personal financial success, he holds about \$5.1 million in Cray Research stock, based on recent over-the-counter trading at \$27 a share.

His colleagues say that one of the reasons for his success in designing computers is his ability to concentrate for hours at a time on a design problem and to conceive the design of an entire computer in his mind before putting it on paper.

His main interest now as he sits in his Chippewa Falls laboratory scribbling away formulas and equations on pads of ruled paper is the development of the Cray 2, which would make a quantum leap in computing power to more than 500 million calculations a second.

Beyond the Cray 2, a yet faster computer is taking shape in Mr. Cray's mind. "I do tend to look forward in my thinking and I don't like to rest on my laurels," he says. How fast could such a computer be? Perhaps, he says, a trillion calculations a second.

That prospect is an intriguing one for scientists. Says Sidney Fernbach, a scientific administrator at Livermore, "There's no machine that Seymour Cray can conceive that would be too fast for us."

CHOOSING COMPUTERS

Ask Five Questions

Before you buy a small business system at a computer store, get satisfactory answers to these questions.

If you are thinking of buying a computer system for your business, you are most likely looking for a solution to a business problem. Unfortunately, many have been led to believe that the computer equipment—hardware—is the solution you need. This couldn't be further from the truth.

Computer hardware, although important, really plays only a small part in the solution—especially since much of the hardware currently on the market is at least adequate for your business data processing needs. For that reason, the questions we suggest deal with software—the programs that cause the hardware to perform business tasks, and with service, training and support, rather than with hardware.

Do you want to do your own programming?

Representatives who sell typical computer store computers claim you can write your own software programs to get the system to do what you want. Theoretically you can, but realistically you have to ask yourself how much your time is worth. Doing your own business software is analogous to buying an automobile in parts from Detroit and putting it together from a list of instructions. Software experts estimate that the average business package contains roughly 20,000 lines of code. Using the rule of thumb of two lines of code per hour to program, document, and test the software, you see the effort required is not at all trivial—even if you are an experienced programmer.

Writing business software from scratch can be a heart breaking task for an amateur. For example, after looking over available microcomputers Dr. Benjamin Edwards, a surgeon in Pacific Palisades, Calif. decided to get a computer for his medical records and billing. Convinced that he could save a lot of money by buying a microcomputer (with accompanying manual) and programming it for himself, Dr. Edwards decided to do his own programming. Finding himself frustrated with trying to do it on his own with the manual as his only guide, he decided to take one of our seminars in BASIC programming (eight 3-hour sessions). While our classes helped him with programming concepts and BASIC, they could not alleviate the time burdens of his job—that of

being a prominent surgeon in Los Angeles. Currently, over a year after he bought his microcomputer, Dr. Edwards still doesn't have the solution he was looking for when he purchased his computer, and that end is not even in sight.

Computer system suppliers oriented to business needs provide complete systems including software that is tested and documented. Some also offer programming classes to teach you to program. However, we believe that the knowledge acquired in these classes can be put to best use if you use it to make minor custom modifications to business packages that you purchase or to write smaller programs, such as those to calculate the return on a particular investment or to monitor actual costs against budget for a particular project.

That was the approach taken by Audrey Roche, an accountant in Marian Del Ray, Calif. Ms. Roche was providing several clients with her bookkeeping services; she believed that with a computer she would have time to service a larger number of clients. Realizing she didn't have sufficient time to develop her own programs, she purchased a computer with packaged general ledger software from COMPAL. Ms. Roche knows some computer programming and uses that knowledge (with some help from a computer consultant) to make minor custom enhancements to the general ledger software. By the beginning of 1979, Ms. Roche was handling about 30 clients. She is very happy with the system and the flexibility of being able to customize it to her specific needs.

If the system breaks down in the middle of a working day, will you be able to get it serviced locally on a timely basis?

There are currently no service networks set up for the computers sold in most computer stores, although the particular store you are dealing with may have established its own service arrangements. In many cases, customers have to ship the system back to a central repair facility in Texas or Northern California. This is hardly the type of arrangement that a business person needs when the business is dependent on the computer system.

One of our customers is the Los Angeles law firm of Shulenberg and Warren. They are in the business of creating and negotiating "volatile"

Ira Kalb COMPAL

entertainment contracts. One of our wordprocessing systems aids them in assembling contracts from "boiler plate" stored on a diskette. Because of the nature of their business, they have become very dependent on the wordprocessor, and if they have an equipment failure that is not repaired within a day, they can suffer a substantial business loss. Recently we had occasion to go to their site to service a Diablo printer unit that had developed a bad printed circuit board. The day they called happened to be a difficult one for us and our technician was unable to get out to their site for four hours (we like to respond within two.) He had diagnosed the problem over the phone and brought a new printed circuit board with him to make the repair on site in a few minutes. Even so, the attorneys were angry that we had not responded quicker.

Computer suppliers oriented to business needs recognize that a company's system must be up and running virtually all the time. In addition to providing systems that are reliable, such suppliers are committed to a high level of service on the systems that they sell. For example, at COMPAL, we service all of our systems out of our own local showrooms and our systems are modular, so we can usually diagnose a problem over the phone, respond to a service call within an hour or two, and carry a replacement component with us so our customer is not down very long. In addition, if a customer needs to get a document or a report out in an emergency, we allow the customer to use one of the computer systems in the nearest local showroom.

Will one phone call initiate service, or will you have to call several different numbers to get all the hardware and software serviced on a timely basis?

If you buy different components of a system from different sources, or if you buy the hardware from a computer store of a manufacturer and do the software on your own, you will most likely be the victim of a finger-pointing exercise when something goes wrong with the system. Hardware faults will be blamed on software; printer faults blamed on the central processing unit etc. For this reason, we recommend that whatever you do, you should buy the complete system from one source of supply. And before you buy the system, you should make sure that the supplier is 100% committed to standing behind the system.

Many distributors of microcomputer equipment offer a "hodgepodge" of hardware and software, and do not have personnel on site that are dedicated to servicing and supporting all of the different product offerings. They may sell central processing units from one manufacturer, memory from another, disc units from a third manufacturer, terminals from a fourth, and printers from still another source. When something goes wrong with the system, the business that uses the computer has to get on the phone and try to find service for all the pieces of equipment they suspect

are not operating properly.

Will you and your employees who are going to use the system be adequately trained to use it; is the training facility located nearby?

In the microcomputer industry, most suppliers provide a system and a manual and then leave the customers entirely to their own resources. Often the manual is poorly written, and even if it isn't, an operator usually needs to be able to ask a knowledgeable instructor questions in order to adequately learn the system.

Computer system suppliers who believe training is an essential component often include places in a training class in the purchase price of every system they sell, and that can be an important service to businesses that buy computer systems. For example, American Home Mortgage is very active in real estate and mortgage brokerage in one of the nation's fastest growing communities—Irvine, CA. Consequently, when they purchased a word processing system from us, they were very anxious to get their secretaries trained on the system. They sent three of their secretaries to our word processing training class. After one three hour training session and some individual practice, these women became fluent with the system. Within one week they were doing complex documents. Since the company needed some work done even before the equipment was delivered, we let the secretaries use classroom machines in off-hours to do that work. Later when they hired added word processing operators, American couldn't "waste time" training them, so they sent the new people to another of our regularly scheduled classes.

If you have any questions about the computer hardware, software, or anything regarding the computer system, can you get answers to these questions on a timely basis from knowledgeable professionals with a single phone call?

When John Gilbert, an accountant with the firm of Gelfand, Breslauer et. al. in Beverly Hills, Calif. saw our word processing system, he liked it immediately, but one of the secretaries of the firm was frightened at the prospect of operating a computer-based system. John asked us if we would spend extra time with her if she needed it. As it turned out she did. After the regular three hour training session, this secretary came to our Beverly Hills showroom, about two miles away from her office, and spent a couple of hours with our customer service person, Margie Sorter. After this session the secretary felt much more comfortable after a few more phone conversations and some hands-on experience, she was in love with the system.

Most computer stores and manufacturers' dealers are not set up to offer this type of support to first-time business users. This level of support requires a dedicated staff of professionals. Computer suppliers oriented to business needs have full-time support professionals on their staff, dedicated to answering customers questions. ■