Cray Supercomputer Axed, Superstar Departs

With competition on the increase, the MP project looked too risky and too expensive

On 2 September, in an effort to focus its resources in the face of steadily increasing competition, Cray Research, Incorporated, of Minneapolis announced that it was canceling its most ambitious supercomputer development project: a machine that would harness 64 processors in parallel and that would function hundreds of times faster than anything now available.

At the same time Cray announced the resignation of project manager Steve Chen, the chief architect of Cray's best-selling X-MP line and one of the company's two superstar designers—the other being founder Seymour Cray himself. The 43-year-old, Taiwanese-born Chen will leave the company to try to develop the technology on his own.

The demise of the MP, or "multiple processor," project sent a noticeable shock wave through the supercomputer user community. Cray has dominated the field since 1976, when Seymour Cray introduced his landmark Cray 1. (Top-end machines are still informally rated as having so many "Crays" of processing power.) The company currently has two-thirds of the world supercomputer market. Decisions made in Minneapolis thus have major implications for the future of supercomputers in general.

"The way I look at it, computers are at the leading edge of high technology, supercomputers are at the leading edge of computers, and Cray is at the leading edge of supercomputers," says John W. D. Connolly, director of the National Science Foundation's Office of Advanced Scientific Computing. "So it's disappointing to see them give this project up. This was their long-term project, their machine for the 1990s."

The immediate reasons for the decision were partly financial and partly philosophical. Cray spokesmen insist that the company is *not* giving up its commitment to advance the technology in supercomputers. Quite the opposite. A team working under executive vice president Lester T. Davis is currently putting the finishing touches on a machine known as the Y-MP, which will have as many as eight processors operating in parallel. It will replace the four-processor X-MP next year and will be about three times faster. Meanwhile, Seymour Cray is working on the Cray 3, which will replace the Cray 2 that he introduced in 1985. Like its predecessor, the Cray 3 will be optimized for applications such as fluid dynamics that require very rapid access to very large memories. It will also be the first computer to use high-speed gallium arsenide chips.

However, from all reports Chen's MP project was ambitious even by Cray's standards. Although the details are proprietary, the MP design apparently called for a new generation of microelectronic devices using ultrafast optical connections, a technology that is still in the laboratory stage. Chen and his team accordingly found themselves putting more and more effort into fundamental research—and in the process, moving farther and farther away from the company's basic design philosophy.

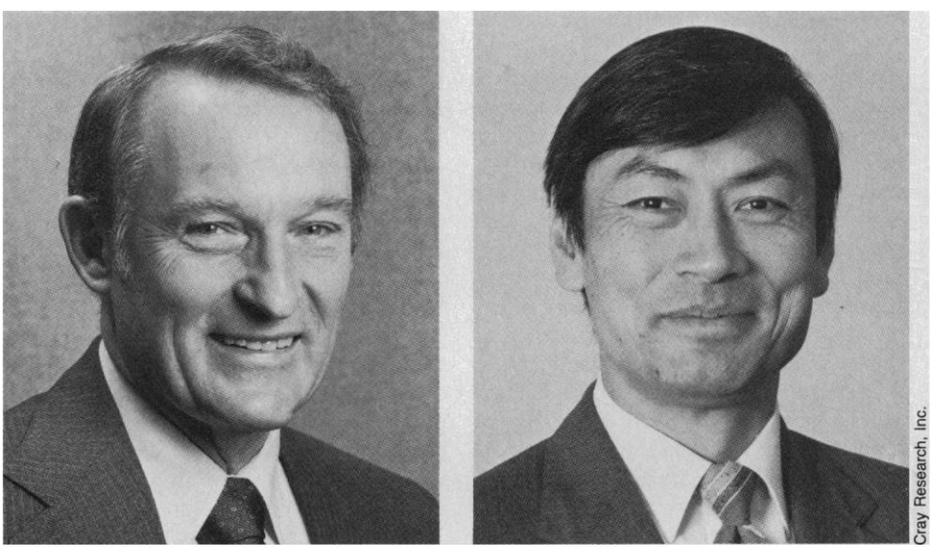
"We at Cray have always tried to develop things in an evolutionary manner," says Marcelo Gumucio, the company's vice president of marketing. By no coincidence this has always been the approach taken by Seymour Cray himself: use proven technology, repackage it in clever ways, and pay fanatic attention to simplicity, reliability, low cost, and ease of maintenance.

"But what Steve wanted to do was to design a supercomputer in a revolutionary way," says Gumucio. "We went along, understanding that this project was different. But when it came up for review, we determined that it was just too aggressive." The 2-year-old MP project had originally been scheduled for completion in the early 1990s and had been budgeted for a total of $50 million. By 2 September the project staff had grown to 180, the schedule had slipped drastically, the cost estimate had doubled—$17 million spent in this year alone—and there was no guarantee that the new technology would even work.

"We asked Steve if he would be willing to tone down the objectives and settle for a somewhat less ambitious machine," says Gumucio. "But he felt that his approach was the right way to go. So he decided to leave."

What happens to the MP technology now is an open question. Chen did not return *Science*'s telephone calls. However, he reportedly is planning to seek venture capital to develop the MP on his own. Company officials have said that Chen is free to continue his work on the MP technology, and even to start his own company, so long as he does not join a competitor. If he does, he loses his rights to the technology.

Outside the company, feelings about the decision are mixed. On the one hand, the departure of Chen is clearly a blow to Cray, just as the cancellation of the MP is potentially a loss for the supercomputer community as a whole. "From a national perspective maybe we ought to support Chen in his technology," says Gordon Bell, chief designer of the Digital Research Corporation's VAX minicomputer and now head of the computer and information science directorate at the National Science Foundation. "I



Cray Research, Inc.

Seymour Cray (left) and Steve Chen. *Cray's departing superstar may start his own company; meanwhile, the company's founder is thinking about a successor to the Cray 3.*

hope the venture capital community will step in and do that."

On the other hand, there is a general recognition that the cancellation was probably the right move for Cray in a strategic sense. "The MP would have been a third line for Cray, and you have to ask if the company could really deal with it," says Larry Smarr, director of the National Science Foundation's Supercomputer Center at the University of Illinois. "Here you have a company that's going to turn over all its products within 2 years, in the middle of a very fast growth phase. They're going to switch from the X-MP to the Y-MP, and from the '2 to the '3—both with totally new architectures—*and* they're switching from the Cray operating system to one based on Unix. So from a business and fiscal point of view they have to focus their resources on the transition. Everything rides on it."

Indeed it does. The supercomputer business is booming right now: in the past year Cray's revenues have risen 57%, to $597 million. And yet that inevitably means that others are entering the marketplace. Long supreme in the field, Cray is now having to adapt itself to an increasingly tough competitive environment.

On the domestic front, for example, IBM has recently entered the supercomputer arena with its 3090 vector multiprocessor; in its most advanced form the new system will offer as many as six parallel processors, and will accelerate IBM's existing 3090 machines by a factor of 30 to 40. "Since so much of corporate America is IBM-based, this would be the path of least resistance [for the customers]," says Smarr. Indeed, the corporate market has become increasingly important in recent years as supercomputers are applied to such problems as automobile design, aircraft design, and geological modeling for oil exploration.

Also on the domestic front is ETA, a newly created subsidiary of Control Data Corporation of Minneapolis. The ETA machine is not yet on the market, but Smarr and Connolly both rate it as a contender.

In Japan, meanwhile, Fujitsu, Hitachi, and the Nippon Electric Company (NEC) are giving Cray a strong run for its money in the European market, where Cray has approximately one-third of its sales. (To date the Japanese companies have only installed one computer in the United States.) NEC in particular makes a single-processor machine that is two to three times faster than any processor Cray has. It is true that NEC has not yet made a multiprocessor machine, which is where Cray retains the advantage. But that could change at any time.

"So now it's a six-way race," says Connolly. "And if Chen gets in, it will be a seven-way race. The industry is becoming almost like the personal computer industry. Maybe there will be a shakeout."

Maybe so. Adding even more to the imponderables is what Smarr calls "a creative burst of invention in parallel machines"—the commercial emergence of exotic architectures such as the hypercube, the Connection Machine, the Butterfly, and a variety of others, all containing hundreds or even thousands of individual processors. For applications such as image processing, where the problem breaks up naturally into many independent pieces, these highly parallel architectures can already offer supercomputer performance at minicomputer prices. Add to that the increasing popularity of more conventional machines known as "near supercomputers," and one arrives at a situation where, as Smarr points out, "it's not even clear what a supercomputer is anymore."

At Cray, marketing director Gumucio says he is well aware of what the environment is like: "We plan our future on the assumption that there will be heavy competition," he says, "but we are confident we will still be the leader." Even as Cray continues to push forward on the Y-MP and Cray 3 machines for example, it is moving to strengthen its hand in software, never a strong suit. "We're entering new industries all the time," says Gumucio, "and as you move into the commercial arena, software becomes more and more important." Thus, on the day of the MP cancellation the company also announced a new vice president for software: Robert H. Ewald, former head of the computer center at the Los Alamos National Laboratory and a major player in setting up the National Science Foundation's system of supercomputer centers. "An extremely strong move," says Smarr, who has worked with Ewald for many years.

However, none of that answers the question of where Cray—or for that matter, any other manufacturer—will go for the next generation of supercomputers. On the other hand, it may be too early to tell. The Cray 3 and the Y-MP will carry the company through about 1993. Moreover, Seymour Cray has already begun to plan a successor to the Cray 3, and the company may even use some of the MP technology in a follow-on to the Y-MP. But as Smarr points out, "if you look at how rapidly the global marketplace is changing, the uncertainty means that it's totally impossible to talk about what will happen in 1993." ■

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SSC, Fusion Machine Hit a Roadblock

The Senate Appropriations Committee is refusing to fund early construction activities for the Superconducting Super Collider (SSC) and the Compact Ignition Tokamak (CIT). Language accompanying the energy and water appropriation bill for fiscal year 1988 indicates that the committee is concerned that pressure to cut the federal deficit will impair the government's ability to fund some major new nuclear and high-energy physics experiments in future years.

The committee provided $35 million in research funds for the SSC to "keep the design team together and support other nonsite activities for 1 more year. . . ." But it explicitly denied DOE's request to spend $10 million on construction-related activities for the 40-trillion-electron-volt particle accelerator. The House Appropriations Committee not only refused to support construction, but held SSC program spending to its 1987 level of $25 million.

The House and Senate committees want the Reagan Administration to propose a funding plan for the SSC before construction proceeds. The Senate committee directed DOE to explore collaboration and project construction opportunities with potential international participants. DOE also is instructed to hire independent financial firms to identify the SSC's potential economic benefits and to lay out a plan for how states competing for the project might help finance it.

As for the magnetic confinement fusion program's CIT, the Senate Committee says the hydrogen plasma ignition machine "should be delayed. . . . Starting this project implies a commitment to provide additional funds in subsequent years which the committee is unable to make at this time."

The Senate language is at odds with the House Appropriations Committee's action. It allocated $13 million for engineering and construction of the CIT and another $6 million for related research and design activities. Construction of the $350-million machine still could proceed if legislators compromise in the House-Senate conference.

John F. Clarke, associate director of the Office of Fusion Energy, says the CIT is necessary for fusion research to move forward. "If you want to have a productive program, we have got to have a small budget increase." Proceeding with the project now, he adds, could result in one or more foreign participants sharing part of the experiment's costs. ■ **MARK CRAWFORD**