Japan stubs its toes on fifth-generation computer

- One-year extension to save face
- US collaboration called a sham

Tokyo & Washington

JAPAN's once mighty fifth-generation computer project, which in the early 1980s sent Western governments scurrying to set up competing computer initiatives, has fallen far short of its mark.

The 10-year project was due to finish at the end of this month, but it has lagged so embarrassingly behind schedule that the Japanese government has given the project an extra year to inch closer to its target.

Launched in 1982 by the Ministry of International Trade and Industry (MITI), the fifth-generation project set out to develop a massive 'user friendly' parallel computer with 1,000 processors. Its software was based on logic rather than on classic structured programming. The Japanese initiative raised fears that Japan was about to take over the world's advanced computer market and sparked many competing projects in the West, such as the UK's Alvey project.

But, after ten years and an investment of more than $400 million, all Japan has produced is a handful of parallel computers, the largest three of which have only a quarter of the target number of processors. And only a limited number of computer experts know how to operate them.

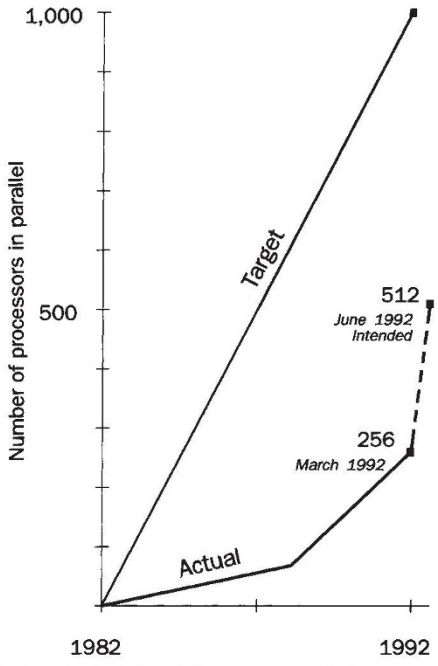
Despite its failings, the project is receiving an extra £3,600 million (nearly US$30 million) from MITI in fiscal year 1992, and project researchers are rushing to assemble a 512-processor machine in time for a final international conference on the project in June.

The fifth-generation computer project is a classic example of how the rigid Japanese bureaucracy can foil a national project. By the mid-1980s, it was clear that other approaches to parallel computing not based on traditional artificial intelligence techniques, such as neural networks or the massively parallel machines created by Thinking Machines Inc. of the United States, looked more promising. But having told the Ministry of Finance that it would build a 1,000-processor machine, MITI had no choice but to continue towards that goal. MITI officials fully realize their failings, however, and in their next 'sixth generation' computer project they intend to set more flexible goals (see next page).

One ray of hope for the fifth-generation computer came in 1990. Some of the researchers at the project's Institute of New Generation Computer Technology (ICOT) in Tokyo established a high-capacity computer link with the US Argonne National Laboratory to try and use one of the prototype fifth-generation computers in ICOT to solve biological problems associated with the human genome project (*Nature* **345**, 466; 1990).

But that collaboration went disastrously awry (see sidebar), and similar collaborations with the US National Institutes of Health (NIH) and the Lawrence Berkeley National Laboratory (LBL) are essentially moribund. US researchers found the fifth-generation computers to be slow, cryptic and filled with bugs. And the documentation that came with them was written with Kanji characters, which were never translated into English.

Short of the mark



As a result, the fifth generation machines in the United States are now "essentially doorstops" that are used mostly for electronic mail, says one researcher. At NIH, "we're not using their hardware or their software," says George Michaels, a NIH geneticist. US researchers say that the Japanese were more interested in showing the world that the machines were being used by NIH and US national laboratories than in any real collaborations. "The reason the machines came here was essentially PR," Michaels says.

(Continued on page 274)

Collaboration vetoed

IN January 1991, with the United States preparing for war in the Middle East and anti-Japanese sentiment running high, officials at the US Department of Energy (DOE) shut down one of the three US collaborations with the Japanese fifth-generation computer project in fear of a backlash from Congress.

The official reason was that the US team at DOE's Argonne National Laboratory had not obtained proper approval before visiting Japanese laboratories and accepting two computers from them. But, in fact, they acted after reading an article about the collaboration in *Supercomputing Review*. Being seen as sharing technology with such a fierce rival, DOE officials told scientists, could cause problems for the agency when it came time to defend its budget before Congress.

In October, the principal US collaborator in the project, Ross Overbeek, resigned in protest after a long war of memoranda. Overbeek declined to discuss the case, but others say that he objected to the DOE claim that the collaboration might lead to "inappropriate technology transfer to the Japanese."

In fact, no technology was transferred — but not because the Argonne team had refused to do so. The Japanese themselves had shown little interest in the software the Argonne researchers had developed.

Ironically, the collaboration had effectively ended before the controversy began. Similar collaborations at the National Institutes of Health (NIH) and the Lawrence Berkeley National Laboratory were not affected by the DOE decision, mostly because the officials who ran those programmes were less concerned about the politics of Japanese collaboration.

First announced in June 1990, the Argonne collaboration was intended to develop software collaboratively that could use the logic-based techniques of the fifth generation computer project to analyse genome data (see *Nature* 345, 467; 1990). But like other US-Japanese collaborations in the project (see adjacent story), it quickly ran into technical problems.

"On the surface, it looked like Washington put pressure on the collaboration to stop," says Rick Stevens, director of Argonne's mathematics and computer science division. "But from our standpoint, it wasn't going anywhere, anyway."

Indeed, DOE officials say, that lack of progress was part of their concern. Collaboration should be "symmetrical", says David Nelson, DOE's director of scientific computing. "Just because someone gives you a free machine," he says, "doesn't make it a collaboration."

Outside observers have another perspective. "It was an amazing overreaction" in a time of political tension, says George Michaels, a NIH genetics researcher. C.A.

(Continued from page 273)

But the project has nevertheless left a legacy in the US genetics community, researchers say. Genetic manipulation software being developed both at NIH and at LBL uses many of the same logic programming techniques as the original fifth-generation software, if none of its actual components. And the project led US genetics researchers to talk among themselves about new computer techniques, says Cassandra Smith, who heads the LBL team. Those collaborations, at least, are still bearing fruit.

ICOT has also tried to link up with biologists at Kyoto University. As in the case of Argonne and NIH, the institute donated personal sequential inference machines to the university that could, in theory, be linked to the mother computer in Tokyo. But because ICOT is not a university and is not part of MITI, its scientists have not been able to establish a computer link.

Nevertheless, MITI officials see the genome project as one possible way to keep at least a part of the fifth-generation project alive after the end of the current fiscal year. And the biochemical industry division of the ministry will soon form a committee to coordinate this and other genome-related research activities supported by MITI (*Nature* **356**, 181; 1992).

However, companies which have been participating in the fifth-generation project have no interest in seeing it continue. They are tired of having some of their best researchers tied up in the project, particularly now that industrial research budgets are being cut. ICOT has 90 researchers, nearly all of them drawn from industry, and another 200 researchers are working for the project at their companies.

Some young ICOT researchers are very keen for the project to continue so that they can develop and test out software on it. But ICOT's director, Kazuhiro Fuchi, thinks it will be very difficult for the project to continue beyond March 1993.

David Swinbanks & Christopher Anderson

DEFENCE RESEARCH

Classification Catch-22

Washington

US DEFENCE officials have accused an outspoken critic of the Patriot missile and the "Star Wars" missile defence system of publishing secrets. But they are unable to prosecute him because he will not allow them to tell him what those secrets are.

The critic, Theodore Postol, a Massachusetts Institute of Technology (MIT) physicist, says that he used only unclassified data in his calculations for an article that claims that the Patriot missile was "an almost total failure" in the Gulf War. But if he lets defence officials identify what they believe is classified information in the article, he says, it will become by definition secret and he will not be allowed to talk about it, even if it was based on unclassified data.

This Catch-22 may have put Postol in the public eye for the moment as the latest in a list of researchers who have run aground in this still uncharted corner of the classification rules. The problem is a concept known as 'compilation'. Simply put, when nominally unclassified data is assembled in such a way that the end result is more secret than the sum of its parts, it can become too secret to publish.

In 1979, *The Progressive* magazine got into trouble with an article that described how to build a hydrogen bomb. Culled from unclassified interviews with nuclear scientists and publicly available information, the article triggered a lengthy legal battle before it was finally allowed to be published.

A few years later, Bruce Blair, an analyst at the Brookings Institute in Washington, DC, found that he had crossed the line in compiling an unclassified report about the electromagnetic pulses that follow nuclear explosions. Even Blair himself was not allowed to keep a copy of this suddenly secret report. Since then, even Stansfield Turner, a retired admiral and former director of the Central Intelligence Agency, ran afoul of officials who sought to remove details from his 1985 book, *Secrecy and Democracy*. They told him that, while the information was not secret, it had been compiled with the help of classified knowledge.

In Postol's case, there are actually two issues. The first is whether there is, indeed, anything secret about his article, which appeared earlier this year in *International Security*. He says no, and he has invited defence officials to check his claim by examining all 100 unclassified references. Postol says that he obtained other figures in the article by doing simple calculations based on publicly available information; to determine the top speed of a Patriot missile, for example, he did a mass distribution calculation based on an unclassified photograph.

But the other issue is trickier. Before coming to MIT, Postol held a top-level classified position with the Navy, where he evaluated advanced weapons. Since then, he has retained his security clearance and recently sat in on two classified talks on issues relating to the Patriot. He says neither of the talks provided him with any information for the article.

He has offered to show the classification officials where and how he obtained each figure in his article. But he says they do not want to bother, and they have told him not to discuss the article until the issue is resolved. Last week, he told the Government Operations Committee of the US House of Representatives that such abuses of the classification system censor free speech and "pose one of the most serious and overriding threats to democracy and its institutions".

Postol's case rests with Congress and the Defense Department. But critics of the current classification system say there are many similar cases in which reports and papers based on unclassified disappear after they are deemed too sensitive. "It's an all-too common extension of an already aggressive classification policy," says Steven Aftergood, a security expert with the Federation of American Scientists.

Turner calls it "a way of improperly classifying material". Avoiding a 'secret' stamp on sensitive articles is not easy, he says, especially if a researcher has a security clearance. "You have to establish that an ordinary person without special skills couldn't have done [the work]" it says. "While there's no law that says you need to prove your innocence, that in fact is what you have to do."

One solution to the problem is to avoid issues that embarrass the government. Failing that, says Roy Woodruff of the Los Alamos National Laboratory, "use good research judgement and dig in your heels when they complain."

Christopher Anderson

Talking about a new generation

JAPAN's Ministry of International Trade and Industry (MITI) is determined to avoid some of the pitfalls of the fifth-generation computer project (see previous page) as it begins a follow-up computer project of comparable scale and duration.

Rather than setting its sights on one specific type of hardware and software, the ministry is planning a multi-pronged approach that will include development of neural network and optical computing systems as well as a general-purpose massively parallel computer. In another departure from the earlier project, MITI plans to farm out much of the work to companies, national research laboratories and universities both within and outside Japan.

MITI also seems determined to erase any connections with the preceding fifth-generation project. MITI has named it 'four-dimensional' (*yojigen*) computer for home consumption and the 'real-world computing program' in English.

Once again, however, MITI is setting itself a very ambitious and specific target. Its ten-year goal is to build a computer with one million processors, some thousand times the goal of the fifth-generation project. **D.S.**