U.S. challenges Japan in planned 'new-generation' computers

Japan startled the international computing community in October 1981 when it announced plans to develop a "fifth generation" of computers — truly intelligent, reasoning machines that would represent a "quantum leap" over existing technology. This coming generation of computers would be the first to depart from information and data processing and move toward an "intelligent" processing of knowledge based on logic, not arithmetic. Though most of America's computing leaders initially responded passively, things are changing. Already three major U.S. research ventures are coalescing to counter the perceived threat: namely that Japan will, if left unchallenged in this area, attain international computing supremacy.

Traditionally, computer eras have been marked by the technology central to each. Generation one relied on vacuum tubes, generation two on transistors, three on integrated circuits, and four on the microscale circuitry characterized as very-large-scale integration (VLSI). The last, still on the horizon, will likely dominate computing in the 1980s.

At the heart of these first four generations is the von Neumann machine — named for the mathematician who pioneered the concept of a logic framework for stored-program computers and for programming concepts (SN: 3/13/82, p. 172). The fifth generation threatens to dump the von Neumann approach of serially processing each step in a multi-step computation. Not only do those contemplating fifth-generation devices expect to gain speed and power through parallel processing, but also by developing new "memories" for knowledge, new languages for programming (based on logic instead of arithmetic) and new hardware-oriented techniques for handling non-numeric symbols.

In their book, *The Fifth Generation* (Addison-Wesley, 1983), Edward Feigenbaum, a Stanford University pioneer in artificial intelligence, and Pamela McCorduck, a computer historian, explain what all the fuss is about: the Japanese "aim to produce machines easy enough to use, and intelligent and fast enough in their responses, to come close to the kinds of transactions intelligent human beings are used to having with each other."

Microelectronics and Computer Technology Corp. (SN: 10/16/82, p. 247) was the first U.S. consortium formed to develop American fifth-generation technology. Plans Japan has outlined for its fifth-generation project "amount to a kind of *Mein Kampf* in electronics terms — a clear-cut statement of intentions that U.S. companies can only ignore at their peril," explains MCC's William Shaffer.

Evidently the Department of Defense shares that view. It just announced Lynn Conway, an expert in custom design of VLSI chips at Xerox's Palo Alto Research Center in California will join the agency's Defense Advanced Research Projects Agency (DARPA) in August. Said DARPA director Robert Cooper, the new "supercomputer" program Conway will head expects "to develop computers capable of symbolic reasoning with effective computational speeds 1,000 times greater than those used in military systems today."

Advanced cruise missiles and unmanned undersea vehicles — to become operational in the early 1990s — "will require almost human-like capabilities to sense, reason, plan and navigate," Cooper says. And the computers that drive these weapons must, he says, "be able to draw on human experience and expertise stored in massive memories called knowledge bases [to] interpret current sensor and situational information much as a human does." DARPA expects to spend $50 million in the coming fiscal year, $95 million in FY '85, on this "new generation" of computers — figures similar to those MCC envisions spending.

Finally, Los Alamos and Lawrence Livermore national laboratories will be teaming up with Menlo Park, Calif.-based SRI International to give Japan a run for its money in the fourth-generation arena. Their aim: development a network of supercomputers, 1,000 times faster than anything yet available. —*J. Raloff*

Acid-rain report blames man-made pollution

Man-made air pollution is probably the main contributor to acid rain in northeastern North America, says a Reagan administration task force report issued last week. The report cautions, however, that current data and methods are insufficient to predict whether cutting power plant emissions would significantly reduce acid rain levels.

The report, prepared by the Interagency Task Force on Acid Precipitation, summarizes results from the first year of a 10-year, congressionally mandated, national acid rain research program. According to Chris Bernabo, task force executive director, these studies will form the technical basis for policy decisions.

Bernabo noted that rain acidity levels have remained relatively constant for the past 10 years at the few locations with reliable, long-term monitoring. The region of high acidity in eastern North America has shifted slightly southward so that it now extends into Tennessee and North Carolina. The report concedes that acid deposition is probably the reason that a few northeastern lakes, especially in the Adirondacks in upstate New York (SN: 5/21/83, p. 332), have been acidified with consequent changes in aquatic life.

The effects of acid rain on crops, forests, wetlands, soils, building materials and drinking water are still undetermined, the report states. Experiments with simulated acid rain have shown both positive and negative effects on crops such as soybeans and potatoes. Although mountainside spruce trees in New England are dying, whether the cause is acid deposition, drought or disease is not known. One study, mentioned in the report, shows that acid rain does not make pine seedlings more susceptible to insects or disease. Some seedlings, in fact, show increased resistance to disease.

The report contains no recommendations for government action because, Bernabo said, "We cannot write a prescription that will solve the acid rain problem." There are several different ways of reducing sulfur dioxide and other pollutant emissions, for example. "We can't say yet which would be better," he said. Nevertheless, neither the U.S. Congress nor the administration needs to wait until all the mandated studies are done, he added. "We can increase the certainties, but we will never get rid of all the uncertainties," Bernabo said. "At some point, policy makers have to take a leap of faith."

A week earlier, at the American Association for the Advancement of Science annual meeting, zoologist Harold H. Harvey of the University of Toronto highlighted another difficulty. "I make a plea that we identify what it is that we need to know, because this is one of those problems that can be researched forever," he said. "We need very clear direction...at the political level to tell those of us gathering the scientific information what kinds of evidence will constitute an adequate case for the demonstration of acid rain effects."

At the same meeting, John Roberts, Canada's environment minister, said, "Our belief is that more scientific work is necessary, more scientific work is useful, but the fact is that we know enough now to begin to act now."

There are signs that the administration is changing its position that too little is known to take immediate action. William D. Ruckelshaus, Environmental Protection Agency administrator, is reviewing administration policy. One possible plan involves initially imposing modest reductions in Midwest power plant and factory emissions with tougher standards being put into effect as data improve.

One important source of data will be a tracer experiment slated for this summer. Inert gas samples will be released from Dayton, Ohio, and Sudbury, Ontario, to trace the exchange of air across the border between Canada and the United States.

— *I. Peterson*