

"the defensive avionics could be overwhelmed in a high-threat environment." The flaw, moreover, lies in the basic "architecture" of the system; it cannot be fixed by software modifications alone.

The Air Force is now looking at ways to improve the ECM system, including a reduction in the number of radar bands that it processes. This "might . . . salvage the capability of the current defensive avionics against the most important air defense threats while keeping the system from being overloaded in a high-threat environment," the CBO report says, but the system may never achieve the level of performance called for in the original specifications.

Another serious problem, which would prevent the aircraft from conducting very deep penetrations now, is that it can fly only about 1300 miles when it is fully loaded and hugging the ground to evade detection. A round trip from a safe distance outside Soviet defenses to Moscow and back is about 2000 miles. CBO notes that the Air Force is pursuing two fixes that will permit the plane to carry more fuel. The first, which has been fully tested, will add about 500 miles to the range. The second, which "is based on preliminary engineering evaluations and could change substantially," could add 1700 miles. If the fixes work, the B-1 fleet should be retrofitted by June 1990.

The Air Force has taken the position that these problems, although serious, would not prevent the bomber from carrying out its assigned missions. Its other attributes, including the ability to fly fast and low, a small radar cross section, and high maneuverability, would get it through existing Soviet defenses, the Air Force says.

However, the Soviet Union is beefing up its defenses, and the CBO says that, in addition to fixing the current problems with the B-1, the Air Force may propose a package of enhancements designed to counter these developments. In most weapons systems, such enhancements are almost routine, but in the politically charged atmosphere surrounding the B-1, they are far from it. Aspin has already announced that "we have to decide first whether it is worth it to fix the B-1's problems."

If Congress decides not to provide funds to fix the problems or enhance the B-1's penetration capabilities, a possible option would be to convert it to a standoff bomber. The CBO explored this option at the request of the Armed Services Committee. It noted that some money would be saved by forgoing the proposed enhancements, but offered no recommendations.

For now, however, Aspin is simply warning that the next fiscal year "is the make-or-break year" for the B-1. ■ COLIN NORMAN

Technology and the Schools

Two million computers have been installed in U.S. schools in the past decade, and virtually every school in the country now has at least one, according to a new study by the congressional Office of Technology Assessment (OTA).^{*} Yet, in spite of this impressive record, the information revolution that has transformed some sectors of American industry and commerce has barely begun to change precollege education, OTA notes.

The study is quick to acknowledge that technology is not the sole remedy for what ails American education. Nevertheless, the report points to many examples where well-funded, sustained support of new education technologies in individual schools has led to improvements in students' achievement. But, with less than one computer for every 30 students in the average school, and access limited to under 1 hour per week for each student, the technology is far from becoming a standard classroom feature, the report notes.

"What we have seen after 10 years is the evidence of a great opportunity," says Michael Feuer, one of the authors of the OTA report. But the opportunity is being limited by a variety of barriers at every level, including shortage of funds, lack of support systems for teachers, a bewildering array of software of generally poor quality, and "erratic and disorganized" federal policy for research on education technology, the report concludes.

At the current rate of investment, "the Nation can expect a continued broad base of experimentation in some schools, steady but slow improvement in software, and spotty access to the technology by children." Stepped-up investment is needed.

Although OTA offers no recommendations on the desired level of computerization in the schools, it calculates that about \$4 billion a year would be required to provide a computer for every three children. This compares with an estimated expenditure of about \$200 million a year on computer hardware over the past decade.

More computers, of course, would not by themselves improve precollege education. OTA points to the critical need to provide more support and training for teachers. It points out that only about one-third of the nation's teachers have had even 10 hours of computer instruction, and that less than one-third of recent education school graduates consider themselves prepared to teach with computers.

As for software, there are an estimated 10,000 products on the market, OTA notes, but quality generally leaves much to be desired. Publishers tend to "play it safe" and offer only what they believe teachers will buy, and state programs for reviewing and evaluating software could be greatly improved, the report says. The federal government could also play a role here by underwriting more software R&D.

A "clear message" to emerge from the study, says Linda Roberts, who directed the effort, is that "effective use of these tools is a national issue, and we need national leadership." Some of the report's strongest criticism, however, is directed toward the federal R&D efforts. The federal government currently spends about \$240 million a year on educational R&D, but more than \$200 million of the total is accounted for by the Department of Defense; only about \$30 million in federal funds is spent on R&D aimed at developing technologies for precollege education, OTA estimates.

The report notes that the National Science Foundation's budget for all science education activities took a nosedive in the early 1980s and has only recently begun to recover. The first new grants were not made until 1985, and the results are only now beginning to percolate through the system.

The Department of Education, in contrast, emphasized technology in the early 1980s but later neglected it. Former Education Secretary Terrell Bell launched a new "Technology Initiative" in 1981 that resulted in a variety of computer projects and the establishment of a new Educational Technology Center with a budget of \$7.7 million over 5 years. When Bell left in 1984, however, "the new Secretary, William Bennett, did not share Bell's vision of improving education through technology. The climate in the Department, reflected partly in the declining number of new grants involving computers, shifted significantly," OTA reports. The department has, however, decided to support the Educational Technology Center for another 5 years—though with a reduced budget.

■ COLIN NORMAN

^{*}Power On! Office of Technology Assessment, September 1985.