The Heritage Foundation
Backgrounder
UPDATE
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Number
9/27/89 110

COMPUTER PROCESSING BREAKTHROUGH: A GAIN FOR SDI BATTLE MANAGEMENT

(Updating *Backgrounder* No. 557, "Technology Speeds the Strategic Defense Initiative Timetable," January 13, 1987.)

The Army Strategic Defense Command, based in Huntsville, Alabama, conducts research on Strategic Defense Initiative (SDI) projects. It announced in June that improvements in computer technology could make strategic defenses more effective. Increasing the capacity of computers to process sensor data could improve the highly important battle management function of the SDI system, which processes information received from sensors, such as observation satellites, and allows the battle management system to direct weapons accurately against target missiles. Speedy processing of information is important to SDI because it has no more than 30 minutes to intercept Soviet ballistic missiles and their subsequent stages before they reach their targets in the United States.

The main responsibility of SDI's battle management system is to sort out the electronic signals received from SDI sensors to distinguish between real missiles and the signals received from decoys and chaff. Discriminating among the flood of electronic signals that would be received by SDI sensors in order to detect a missile is similar to finding a needle in a haystack. The designers of SDI's battle management system therefore are faced with a dilemma. They can either design a system that will receive the greatest volume of information possible by using ultra-wideband radars (which cover a wide range of frequencies), thereby increasing the potential of the battle management system to provide the most information possible about a ballistic missile attack, or they can cut down on the amount of incoming surveillance information (by limiting the range of frequencies covered by the radar) so as not to flood the computer with more data than it can process.

Billions of Operations Per Second. The technology developed by the Army Strategic Defense Command will ease the dilemma facing the designers of SDI's battle management system by increasing the capacity of the computers to process huge volumes of data. This will allow the designers to use the ultra-wideband radars in SDI sensor systems because the larger capacity computers will able to process a larger volume of data in less time. According to the Army Strategic Defense Command, computers using this technology will be able to process hundreds of signals in one billionth of a second or perform billions to trillions of operations per second.

Comparing Radar Signals. The key to this technology is an electro-optic computer that uses laser light to process radar signals. The computer is able to compare radar signals that have been "spliced" onto individual laser beams. While the high-speed processing properties of this computer technology have been known for almost 40 years, the technology was considered impractical because of its sensitivity to such environmental disturbances as vibration and temperature changes. Conventional digital technology is not so sensitive. The high-speed technology now is more tolerant of such disturbances, thus making it more useful.

The computer works in the following manner. A single laser beam is split into two beams. The ultra-wideband radar's signal is transmitted onto the first beam using acousto-optic technology, which uses a crystal to refract laser light. The pattern of the signal that returns to the radar after bouncing off a detected object, such as a missile, is transmitted onto the other laser beam. The two beams are merged and the distinctive light pattern created by the merging of the two laser beams is focused on sensitive light detectors called charge-coupled-devices (CCDs). This enables an SDI battle management system to compare signal frequencies emitted by Soviet missiles or other objects in space. It would give SDI battle managers precise information about which specific objects detected by the radar are threatening objects that need to be destroyed, such as missiles, and which are not threatening objects, such as decoys or chaff.

Capable and Reliable. Progress with this computer technology is good news for SDI. It means that SDI's battle management system will be capable of processing larger volumes of signal data, thus making the entire battle management system more capable and reliable. A more capable and reliable SDI system will be better able to deter a nuclear attack on the U.S. and its allies.

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