grams, while appearing to maintain the status quo, are actually moving toward important new capabilities.

U.S. plans to build an ABM system in the late 1960's were defeated, ultimately, on two grounds. One was that the Army wanted to defend both U.S. cities and missile sites from ICBM attack, and this was viewed as increasing the incentive to try a first strike and therefore as destabilizing. Equally weighty was the argument of many prominent scientists who had consulted with the Defense Department that the system simply would not work. The contention that it was unworkable succeeded not only in defeating the proposed U.S. ABM system but in prompting the United States to move for, and both sides to agree to, a mutual ABM ban as part of the May 1972 Strategic Arms Limitation Talks (SALT) accords.

Since the treaty reduced some of the risk of nuclear war, it is often hailed as a major escalating step in the arms race that the leaders of both sides wisely opted not to take. Under the treaty, both U.S. and Soviet ABM activities were limited to R & D work: also tests of other systems "in an ABM mode" were prohibited.

But ABM technology has not stayed within the neat confines of the R & D clause to which it was relegated. Tantalizing new methods of intercepting an ICBM attack are emerging not only from the Army's truncated ABM program, the Ballistic Missile Defense (BMD) program, but from the Air Force's separate program to develop antisatellite technology (ASAT). This is not surprising since the two problems are the same: Can one bullet hit another bullet in the vast reaches of space? The problem has three requirements: a tracking system to find the tiny object in space, some software to identify it correctly, and an interceptor to destroy it.

In the late 1960's the Army proposed to solve the first part of the problem with huge radars spaced around the country. But they were criticized because the cross sections of distant objects then available were not refined enough to discriminate between the incoming warhead and broken missile fragments, chaff, and decoys that could also be reentering the atmosphere. Moreover, the radars themselves were inviting targets because of their huge size and importance to the entire ABM system.

But sensing technology has come a long way since 1968: the BMD program is looking into long-wave infrared sensors that might sense temperature differences between the warhead and accompanying debris and could serve as an adjunct to regular radar. At the Kwajalein test range in the Pacific, the BMD program is testing a laser radar, or ladar, which, according to the government's arms control impact statement, is "inherently more accurate, may be smaller in size and weight, and less susceptible to electronic countermeasures" than ordinary radar.

Another technique that is being sought for the ASAT program, which also has applications in basic astronomy, is adaptive optics. In this optical viewing system, a fixed mirror is replaced by either a mosaic of small mirrors or a single, deformable mirror. These are linked to a sensing system and computer, which constantly bends the mirror to correct for distortions in images produced by the atmosphere.

The self-correcting feature of adaptive optics also permits a system to correct for defects in the mirror itself—enabling cheaper mirrors to be used. The resolutions attainable by adaptive optics are said to be limited only by light diffraction.

In the late 1960's, Army ABM planners proposed that a single computer could mastermind the incoming radar data, decide which objects were warheads, and orchestrate the launch of a national system of interceptor missiles to counterattack. But critics charged that the computer would become a target itself and could become confused in the

Cattle Virus Escapes from a P4 Lab

An outbreak of foot-and-mouth disease was diagnosed on 15 September among cattle on Plum Island, site of the only laboratory in the United States allowed to handle the virus. The outbreak has so far been contained without its spreading to neighboring Long Island. A study is still in progress to ascertain how the virus escaped from the high-security laboratory which is rated a "P4" containment facility equivalent to the former biological warfare laboratories at Fort Detrick, Maryland.

Foot-and-mouth disease, a dreaded and highly infectious malady of cattle and pigs, is usually combated by wholesale slaughter of all ill and exposed animals. The United States has been free of the disease since 1929. Last month the symptoms of foot-and-mouth were noticed in steers at a holding pen outside the main laboratories on Plum Island, a Department of Agriculture site devoted to study of animal diseases exotic to the United States.

When the disease was confirmed the following day, authorities dusted off an old emergency plan designed for such an occasion but never before needed. All employees save a skeleton crew were asked to leave behind their clothing and were sent home, off the island, in decontaminated coveralls and sneakers. The 30 or so infected steers were killed and hauled inside the laboratory for safe disposal of the carcasses. All other animals outside were slaughtered. The animal premises and all roads and vehicles on the island were sprayed with lye, and the office and cafeteria floors were treated with acetic acid. Meanwhile on the mainland, the Animal and Plant Health Inspection Service verified that the herds from which the infected animals had been purchased were not the source of the disease and that people from Plum Island were keeping away from domestic animals.

When decontamination procedures on Plum Island are completed, sentinel animals will be installed. If no signs of the disease develop, the island could be back to normal operation by mid-November.

"We feel very pleased about it. We have contained the virus, there has been no spread, and we think our steps are well planned," says Plum Island researcher Charles Campbell. The designers of the laboratory specified that it should be built on an island. "We are rather thankful for that," says Campbell.

It is not yet known how the virus eluded the elaborate precautions and physical equipment designed to contain it. The laboratory building where it was being handled is kept under negative pressure so that no air will leave except through filters. Solids are incinerated and sewage decontaminated; workers shower and change clothes on leaving. The fact that only one pen of animals was infected suggests mechanical transmission of the virus rather than a direct airborne route from the laboratory. Construction activity on the island may be involved in some way; the outbreak is the first since the laboratory was founded in 1954.—N.W.

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