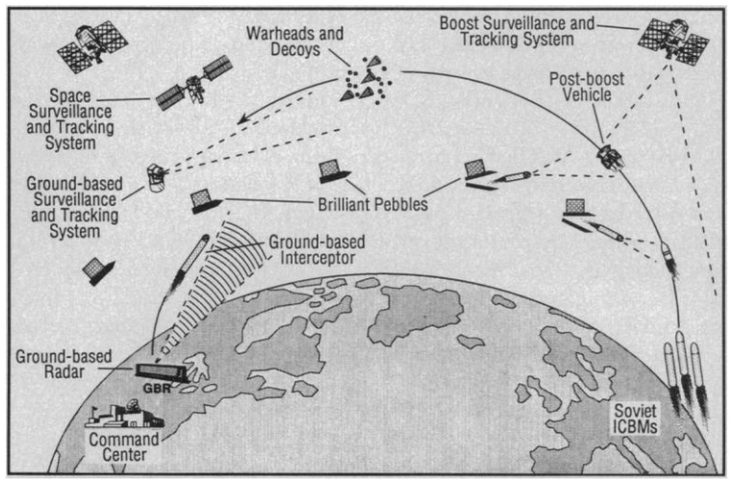
SDI Heads for Fiscal Crash

While the number of tests is going up, the budget is going down, and the rationale is changing

ON 26 JANUARY, a small missile streaked from its launch pad at White Sands Missile Range in New Mexico. The 9-second flight cost about $30 million. The payoff: the Pentagon knows more about the reliability of components of a system designed to provide a last-ditch defense against incoming Soviet warheads.

Less than 3 weeks later, two satellites were shot into space from Cape Canaveral on a $313-million mission. Over the next year they will be used to see if orbiting mirrors could focus laser beams from Earth onto hostile missiles or warheads in space.



The latest plan. *The Pentagon is currently focusing on this set of systems for deployment in the 1990s, and it is spending a growing share of its budget on them.*

Welcome to the world of the Strategic Defense Initiative. Before the year is out, there will be another 10 major SDI experiments—and 16 more are planned for 1991. That exceeds the past 6 years' tests. Though the Cold War has begun to thaw, "the program is sailing along as if nothing has changed," says John Pike, an SDI critic at the Federation of American Scientists. Pike's reason: Ronald Reagan "put it on automatic pilot."

A presidential directive, issued by Reagan in mid-1988, requires the program to provide sufficient technical information by late 1992 to enable the Administration to determine whether or not to deploy a strategic defense system in the late 1990s. President Bush has not changed these marching orders, and the SDI Organization—an entity inside the Pentagon—is pushing ahead with its expensive testing schedule, striving to supply the data before Bush's first term ends.

But this autopilot may be putting the program on a collision course with fiscal and political reality. Though Congress has appropriated $19.7 billion for SDI since President Reagan launched the program 7 years ago this week, it cut the budget for the first time last year. Total funding in fiscal year 1990 is $3.819 billion, down from $3.951 billion in 1989. Undaunted, the Administration has requested $4.663 billion in fiscal 1991. But Congress, looking for a peace dividend from the political changes in the Soviet Union and Eastern Europe, is likely to cut the budget again—below $3.5 billion say many observers.

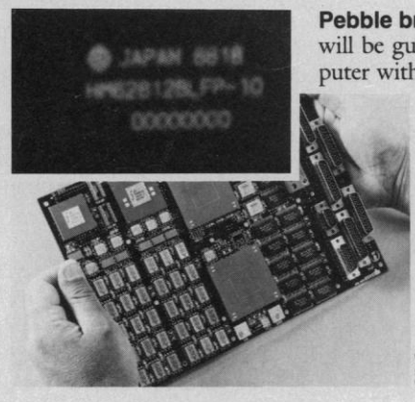
If the budget continues to shrink and the timetable for a deployment decision remains unchanged, program managers may be forced to put a much larger share of their resources into relatively mature near-term technologies, while cutting back heavily on longer term research. Last month, SDI Director General George Monahan told reporters that's exactly what he would have to do.

And that prospect worries many researchers, who believe valuable projects would be shortchanged. "I hope they [Administration officials] don't press too hard on early deployment, because I'm afraid . . . we'll be in worse shape than if there had been no SDI," says Princeton University physicist William Happer, a defense adviser, adding that "there was a pretty good ballistic missile defense research program before SDI came along."

For the moment, the Bush Administration is holding fast. During a visit to Lawrence Livermore National Laboratory last month, Bush said that "in the 1990s, strategic defense makes sense more than ever before," not only to blunt Soviet planning for a first strike, but to defend against unauthorized launches.

The kind of system that could be deployed in the 1990s would be designed to stop only a small fraction of the warheads the Soviet Union could launch. SDIO is currently focusing on a system whose centerpiece would be some 4000 orbiting rockets, called brilliant pebbles, that would attack Soviet missiles soon after launch. They would be backed up by ground-based rockets that would attempt to intercept warheads in mid-flight. The targets would be tracked by two sets of satellites, a ground-based radar, and a sensor that would be lofted

With a Little Help. . . .



Pebble brain. Each brilliant pebble will be guided by an onboard computer with roughly the capability of a Cray-1. This circuit board, which represents half of a pebble's brain, will fly on prototypes to be tested later this year; later versions are slated to shrink to one-tenth this size. It is not entirely a U.S. product: 15 key computer chips are clearly stamped "Japan."

SDIO

Army, Air Force Eye SDI Spinoffs

Satellite Killers

Shooting at satellites, with their slow and predictable trajectories, is not exactly duck hunting, but it is a lot easier than shooting down tiny nuclear warheads whizzing through space at hundreds of miles a second. So it has long been recognized that technologies developed by the Strategic Defense Initiative—originally proposed as a means to protect cities from those warheads—could be potent antisatellite (ASAT) weapons. What has not been widely recognized, however, is that the Pentagon is planning to spend hundreds of millions of dollars to convert SDI technologies into satellite killers.

The Defense Department launched a new ASAT effort just a year ago, and it is already one of the fastest growing items in the entire defense budget. It is aiming to develop a ground-based rocket that would shoot a small heat-seeking interceptor toward low-flying spacecraft. The new program, which is being managed by the Army, "will use existing or maturing Strategic Defense Initiative Organization KE [kinetic energy] weapon technologies," according to an announcement last month—apparently a spinoff of the Army's SDI system that is supposed to stop incoming warheads in mid-flight.

With its new ASAT, the Army steps into a void created 2 years ago when the Air Force dropped out of this field. The Air Force had developed a prototype interceptor, lofted it into space on a rocket fired from an F-15 fighter, and smashed up an old solar astronomy satellite in a 1985 test. But afterward, Congress banned further tests, in part because the Soviet Union had been observing a moratorium on testing its own ASAT system since 1982. So the Air Force program was quietly killed.

The Pentagon got the green light for the new program in March 1989 when the Defense Acquisition Board gave the go-ahead for preliminary studies. On 15 February, the Army invited contractors to submit proposals to design, build, and test a complete system. A total of $74 million is being spent on the effort this year, and the Army has requested a huge increase, to $208 million, for fiscal year 1991. According to last month's announcement, flight tests could begin as early as 1992, and eventually 65 to 70 weapons may be built.

The Defense Department is also eyeing laser technologies for ASAT weapons. In late 1988, then Defense Secretary Frank Carlucci directed that a 2.2-megawatt laser at White Sands Missile Range in New Mexico, which had been used for SDI experiments, be converted for use as an ASAT weapon. Known as MIRACL (for Mid-Infrared Advanced Chemical Laser), it has been fitted with new optics that will permit it to flash its beam into space. In testimony last week, Defense Department officials said they plan to test it next year against high-flying drones.

MIRACL would have only limited capabilities. Matthew Bunn of the private Arms Control Association likens it to a "long-distance toaster" that may be able to disable the solar panels of low-flying satellites but would pose no threat to most of the Soviet Union's spy satellites—especialy ocean reconnaissance satellites, which are nuclear-powered. But more exotic SDI directed energy weapons, such as the free-electron laser, are also under investigation as future ASAT systems.

So far, the new program has attracted little congressional attention, in part because testing is not imminent. But, with a $208-million budget, it's now far more visible. ■ C.N.

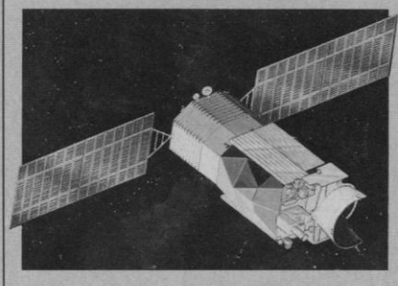
Eyes in the Sky

The first SDI system likely to be deployed is a set of satellites capable of detecting the launch of Soviet rockets and tracking them as they streak into space. The Defense Department is asking for $400 million next year to begin full-scale development, which would put them in a unique category as the only SDI components that are actually nearing reality. The Pentagon may, in fact, push to deploy the satellites no matter what happens to the SDI program.

Called the Boost Surveillance and Tracking System, or BSTS, the satellites would sit in near-geosynchronous orbit and peer down at Soviet missile fields with short-wavelength infrared sensors. Although their capability is classified, outside observers suggest that they would be able to tell which silos have been emptied and provide highly accurate tracking of large numbers of rocket plumes simultaneously.

The role BSTS would play in SDI has changed over the years. Under a plan developed a couple of years ago, they would provide warning of attack and hand over tracking information to a second set of satellites that would help direct space-based rockets toward the Soviet missiles. Now that SDI is banking on brilliant pebbles to home in on their targets without independent tracking data (see accompanying story), BSTS would serve mostly an early-warning function. The satellites may also provide some targeting information to brilliant pebbles that have not orbited into direct line-of-sight of Soviet missiles in the initial stages of an attack.

"If the country did not develop SDI it would still need a BSTS," argues O'Dean Judd, chief scientist at the SDI Organization. The reason: The precise information on missile launches would provide vital targeting data for a retaliatory strike—the United States would not waste its remaining warheads on empty silos. Indeed, the BSTS grew out of an Air Force program that was begun in 1979 for that reason.



Grumman Corp.

Early warning, early deployment.

The Air Force is therefore hoping eventually to replace its current generation of early-warning satellites with BSTS. But there is likely to be debate over whether the additional capability would be worth the cost just for early warning. Estimates released last month by the SDI Organization indicate that it would take $8 billion to build ten satellites and another $2 billion to launch them. Moreover, contracts have been signed with TRW for another ten in the current series of early-warning satellites—enough for another 15 years if the historical 18-month interval between launches is maintained.

So far, BSTS is "the one item we've maintained on schedule," says Judd. But one well-placed congressional source says there may be opposition in Congress this year to moving the program into full-scale development if it results in shortchanging research programs. And some SDI supporters, such as former SDIO official Lou Marquet, suggest that if the Air Force wants BSTS for early warning, it should help pay for the program. ■ C.N.

The Ups and Downs of Strategic Defense Weapons

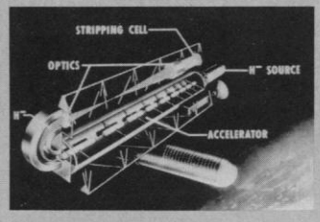
Directed Energy

The **x-ray laser**, the weapon that captured President Reagan's attention when he launched SDI, has fallen on hard times as researchers have been grappling with technical difficulties and funding cuts. Though never officially part of any SDI architecture, it has been a prominent symbol of the program.

Space-based **chemical lasers**, an early favorite, fell out of favor in the mid-1980s, largely because of their vulnerability to attack. They got a boost in 1987 when President Reagan announced plans for a space test around 1993 called Zenith Star that critics say would breach the traditional interpretation of the Anti-Ballistic Missile Treaty. Zenith Star has now been shoved back to 1998.

As chemical lasers faded, the ground-based **free electron laser** became the leading directed energy weapon. A giant test instrument is planned for White Sands, New Mexico, but recent budget cuts have scaled down and stretched out the program.

Now riding high is the **neutral particle beam**. Two years ago, the Pentagon considered closing the program down, but complaints from Congress and the Army, which runs the effort, won it a reprieve. A space test of a small reactor last year gave the program a boost, and it is scheduled for a healthy budget increase next year.



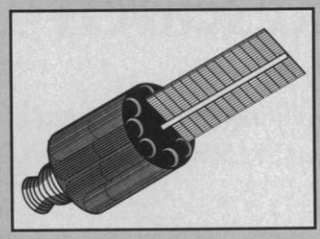
Up. *Particle beams.*

Kinetic Energy

Small interceptors that would smash into Soviet rockets or warheads are the only weapons being considered for the first stages of SDI.

Space-based interceptors, rockets that would be housed in orbiting "garages" from which they would fly out to attack Soviet boosters, were launched to prominence in 1987. They were the centerpiece of an SDI system then being considered as a candidate for early deployment. But they soon dropped out of favor because they would be too vulnerable and too expensive. They have now been supplanted by **brilliant pebbles**, cheaper free-flying interceptors with sufficient computer power aboard to attack targets independently.

Ground-based interceptors, which would be launched from U.S. soil and home in on heat radiated from incoming warheads before they enter Earth's atmosphere, have been a fixture in plans for early SDI systems. The first flight test of the interceptor is scheduled for this summer. The main hurdle: discriminating between warheads and decoys.



Down. *Space-based interceptors.*

The **high endoatmospheric defense interceptor**, a fast-acceleration rocket that would provide last-ditch defense by smashing into warheads after they enter the atmosphere, began a series of tests in January. It is not currently a candidate for early deployment. ■ **C.N.**

into space as soon as an attack is under way (see diagram on p. 1283). Two-thirds of the increase proposed for SDI next year would go into this constellation of technologies. More exotic technologies, such as lasers and particle beams would be added later, sometime in the 21st century.

It's a far cry from the leakproof defense Reagan envisioned when he launched SDI with his "Star Wars" speech on 23 March 1983. It is also quite different in some key respects from an initial defense system pursued by the SDI office as recently as 1988.

The earlier scheme would have placed about 3000 space-based interceptors on some 300 orbiting "garages." Guided by tracking data supplied by satellites, they would have attacked Soviet boosters within a few minutes of launch, when they were firing their engines. As in the latest scheme, ground-based interceptors would provide a second layer of defense. But this so-called Phase 1 system was estimated to cost up to $150 billion to build and deploy, a figure that set off alarms even in the Pentagon. So, in mid-1988, the scheme was overhauled. The number of space-based interceptors was cut by more than half; the number of ground-based interceptors increased by 70%. The result: the costs dropped to $69 billion, but the system was deemed vulnerable to attack—it hinged on relatively few low-flying satellites.

Enter brilliant pebbles. A team of scientists at Lawrence Livermore National Laboratory, headed by Lowell Wood and Edward Teller, had begun touting space-based defenses consisting of thousands of small rockets orbiting independently, each equipped with short-wavelength infrared seekers and a compact computer about as powerful as a Cray-1. Dubbed brilliant pebbles (a play on the "smart rocks" moniker that had been applied to the space-based interceptors), they would attack Soviet boosters on their own, without needing instructions from other satellites.

The SDIO bought it, and brilliant pebbles have supplanted space-based interceptors in the putative Phase 1 system. From virtually nothing in 1989, the budget to develop the technology has shot to $129 million this year and is slated to jump to $329 million next year.

So far, the system is completely untested. SDIO has suggested that two reviews conducted last year by committees of the Defense Science Board and the Jasons, a group of academic scientists who advise the Defense Department, endorsed the concept. True, both groups found no fundamental flaws in the idea, but both concluded that many problems remain to be resolved. Nevertheless, General Monahan announced that "the technology is at hand to deploy such a system." With brilliant pebbles in the scheme, he claimed Phase 1 of SDI could be built and deployed for $55.3 billion.

There is little evidence that Congress will be convinced. "Assume Lowell Wood is exactly right this time, and brilliant pebbles works out exactly as planned; it is hard to imagine that the American public will jump up and down and sing Hallelujah and deploy it," says one well-placed congressional staff member. "It is a technology in search of a mission," he said.

More likely, Congress will slash the overall budget, forcing a rethinking of goals and timing. O'Dean Judd, the chief scientist at SDIO, recalls that after last year's budget cut, a lot of things got delayed, "but I don't think we really canceled anything." But another major cut with no change in the schedule for a deployment decision would result in a program geared heavily toward the short term. That is not what Ronald Reagan had in mind 7 years ago this week . . . nor is it likely to be palatable to Congress. ■ **COLIN NORMAN**