

***STRATEGIC DEFENSE
STRATEGIC CHOICES***

STAFF REPORT

OF THE

STRATEGIC DEFENSE INITIATIVE



DEMOCRATIC CAUCUS

OF THE

U.S. HOUSE OF REPRESENTATIVES

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ABOUT THIS REPORT

This staff report is prepared under the auspices of the Democratic Caucus of the House of Representatives. It is the result of extensive research and consultations conducted by the Task Force on the Strategic Defense Initiative, chaired by Representatives Charles E. Bennett (D-Fla) and Vic Fazio (D-Ca), and appointed by the Caucus for this purpose.

From January to May 1988, the members and staff of the Task Force held twenty-five meetings with many of the nation's most knowledgeable experts on strategic defense. The Task Force members have all had oversight responsibility for SDI while serving on the Committees on Armed Services, Appropriations, Budget, Foreign Affairs, Government Operations, Intelligence, and Science, Space and Technology.

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STRATEGIC DEFENSE STRATEGIC CHOICES

REPORT TO THE TASK FORCE ON THE STRATEGIC DEFENSE INITIATIVE

DEMOCRATIC CAUCUS OF THE U.S. HOUSE OF REPRESENTATIVES

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INTRODUCTION

On March 23, 1983, President Reagan called upon scientists to help render "nuclear weapons impotent and obsolete." In response, Congress approved an unprecedented growth in funding for research into defensive technologies, making the Strategic Defense Initiative (SDI) the largest research program in the United States.

Today, SDI is becoming an acquisition program geared toward deployment in the 1990s of a specific weapons system - the Strategic Defense System (SDS) - composed of hundreds of weapons satellites and ground-launched interceptor rockets.

This system would neither defend people in a nuclear war nor render nuclear weapons impotent and obsolete. Instead, its primary mission is to defend our land-based nuclear missiles and key command centers.

Congress must decide whether to embrace this far more limited goal and approve the substantial increases in funding necessary for developing the system. The decision comes at a time when the massive budget deficit incurred by the Administration forces the nation to make extremely difficult budget choices. For the foreseeable future, the defense budget may well be a zero-sum game: Increased funding for SDI will almost certainly come at the expense of funding for conventional and strategic forces. Criteria must be developed for evaluating SDS relative to our other weapons.

Other key issues include the effect a decision to develop, test, and deploy SDS would have on a variety of issues, such as stability, arms control, the space program, and our long-term prospects for meeting the President's original goal. In addition, if Congress rejects SDS, it should then determine whether there are superior near-term options for the SDI program.

Because these issues are so vital to the nation, the House Democratic Caucus chartered the Task Force on the Strategic Defense Initiative to "assist the Democratic Caucus in shaping a Majority consensus on SDI research, testing, development and deployment." The report should reflect "broadly-supported, essential Democratic beliefs on the direction, scope, and timing of the SDI program." The charter states:

"The Task Force shall consider the implication of United States strategic defense for nuclear strategy, arms control, the defense budget and U.S./Soviet relations...."

In considering the role of strategic defenses in U.S. policy, we begin by placing the current debate over SDI within a historical context.

THE HISTORY OF BALLISTIC MISSILE DEFENSE

At the time of President Reagan's March 23, 1983 speech, the U.S.'s annual expenditure on strategic defense technologies was \$991 million. Since the end of World War II, Congress has allocated more than \$100 billion for the pursuit of various types of strategic defenses.

In the 1950s, the primary strategic threat to the United States was an attack by Soviet long-range bombers from the North. Congress appropriated tens of billions of dollars for the construction of a vast and elaborate North American Air Defense system (NORAD). In 1957, America received a rude technological shock when the Soviet Union launched Sputnik. A nation that could launch a satellite into orbit atop a rocket could also deliver a nuclear bomb atop a similar rocket. By 1960, it became clear that the predominant threat to America would be intercontinental ballistic missiles (ICBMs).

There were three responses. President Dwight Eisenhower and later President John Kennedy began to develop what ultimately became America's force of 1000 ICBMs (with a similar effort underway in the Soviet Union). Eisenhower also began the search for a defense to these missiles when he authorized the operational development of a nuclear-tipped interceptor missile, Nike-Zeus, and commissioned Project Defender to develop components for a nationwide ballistic missile defense system. Finally, defense officials realized that our air defenses were now obsolete: They could be bypassed or destroyed by ICBMs. The NORAD picket line was deemphasized.

From 1958 to 1969, the United States spent over \$1 billion (in then-year dollars) on research for Project Defender, a comprehensive examination of means for achieving strategic defense. Part of these funds were spent on "BAMBI" (Ballistic Missile Boost Intercept). Defense officials envisioned BAMBI as "...a system in the form of hundreds of satellites circling the globe, in which each one is equipped with many small missiles with an infrared homing device that can be launched automatically..."

BAMBI was abandoned in 1962 when it became apparent that the system would be vulnerable to attack by space mines and other anti-satellite weapons, and "the probability of BAMBI ever being a cost-effective system" was low, according to Dr. Robert Cooper. Dr. Jack Ruina, then director of the agency in charge of BAMBI, did not think that the project was either a "good idea or a good system."

In the late 1960s, President Richard Nixon approved the deployment of the Safeguard Anti-Ballistic Missile (ABM) system, in response to the Soviet development of an ABM system around Moscow. Although many in Congress were concerned that the system would be ineffective, vulnerable to attack, and easily overwhelmed, it was approved in order not to undermine America's negotiating position in the Strategic Arms Limitation Talks.

In 1972, the Soviet Union and the United States announced the first Strategic Arms Limitation Treaty (SALT I) as well as an agreement limiting defensive systems--the ABM Treaty. Both nations agreed "that effective measures to limit anti-ballistic missile systems would lead to a decrease in the risk of outbreak of war involving nuclear weapons." In attaining both of these agreements at the same time, the negotiators intended to insure strategic stability by stopping large scale deployment of strategic defensive systems while attempting to limit offensive forces.

The ABM Treaty permitted a limited deployment of defenses. The Soviet Union maintains today a site around Moscow. Administration officials are confident that the United States can penetrate and overwhelm this Soviet defense with our existing ballistic missiles; should the Soviets deploy more advanced or proliferated defenses, we could deploy more advanced devices to ensure our continued capability to penetrate them (see p. 32).

Ford Administration officials and military advisors determined that defenses permitted us under the Treaty were not worth maintaining since they could easily be penetrated by Soviet ballistic missiles. As a panel of the George C. Marshall Institute (proponents of deploying a space-based defensive system) recently noted, the problems with the 1970s defensive systems were that "a 'ground-based' defense is readily overwhelmed" and that the fixed, ground-based radars on which the system depends are "easily targeted by the Soviets and vulnerable to destruction in a surprise attack." Ultimately, although the Safeguard system was deployed, it was operational for only a few months in the mid 1970s, and then shut down as obsolete.

Both nations continued an active research program into strategic defenses. In 1988, the United States spent about \$4 billion on research. Estimates for the Soviet defense program run as high as \$20 billion per year, though most of that is for the extensive Soviet air defense system, not defenses against ballistic missiles. The Defense Department currently estimates that for the last two decades the Soviets have spent about \$15 to \$18 billion a year on their air defenses, which include radars, surface-to-air missiles, and interceptor aircraft. In spite of the sizable Soviet air defense force, Dr. Lawrence Woodruff, Deputy Under Secretary of Defense for Strategic and Theater Nuclear Forces, told the House Armed Services Committee in March 1988,

"The new low-observables technology will enable our bombers and cruise missiles to penetrate Soviet defenses effectively for the foreseeable future."

Purpose of the ABM Treaty

The broad purpose of the ABM Treaty is to prevent either party from fielding a nationwide ballistic missile defense of its territory. The Treaty prohibits the development, testing or deployment of sea-based, air-based, space-based, or mobile land-based ABM systems and components whether they are based on traditional ABM technologies or other physical principles (Article V and Agreed Statement D). The U.S. Arms Control and Disarmament Agency says the ABM Treaty is designed to "decrease the pressures of technological change and its unsettling impact on the strategic balance."

The proven logic behind the prohibition against a nationwide defense is that an arms race in strategic defense systems fosters the proliferation of offensive missiles and the development of countermeasures to defeat the defense. That is, the deployment of systems designed to shoot down ballistic missiles would trigger an acceleration of the current arms race in offensive systems and start two new contests--in defensive systems and in countermeasures--without a commensurate gain in security by either side.

For the past 16 years, the ABM Treaty has served to limit the arms race in strategic defenses. The Treaty reflects the view of the past four administrations, including the current one (until its reinterpretation of the Treaty in October 1985), that the Treaty serves our national security interests. Six former Secretaries of Defense--Harold Brown, Clark Clifford, Melvin Laird, Robert McNamara, Elliot Richardson and James Schlesinger--affirmed the ABM Treaty as "an important contribution to American security and to reducing the risk of nuclear war."

In October 1985, the Reagan Administration announced a reinterpretation of the ABM Treaty. Under their new interpretation, the development and testing of air-based, sea-based, space-based, or mobile land-based ABM systems and components based on other physical principles would no longer be prohibited. Such development and testing is, however, prohibited by the ABM Treaty, as reflected in every Arms Control Impact Statement submitted to the Congress over the past ten years, including those submitted by the Reagan Administration through fiscal year 1987.

In response to the Administration's unilateral reinterpretation, the House Foreign Affairs Committee held the first Congressional hearings on the subject in October 1985. This and subsequent hearings helped establish the traditional view of the prohibitions as correct and consistent with the testimony of virtually every member of the ABM Treaty negotiation team, with the interpretation of the Treaty presented to the Senate, with the Treaty negotiating record, and with the subsequent practice of the United States and the Soviet Union.

The Reagan Administration's new interpretation poses the danger of allowing the Soviet Union free reign to conduct similar space-based tests, thereby opening up space to an unconstrained arms race--which is not in our national security interests. Ambassador Paul Warnke, Secretary Robert McNamara and General Brent Scowcroft all reaffirmed to the Task Force that mutual adherence to the traditional interpretation of the ABM Treaty remains in the security interests of both the United States and the Soviet Union. For the past two years, Congress has voted to uphold the traditional interpretation.

The Reagan Administration

At the start of the Reagan Administration the consensus in the defense

community continued to be that ballistic missile defenses could not be militarily effective. Some, however, disagreed and promoted two systems - High Frontier and space-based lasers - each considered by the Administration and rejected before the President's 1983 speech.

HIGH FRONTIER

Retired General Daniel Graham promised that by using "off-the-shelf" technology our nation could build a network of several hundred satellites carrying rocket interceptors that would defeat any Soviet attack. He claimed we could launch this system for some tens of billions of dollars. This plan met with nearly universal rejection by defense analysts. In November 1982, Secretary of Defense Caspar Weinberger wrote Graham,

"Although we appreciate your optimism that 'technicians will find the way and quickly,' we are unwilling to commit this nation to a course which calls for growing into a capability that does not currently exist... While there are many instances in history where technology has developed more quickly than the experts predicted, there are equally as many cases where technology developed more slowly."

Weinberger based his view, in part, on an Air Force Space Division analysis that had concluded High Frontier "has no technical merit and should be rejected.. No alternate configuration supported a favorable conclusion." Another Defense Department analysis stated,

"It is the unanimous opinion of the Air Force technical community that the High Frontier proposals are unrealistic regarding state of technology, cost and schedule."

LASERS IN SPACE

Another possible defensive system, space-based lasers, was also found to be unpromising. In 1981, the Department of Defense's Science Board concluded unanimously:

"It is too soon to attempt to accelerate space-based laser development towards integrated space demonstration for any mission, particularly ballistic missile defense."

On March 23, 1983, the day of President Reagan's speech, Air Force officials were on Capitol Hill testifying about the space laser programs they ran. General Donald L. Lamberson told the Senate that he could not recommend an acceleration of the space-based laser program on technical grounds "at this point in time." General Bernard Randolph told the House of Representatives that a laser weapon system would require many megawatts of power, would need a precision mirror much larger than any yet manufactured, would weigh 150,000 pounds, and would cost "many, many billions of dollars." He explained that "to point the system at a target would be like pointing from the Washington Monument to a baseball on the top of the Empire State Building and hold it there while both of you are moving.... I view the whole thing with a fair amount of

trepidation.”

THE PRESIDENT'S VISION

That night, President Reagan made his speech, asking:

“What if free people could live secure in the knowledge that their security did not rest upon the threat of instant retaliation to deter a Soviet attack, that we could intercept and destroy strategic ballistic missiles before they reached our own soil or that of our allies?”

President Reagan called on the scientific community “to turn their great talents now to the cause of mankind and world peace, to give us the means of rendering nuclear weapons impotent and obsolete.” The President said he was directing “a long term research and development program to begin to achieve our ultimate goal of eliminating the threat posed by strategic nuclear missiles.” He said, “It will take years, probably decades, of effort on many fronts.”

Congress responded to the President’s vision, appropriating through fiscal year 1988 over \$13 billion for the Strategic Defense Initiative. SDI officials have made clear that this research, from the beginning, was directed towards countering only ballistic missiles, not cruise missiles, bombers, or other nuclear weapons. The annual SDI budget has quadrupled, from \$1 billion in fiscal year 1984 to \$4 billion in FY 1988. Even as other defense and domestic programs have suffered cutbacks forced by the mounting national deficit, SDI has grown. Last year, for example, the SDI budget jumped 11 percent while the overall national defense budget declined by 3 percent in real terms.

Throughout these five years, the President’s personal sponsorship and persistence has propelled the SDI program through Congress far beyond its technical and strategic merits. The President has kept his vision alive with repeated references to his hope that SDI could, as he told a 1986 high school graduating class, “put in space a shield that missiles could not penetrate--a shield that could protect us from nuclear missiles just as a roof protects a family from rain.”

During these five years, the SDI program has produced technological advances in some areas, such as sensors, miniaturization, and lasers. This March, SDI Director General James Abrahamson cited to the House Armed Services Committee numerous instances of SDI-related technologies with possible non-military applications. These included a linear accelerator being considered as a source for food irradiation, a carbon fiber ceramic material for use as hip joint replacements, and use of the Free Electron Laser for a number of medical applications such as fragmenting kidney stones.

But have we advanced on our search for a shield against ballistic missiles?

FROM DEFENSE INITIATIVE TO DEFENSE SYSTEM

For the first four years, the program emphasized advanced research and long-term system goals. In the summer of 1987, that changed. The SDI Organization

presented to the Department of Defense's Acquisition Board a plan for the "phased" deployment of strategic defenses. SDI officials advocated the development of a "Strategic Defense System." The Department of Defense approved the new plan, despite the sharp warnings of its own Defense Science Board, which said "there is presently no way of confidently assessing" the system's price or its effectiveness. The board recommended delaying approval for "the next year or two" while SDI officials filled in "gaps in system design and key technologies." These key recommendations were cut from the report before it went to the Acquisition Board. The plan was approved in August 1987. As SDI consultant William Davis told Congress in April 1988, "This event set the program on a fundamentally different course."

Billions of dollars in contracts are being signed with some of our nation's largest defense corporations for the design and construction of prototype weapons for this system. For example, \$358 million will go towards building and flight testing space-based interceptors. A \$508 million contract will go for the design and operation of a \$1 billion test and command center in Colorado. In May 1988, a \$236 million contract was awarded a major corporation which will play the leading role in the planned development and initial deployment of the SDS.

The primary mission of Phase I of this system, which is to be deployed in the 1990s, is protecting only our nuclear forces and key command centers. The lowered goal now is to "reduce Soviet confidence in the military utility of its ballistic missile force" and to "complicate Soviet attack plans." As SDI officials explained in a 1988 report to Congress:

"These first phases could severely restrict Soviet attack timing by denying them cross-targeting flexibility, imposing launching window constraints, and confounding weapon-to-target assignments, particularly of their hard-target kill capable weapons."

The centerpiece of Phase I is the space-based Interceptor, much like BAMBI and High Frontier. Phase I will also include ground-based interceptors; ground- and space-based sensors to detect, track, and target Soviet missiles; and a command, control, and communications network to manage the battle.

The follow-on phases are only at a preliminary stage of development, but they are expected to include advanced interceptor rockets, more sophisticated sensors, and directed energy weapons. **It appears that the centerpiece of Phase II will be the space-based laser.**

CAN WE AFFORD SDS?

The Strategic Defense System could cost more than \$450 billion to deploy over a ten year period, according to an analysis prepared by the Congressional Budget Office (CBO) at the request of the chairmen of the Task Force. The staff of CBO prepared budget estimates of various scenarios for deploying SDS based on the schedule and cost estimates provided by the Strategic Defense Initiative Organization.

The Cost of Deployment (1993 to 2002)

The SDI Organization has developed a conceptual plan for a "phased" deployment of a Strategic Defense System. According to this plan, a decision would be made in the mid-1990s to launch into space the 300 satellites of Phase I.

However, according to SDI officials, the effectiveness of Phase I would be limited. Soviet responses to Phase I (such as fast-burn boosters, more missiles, and decoys) would diminish the effectiveness of the system within a few years. Therefore, Phase I would have to be augmented by Phase II--a new set of more advanced space weapons and sensors. SDI officials say, however, that the effectiveness of Phase II would also soon decline as the Soviets responded with new weapons and countermeasures. Thus, a Phase III is included in current SDI plans. This process might continue indefinitely. General Abrahamson told the House Armed Services Committee in March 1988, "We have not created a situation where Phase I is the end .it is only the beginning."

The Administration has estimated the total costs of developing and deploying Phase I alone at between \$75 and \$150 billion. According to the Administration timetable, by the year 2000 the country would be paying for all three initial phases of SDS.

The following table, prepared by CBO staff, assumes that the Administration can meet its planned deployment schedule and that these follow-on phases would cost the same as Phase I. The cost of deploying this phased system during its first ten years would range from \$249 billion to \$452 billion. The methodology CBO used in coming to this conclusion is described in the table (not included in the Internet version).

CBO staff caution that there is uncertainty associated with the current SDI estimates. These estimates are rough and preliminary. Many experts consider the figures unrealistically low. Further, these estimates do not include the cost of operations and maintenance (O&M), which normally account for some 60 percent of a weapon's cost over its lifetime. Nor do they include the cost of defenses against weapons such as bombers, cruise missiles and low-trajectory submarine-launched missiles, which SDS could not stop.

Opportunity Costs

To put this in perspective, the CBO staff provided the Task Force with costs of funding other military systems. These comparisons are made only to illustrate opportunities foregone by investing in a Strategic Defense System (SDS).

<i>System</i>	<i>Cost in Billions of Dollars</i>	<i>Annual O&M</i>
SDS (10 year cost)	\$249-452	unknown
Carrier Battle Group	14	.5
F-15 Fighter Wing	4	.2
F-16 Fighter Wing	2	.2
Modern Armored Division	5	1.4

(all figures in this analysis are in 1988 dollars)

If the United States chose to invest the funds required for SOS in conventional forces over the ten years needed to deploy SOS, we could buy:

17 to 32	Carrier battle groups, or
62 to 113	F-15 fighter wings, or
124 to 226	F-16 fighter wings, or
49 to 90	Modern armored divisions

Moreover, as the CBO staff points out, "In some years in the late 1990s, the costs of deploying an SDS could exceed total funds allocated to all strategic forces during a peak year of funding." At its peak in 1984, the budget for strategic forces was about \$40 billion and made up about 14 percent of the defense budget. Current spending is about \$31 billion. The annual cost for SOS in 1996 could be between \$28 billion and \$52 billion. In the year 2000, SOS could cost from \$41 billion to \$81 billion.

Furthermore, the cost analysis presented here has not even considered how we will deal with the threat of "stealthy" Soviet bombers and cruise missiles. As Defense Department officials testified in March 1988, the Soviets are eventually expected to deploy such "low observable technology." The Soviets have spent hundreds of billions of dollars on their air defenses over the past two decades alone, and yet Dr. Woodruff testified that U.S. stealth technology will enable us to "penetrate Soviet defenses for the foreseeable future." The Air Force's Air Defense Initiative is only at the beginning

stages, with funding levels of tens of millions of dollars. **Ultimately, an air defense system might cost as much as the Strategic Defense System.**

The CBO report to the Task Force concludes:

“Under current Administration plans, the budgetary impact of an SOS would clearly be substantial. Spending of this magnitude could be particularly difficult to accommodate if total funds available for defense continue to be limited, as in recent years. In the absence of large increases in the defense budget, funding an SDS under the Administration assumptions...would require substantial reallocations of resources from other strategic nuclear programs and from conventional forces.”

Cost of SDI Research (1989 to 1993)

In order to support a plan to deploy space weapons in the 1990s, the Administration plans to greatly increase the SDI research budget each year. About half of this money will not go to basic research but to expensive demonstrations of the proposed systems. The Delta 181 rocket launch in early 1988, for example, cost over \$250 million. Half of the budgets for fiscal years 1988 and 1989 are devoted to Phase I systems and similar “technology validation experiments.”

In 1984, Administration officials testified to Congress that the SDI research program would cost \$26 billion before an “informed technical decision” could be made in 1990 on whether to proceed to full scale engineering development of the system. **This estimate has now more than doubled.**

Task Force member Jack Brooks told Congress this May that **the new official estimate was now \$57.5 billion** and that the decision could not be made until 1993. Thus, another \$45 billion would be required, in addition to the research funds already expended, before SDI officials believe they could make an informed decision. “It is very clear,” said Congressman Brooks, “that SDI’s ‘up front’ costs are indisputably greater than Congress was initially led to believe.”

These funding plans would require an average annual expenditure for SDI research of more than \$9 billion per year over the next five years. This figure is almost twice as much as the entire research budget for the Army this year (\$5.03 billion) and nearly equal to that of the Navy (\$9.2 billion).

Administration defense budget projections for the next five years show a decline in research funds overall, except for SDI. According to CBQ projections,

- SDI could grow after inflation by an average of 16.9 percent per year, to a level of \$9.5 billion in FY93 (research budget only);
- SDI as a share of funding for strategic forces programs would double, from a 9.6 percent in FY88 to 20.3 percent in FY93; and,

- SDI as a share of military R&D would double, from 9.7 percent in FY88 to 20.7 percent in FY93.

As Robert F. Hale of CBO testified in 1987, "SDI is consuming a growing share of a relatively constant R&D pie.. .As a result, R&D programs other than SDI will experience real declines."

Strategic Choices

Certainly, the nation faces difficult choices. In a constrained budget environment, there is limited funding that can be devoted to high-risk technologies that may well fail to produce effective weapons, especially when we have so many other indisputable defense needs. National security experts are already concerned about the crowding out of essential non-SDI research.

During the last five years, Congress has largely accepted Administration priorities, and has increased annual funding for strategic defense programs from about \$1 billion in fiscal year 1984 to about \$4 billion in fiscal year 1988. During this period, conventional force technologies, among other military priorities, have remained relatively lean. Recently, Congress has tried to balance our defense priorities, slowing somewhat the rate of increase in SDI, and fortifying conventional forces and technologies.

Administration plans would undoubtedly aggravate the problems experienced during the last five years. During the next five years, we will need to improve our conventional forces as well as maintain our strategic forces. The planned SDI **research** budget would itself jeopardize conventional force enhancements and strategic force modernization. The SDS **deployment** budget would consume funding for all our strategic systems and more.

We must make strategic choices. Is the possibility of a partial defense against some nuclear weapons worth sacrificing our other pressing security needs? How do we decide?

THE ROLE OF DEFENSES

Our armed forces will have to forego significant strategic and conventional force programs if we follow the SDI Organization's schedule for the development, testing, and deployment of the Strategic Defense System. To choose wisely among weapons systems, we must understand the role of strategic defenses in U.S. defense policy and develop criteria for comparing potential defenses with other weapons.

Population Shield

One goal of strategic defense might be to protect the nation's population from nuclear destruction. This would be a formidable task.

Each superpower has some 10,000 long-range nuclear weapons; these weapons are so tremendously destructive that a single one can destroy a major city, military base, or industrial facility. As former Chairman of the Joint Chiefs of Staff, General David Jones testified in March 1987,

"Today, it would take no more than two percent of the strategic force of a superpower striking the other side to cause catastrophic damage to much of the urban area."

Only defenses that are near-perfect against ballistic missiles, bombers, and cruise missiles can hope to render "nuclear weapons impotent and obsolete."

In 1987, the Aspen Strategy Group, co-chaired by retired General Brent Scowcroft and former Under Secretary of Defense Dr. William Perry, concluded:

"We see virtually no prospect of building a significant and effective population shield against a responsive enemy inside this century, and there is great uncertainty about the long term."

This is the opinion of the overwhelming majority of the scientific and defense community. There are few who promote today the kind of defense that the President popularized in his speeches. **General Abrahamson told the Task Force, "The 'Astrodome' type of defense is ridiculous."** This, however, is what the majority of American people seem to believe is the purpose of our extensive SDI program.

Partial Defenses

A second goal, the one now adopted by the Administration, may be to provide a partially effective defense, such as SDS Phase I. Rather than replace deterrence, the military objective of Phase I is “to enhance the U.S. deterrence posture,” according to the SDI Organization.

Currently, we deter a Soviet nuclear attack on the United States by maintaining a highly survivable retaliatory force. In 1988, our nation will devote some \$31 billion to our nuclear weapons programs. Even the most successful Soviet nuclear attack would still leave us with more than 4000 “second-strike” nuclear weapons, mainly on submarines and bombers. The possible vulnerability of our ICBMs is a cause of concern, and indeed, the primary way that Phase I might enhance deterrence is by defending our ICBM force. As one of our members, Les Aspin, wrote,

“There have been indications that the real objective of SDI is not to eliminate deterrence, but merely to reinforce it through active defense of our retaliatory forces....”

Since the objective of Phase I is to improve land-based missile survivability and thus complicate Soviet attack, it is not intended to replace our offensive forces. Instead, it is intended to work in combination with them. Phase I weapons must therefore be judged against other systems that complicate Soviet attack plans, such as mobile ICBMs, cruise missiles, and our nearly invulnerable submarines.

The criteria we use to judge our other strategic systems are cost-effectiveness and survivability. The idea of applying these criteria to strategic defenses was first put forward by Ambassador Paul Nitze. Later, President Reagan and Congress officially adopted these criteria.

If it costs the United States more to field a defensive system than it does for the Soviets to overcome it with offensive weapons, then the U.S. defensive system is not cost-effective and is hardly in our national interest to deploy. Such a defensive system would increase the likelihood of an arms race.

If a defensive system were not survivable, “an adversary could well have an incentive in a crisis to strike first at vulnerable elements of the defense,” wrote Nitze in 1985. Such a system will add to “crisis instability,” and increase rather than decrease the risk of nuclear war. Secretary of State George Shultz said that each phase of a strategic defense should contribute to stability.

Do we need SDS to improve deterrence? In 1983, President Reagan’s hand-picked bipartisan Commission on Strategic Forces--the Scowcroft Commission--examined the U.S. deterrent. The Commission’s primary recommendations for dealing with the perceived vulnerability of our land-based missiles were mobile ICBMs and arms control provisions to enhance ICBM survivability. In March 1984, the Commission wrote,

“The Commission was requested to review the Administration’s proposals for research on strategic defense. In the Commission’s view, research permitted by the ABM treaty is important in order to ascertain the realistic possibilities which technology might offer, as well as to guard against the possibility of an ABM breakout by the other side. But **the strategic implications of ballistic missile defense and the criticality of the ABM treaty to further arms control agreements dictate extreme caution in proceeding to engineering development in this sensitive area.**” (emphasis added)

General Scowcroft told the Task Force this April that his assessment had not changed. “I don’t like the first phase (of SDS),” he said, “because it changes the whole notion of what the program was intended to find out.” He felt that mobile missiles and arms control were better ways of dealing with our ICBM vulnerability than deploying Phase I.

The President’s arms control proposals in the START talks with the Soviet Union, for example, would enhance deterrence by eliminating some of the most dangerous and destabilizing Soviet nuclear weapons. The President proposes that the Soviet Union destroy half of their SS-18 ICBMs, which are considered accurate enough to blow up our ICBMs in their silos. This is the same goal as SDS, for, as Congressman Les Aspin writes, “The military requirements for Phase I from the Joint Chiefs of Staff specify that only 50 percent of the SS-18 hard target killing warheads in a first wave attack should be stopped.”

A combination of strategic modernization programs and arms reduction negotiations could enhance deterrence and lower the chances of nuclear war at far less cost and considerably less risk than the proposed Strategic Defense System.

ANALYSIS OF PHASED DEPLOYMENT

The Strategic Defense System is intended to attack ballistic missiles. The flight of a ballistic missile consists of several phases.

- During the **boost phase**, the rocket engines accelerate the missile payload through and out of the atmosphere.
- **A post-boost phase** occurs next, during which multiple warheads and penetration aids (such as decoy warheads and radar chaff) are released from the post-boost vehicle or “bus”.
- **In the midcourse phase** the warheads and penetration aids travel on trajectories above the atmosphere, and they reenter it in the terminal phase.

The ideal time to destroy a Soviet ICBM is in the boost phase. The ICBM itself has a large, fiery rocket plume, making it easy to see; it carries large amounts of highly explosive fuel, making it potentially easy to destroy; and a single U.S. shot could destroy 10 or more Soviet warheads. The difficulty is that the newest generation of Soviet ICBMs have a boost phase that lasts only three minutes.

The most potentially effective boost phase weapons are directed energy weapons because they would make use of intense beams of light or particles that travel almost instantaneously. An ICBM achieves a speed of only few miles per second, while the speed of light is 186,000 miles per second.

In 1987, the American Physical Society (APS) Study group released their report on directed energy weapons (DEWs). Members of the Study Group included prestigious physicists from industry, universities, and major government labs, including the Air Force Weapons Laboratory, Sandia National Laboratory, the U.S. Military Academy, and Bell Laboratories, many of whom were active participants in SDI research. The Study Group had complete access to classified information and they reached their conclusions unanimously. They wrote,

“We estimate that even in the best of circumstances, a decade or more of intensive research would be required to provide the technical knowledge needed for an informed decision about the potential effectiveness and survivability of directed energy weapon systems. In addition, the important issues of overall system integration and effectiveness depend critically upon information that, to our knowledge, does not yet exist.”

Harold Brown told the Task Force “directed energy weapons seem more difficult than they did five years ago.” But the SDI program has not made directed energy programs its top priority. Dr. John Brown, Associate Director for Defense Research and Applications at Los Alamos National Laboratory said in recent House

testimony, that directed energy weapon “funding to date has been neither adequate nor predictable.”

“The only [DEW] technology that can possibly support a Phase II decision in the early to mid 90s is the space-based HF [hydrogen fluoride] chemical laser,” wrote Edward T. Gerry of the Fletcher Commission in November 1987. Yet, as noted earlier, Pentagon officials have pointed out serious problems with this system. In mid-1987, Richard Wayne, the Director of Component and System Research for Sandia National Laboratory said, “Systems analysis showed that in the near term (the space-based laser] would be extremely difficult to deploy in space, to operate in that environment and make it survivable.”

Since effective directed energy weapons remain only a very long-term option, and since the SDI Organization is looking toward deployment of Phase I in the mid- to late-1990s, it has focused on the technology of interceptor rockets.

Phase I is composed of several elements. Each is the equivalent of a major defense weapons program. These programs would have to be developed and deployed concurrently, and then connected by a computer network of unprecedented scale and complexity.

- The satellites in the Boost Surveillance and Tracking System (BSTS) would carry sensors to detect and track a hostile missile launch.
- Some 3000 Space-based Interceptors (SBIs) on 300 satellites are planned to intercept Soviet missiles in their boost and post-boost phases.
- Midcourse sensors (SSTS and GSTS) would use infrared and radar sensors to try to acquire, track, and discriminate post-boost vehicles, warheads, and decoys.
- The Exoatmospheric Reentry Vehicle Interceptor System (ERIS) is a planned ground-based rocket intended to hit incoming warheads. Guidance for ERIS would be dependent on data provided by the midcourse sensors.
- A Battle Management/Command, Control, and Communications (*BMIC3*) system would have to coordinate all elements of Phase I, rapidly processing information and relaying commands.

Space Based Interceptors (SBIs)

The Space-Based Interceptor (SBI) is intended to fulfill the complex mission of trying to rapidly find and hit a rising Soviet ballistic missile surrounded by an enormous fiery rocket plume, while still maintaining human control of the decision to fire, and to do this job with an affordable weapon. Although the current generation of Soviet ICBMs, such as the SS-18, have a boost-phase that lasts about 5 minutes, the Soviets are now deploying SS-24s and SS-25s, which have a 3-minute boost phase.

A force consisting of a few thousand space-based interceptors would be only about 15% to 20% effective against the projected Soviet ICBM threat in the mid-1990s, according to a recent study by the Strategic Defense Systems Studies Group at Lawrence Livermore National Laboratory. The projected threat for the mid-1990s used by the study--14,000 ICBM warheads--comes from the Department of Defense. With Phase I in place, most of those warheads would still detonate on the territory of the United States. The study concluded that in order to achieve the 90 percent effectiveness some have mentioned for an SDI system we would need not the proposed 3,000 SBI interceptors, but "about 100,000."

The Livermore study comes to these conclusions in spite of several optimistic assumptions: There is no attack on the system by Soviet anti-satellite weapons; each interceptor would have a 90% kill probability; all other systems (such as battle management) function perfectly; and U.S. interceptors are launched 20 to 30 seconds after Soviet launch--which means no human decisionmaker.

SURVIVABILITY OF SPACE-BASED WEAPONS

What would happen if the Strategic Defense System were attacked? The basic satellite survivability problem was explained in Senate testimony by former Assistant Secretary of Defense Richard Perle:

"The difficulty is that satellites are delicate instruments, of necessity. Building satellites that could resist the explosive force of even the current generation of Soviet anti-satellite weapons would be extraordinarily difficult technically. The weights involved would be enormous.... The sensors on satellites themselves are extremely delicate, so there is really not a lot we can do with respect to some satellites."

The Defense Science Board reported in 1987 that the technology for the survivability of the space-based interceptor platform is "still uncertain," and that, "Vulnerability to attack by ground-based ASATS (anti-satellite weapons] during peacetime is particularly disturbing." **Livermore scientist George Miller told the Task Force that "survivability of objects in space ... has not even been conceptually solved."** Curtis Hines, a department manager for systems analysis at Sandia National Laboratory, has said, "Every time we look at it, it seems very difficult to ensure the survivability of space-based assets."

Failure to solve the survivability problem was one of the primary reasons the BAMBI space-based interceptor program was cancelled in the 1960s. Robert Cooper, former director of the Defense Advanced Research Projects Agency (DARPA) in the Reagan Administration, said in 1987 House testimony:

“The particular tactics that were proposed in the 1960s to breach such a system ... are still available and in my judgment, and in the judgment of a vast number of conservative engineering opinion out there, there is just no way to deal with it.”

Representatives from Rockwell Corporation told the Task Force staff that their SBI satellites could be made survivable. SDI officials have pointed to a variety of measures to increase the survivability of satellites. The issue Perle raises is what weight, complexity, and hence cost will they add to the system?

Putting objects into even low earth orbit is extremely expensive, costing some \$3000 a pound, which is almost the price of gold. **Contractor projections indicate that the SBI satellites will cost more than \$100 million apiece. If the Soviets can build an inexpensive ground-based Interceptor like ERIS, then they may have an anti-satellite weapon (ASAT) that costs only a few million dollars.**

One of the most potent ASATs available to the Soviets is simply an ICBM fused to detonate at a point in space. A nuclear detonation can destroy or incapacitate satellites many miles away. This so-called direct ascent nuclear ASAT would be a very potent weapon, particularly if accompanied by decoys to fool enemy defenses. SDI officials told the Task Force staff they believed the Phase I system could survive these attacks. In 1988, however, the Office of Technology Assessment came to a different conclusion, following a two-year review of SDI's phased-deployment plan. The OTA had access to classified information, and the report was subject to external review. They concluded,

“It appears that direct-ascent nuclear anti-satellite weapons (DANASATs) would pose a significant threat to all three defense system phases, but particularly to the first two.”

The Soviets may now have ground-based lasers capable of destroying or damaging satellites in low orbit. In the future, the Soviets can be expected to have more powerful ground-based lasers. One widely discussed ASAT is a space mine, a satellite that tracks and follows an enemy satellite and that carries a bomb. The SDI weapons themselves, such as ERIS and SBIs, can be used as ASATs. Harold Brown has said, “It continues to appear that everything that works well as a defense also works somewhat better as a defense suppressor.” Unfortunately, as Task Force staff discovered and OTA concluded,

“There has been little analysis of any kind of space-based threats to [ABM] system survivability.... In particular, SDIO and its contractors have conducted no serious study of the situation in which the United States and the Soviet Union both occupy space with comparable [ABM] systems.”

The Soviets would not have to attack the whole space-based system, but only the key components, such as the sensor or battle management satellites. Because the Phase I SBI satellites are in orbit around the earth, only a fraction of them (about 10%) are actually near Soviet ICBMs at any one time. Destroying that 10% (30 satellites) might cripple the system's ability to handle a massive simultaneous Soviet launch. Given the range of existing and potential ASAT weapons available to the Soviets, it seems only prudent to assume that they could launch a fairly successful attack on 30 satellites.

COST EFFECTIVENESS OF SBIS

How much does it cost the Soviets to build ICBMs? While it is always difficult to calculate the cost of Soviet weaponry, last year the CIA provided unclassified figures to one of our members, Frank McCloskey. The CIA estimates that, from 1976 to 1986, the Soviets' total dollar costs (in 1985 dollars) for the procurement, personnel, operations and maintenance, and construction of Soviet ICBM systems equaled \$75 billion. During this time the CIA estimates the Soviets produced 950 ICBM launchers. This represents almost all of the Soviets' modern multiple warhead ICBM force and suggests that a modern ICBM costs the Soviets under \$100 million.

In 1985, the CIA estimated that the Soviet ICBM force "will have been almost entirely replaced with new systems by the mid-1990s." The projection the Livermore study uses (which is based on Defense Department estimates) is that the Soviets will have a force of 1800 ICBMs (carrying a total of 14,000 warheads). The Livermore analysis concludes that the SBIs can only shoot down the equivalent of about 15 to 20 percent of the projected Soviet ICBM force...about 300 missiles worth \$30 billion. For the SBI system to be cost-effective, it would have to cost under \$30 billion. However, Rockwell officials told the Task Force that they and the SDI Organization agree the SBI system would cost about \$50 billion. Many analysts, including Harold Brown, project a much higher cost.

Since SBIs have not yet been developed, cost and effectiveness calculations can only be estimated. Nevertheless, the basic conclusion reached by most analysts is straightforward: **In an arms race between Soviet ICBMs and U.S. space-based Interceptors, the U.S. loses.**

This is not a new conclusion, as former Secretary of Defense James Schlesinger wrote in 1985,

"The historic judgment...in the mid-60s was that the cost ratio between defense and offense was on the order of five to one. In other words, one's opponent could, by an investment of 20 percent of one's own investment in defense, create the offensive forces that would neutralize that investment in defense....

"It is now hypothesized that these cost ratios have modestly improved since the 1960s, although that argument is somewhat flimsy... Nonetheless, it is clear that the ratio is still strongly weighted against defense and will remain so."

- This suggests that the simplest response for the Soviets in the face of Phase I is to simply build more ICBMs.

FAST BURN BOOSTERS AND SBIS

There is scarcely any time available for intercepting current Soviet ICBMs during the boost and post-boost phases. The boost phase of the most modern Soviet ICBMs lasts only 3 minutes. This booster burn time can be significantly reduced, according to weapons contractor studies. Stephen Rockwood, former director of SDI research at Los Alamos, has said that a fast-burn booster “pushes chemical rocket [interceptors] out of business very quickly.” Former SDI Deputy Director Louis Marquet said last year that “fast-burn boosters could rise up and deploy their vehicles before the kinetic energy interceptors could reach them.”

Harold Brown has testified that fast-burn boosters would be both less expensive and technically easier to develop than space-based interceptors. In his Senate testimony, George Miller suggested that the Soviets “would not have to develop a brand new fleet of missiles, but merely modify the ones that they have.” Dr. Miller elaborated on this idea in his discussion with the Task Force and explained that reducing the boost and post-boost phases of the SS-24s would require “relatively simple modifications of existing technology.. you don’t need any new inventions.”

Dr. Miller said that Livermore had examined possible U.S. SB1 countermeasures to fast-burn boosters and concluded that they were “by no means easy to do.” Discussing an arms race between U.S. SBIs and Soviet ICBMs, Dr. Miller said that Soviet “responsive measures are very straightforward and in my opinion much cheaper...the marginal cost tremendously favors the offense.” If Soviet fast-burn boosters can bypass Phase I in the boost and post-boost phases, then the U.S. would be left with a very ineffective system, while the Soviets would have a very potent ICBM force. **Space-based interceptors encourage, rather than discourage, Soviet ICBM modernization.**

MID-COURSE DISCRIMINATION

More than 2000 years ago, the classic military thinker Sun Tzu said, “All warfare is based on deception.” The Soviets are well known for their use of deception and decoys in military deployments. Statements by the Defense Department, the SDI Organization, and weapons labs scientists indicate that the Soviets could deploy hundreds of thousands of decoys and penetration aids mixed together with their warheads .. particularly if our boost phase defense is not very effective.

Our midcourse sensors will be required to discriminate warheads from decoys, since there is neither time nor interceptors to shoot at everything. The primary midcourse sensors the SDI Organization plans for Phase I are the ground-launched Probe system, and the satellite-based Space Surveillance and Tracking System

(SSTS). In 1987, the Defense Science Board wrote,

“Serious questions remain unanswered about the ability of the passive IR (infrared) sensors on Probe and SSTS to carry out discrimination against anything but the most primitive decoys and debris. In addition, the presence of cooled RVs (re-entry vehicles) would greatly reduce the range of proposed sensors.”

The Livermore study cited earlier concluded, “Large numbers of effective midcourse decoys are possible for the near term.” **George Miller told the Task Force that a decoy weighing a “fraction of a kilogram” could be made to look like a warhead that weighs a few hundred kilograms.** Effective radar countermeasures might weigh under an ounce. Because of the tremendous excess payload capacity the Soviets have on missiles such as their SS-18, we might expect clouds of chaff and aerosol and hundreds of infrared decoys on each missile.

Representatives from Lockheed Corporation testified that they could discriminate warheads from decoys using radars in conjunction with the infrared detectors. **Harold Brown, however, told the Task Force, “We do not know how to do midcourse discrimination.”** The OTA staff agrees. In a letter prepared for Congressman Bennett, they note:

“...there are plausible decoy designs that would be very difficult to counter merely with passive infrared sensors in conjunction with radar.”

“...It appears possible that chaff, if properly deployed with decoys, could be used to deny RV (re-entry vehicle) detection and, more easily, deny RF [radio frequency] discrimination to the radar elements of a defense...”

“...whereas chaff would deny information to radar, aerosols would mask RVs and decoys from infrared sensors...”

So far, the Soviets have had little reason to build decoys. Since effective Soviet decoys are well within the realm of current Soviet technology, prudent U.S. defense planners should assume they could be developed and deployed by the time the United States could finish deploying Phase I.

A November 1987 General Accounting Office (GAO) report on SSTS warns that the whole midcourse sensor program has been in a state of disarray for years. Recent news stories suggest that this condition has not changed. The GAO report concluded, “Technological risks, as well as schedule and cost risks, are assessed as high under the existing program schedule, according to program estimates.”

BATTLE MANAGEMENT

The battle management, command, control, and communications (BM/C3) system must receive and relay vast amounts of information from the Phase I sensors as they try to track and discriminate hundreds of thousands of objects. It must assign hundreds of Phase I weapons to attack the real targets alone, not debris, decoys, or

U.S. weapons. And it must maintain control and communications in the face of a determined attack on the system elements and the BM/C3.

There are two crucial problems: maintaining space-based BM/C3 components in a nuclear environment; and designing battle management software that will work the first time, which is also its first realistic test in such an environment. The software has been called “the biggest technical problem for the entire program” by one SDI Organization official. The OTA report details many of the software problems. Based on an analysis of previous experience with large, complex software systems, the OTA concluded,

“There would be a significant probability ... that the first (and presumably only) time the (ABM] system were used in a real war, it would suffer a catastrophic failure.”

Scientists are uncertain of the effects of the so-called electromagnetic pulse of energy created by high-altitude nuclear explosions. A single nuclear detonation at a height of a few hundred kilometers over the U.S. might bring down America’s electrical power grid system, damage computers and radar installations around the nation, and disrupt communication links for hours at altitudes up to 2000 kilometers over areas of millions of square kilometers.

In House Armed Services Committee hearings, former staff member Tony Battista repeatedly noted that the present U.S. command, control, communications, and intelligence (C31) is not expected to work in a nuclear environment. In 1987 hearings he said,

“Yesterday we were pursuing this with the head guy in the Pentagon for C31 (Donald Latham) and we were told yesterday that there is absolutely no way that we can provide the command and control to support any kind of early deployment. Even if we had the dollars, we were technology limited in the C31 area.”

“SDI command and control is a total and complete disaster,”

Donald Latham told Armed Forces Journal International in 1988. **“We spent \$600 million and have nothing to show for it. We can’t show, except for what I call view-graph engineering, how it is supposed to work even for Phase One.”**

Conclusion of Technical Analysis

The major technical problems that remain unresolved are the same obstacles that have ruled out an effective ballistic missile defense for almost thirty years. The basic problems with the proposed SDS are the following:

- the ability of the enemy to overwhelm a system with offensive missiles;
- the questionable survivability of space-based weapons;

- the inability to discriminate among real warheads and hundreds of thousands of decoys;
- the problem of designing battle management, command, control and communications that could function in a nuclear war; and,
- low confidence in the ability of the system to work perfectly the first and only time it is ever used.

This analysis represents the consensus of the experts with whom the Task Force spoke, and it is supported by two major independent studies of the SDI program--the 1987 American Physical Society Directed Energy Weapon study and the 1988 Office of Technology Assessment study.

Our analysis here has focused on the key obstacles, but there are literally hundreds of other major technical problems that would have to be resolved before an effective defense can be deployed. In the long term, new technologies, particularly directed energy weapons, hold out the prospect that some of the problems might be solved in the next century. In the short term, Senator Sam Nunn, Chairman of the Senate Armed Services Committee, stated the central conclusion in January 1988:

“Most objective and independent analysts agree that a phase-one system based primarily on space-based kinetic-kill vehicles could not satisfy the Nitze criteria.”

If Ambassador Nitze’s original analysis is correct, then deploying defenses that fail to meet his twin criteria of survivability and cost-effectiveness would have a disastrous effect on both arms race stability and crisis stability.

STRATEGIC STABILITY

In his classic, On War, Carl von Clausewitz wrote, "In war, the will is directed at an animate object that reacts." It is this action and reaction that is at the heart of strategic stability.

We have seen that the Soviets appear to have within their technical capabilities a variety of possible reactions or responses that would seriously diminish the effectiveness of Phase I. The 50-member Defensive Technologies Study team assembled by the Reagan Administration to set the research agenda for SDI - the Fletcher Commission - wrote in 1983:

"In response to the development of a ballistic missile defense system, history indicates that a potential opponent will, in general, proceed in a straightforward manner with the lowest level of countering technology judged adequate."

The simplest Soviet response would likely be acceleration of their ICBM modernization program. **The arms race that Phase I would create would pit something the Soviets are good at, building ICBMs, versus something the U.S. has never done before, building space-based weapons.**

The Soviets would also be likely to deploy countermeasures to confuse or destroy the system. This could well include decoys, and would almost certainly include anti-satellite weapons (ASATs). The U.S. would probably respond with anti-ASATs, and so on.

The Soviets might also deploy a space-based Phase I system of their own. As Caspar Weinberger wrote in 1985, this "would require us to increase the number of our offensive forces and their ability to penetrate Soviet defenses to assure that our operational plans could be executed."

We can expect the Soviets to do more. A recent report from the Center for Strategic Technology at Texas A&M University concludes that the Soviets are likely to increase the production of bombers and cruise missiles, which can fly under U.S. radar to reach their target. Dr. Loren Thompson told the Task Force staff that "according to current trends:

"It appears that by 1991 the number of Soviet Bear H bombers will exceed that of our B-1 s, and the number of Soviet AS-i 5 cruise missiles deployed with them will be approximately 1,000.. The appearance of long-range sea-launched cruise missiles aboard Soviet attack submarines and the reduced acoustic signature of newer Soviet subs suggest that land attack missions against the United States will be much more feasible in the future."

The danger in the long run is that as cruise missiles become more and more difficult to detect, through application of stealth technologies, they may become a silent “first strike” weapon. General Scowcroft told the Task Force, “I’m not convinced that in the long run cruise missiles would be advantageous to the U.S.” Therefore, while it is sometimes argued that Phase I will force the Soviets toward more “stabilizing” weapons deployments, it is difficult to see how thousands of air-launched, sea-launched, and ground-launched cruise missiles added to the Soviet arsenal will make the world more stable.

It does not appear that deploying a partially effective defense (such as Phase I) would have a stabilizing effect on the arms race. The Soviets have too many existing and potential countering technologies, such as newer ICBMs, decoys, ASATs, their own defensive weapons, bombers, and cruise missiles. The apparent vulnerability of Phase I to ASATs in particular also means that “an adversary could well have an incentive in a crisis to strike first at vulnerable elements of the defense,” as Ambassador Nitze wrote in 1985. The issue of crisis stability, however, goes beyond the system’s vulnerability to attack, or its inability to deal with the proliferation of ICBMs and cruise missiles.

Offensive Uses of Strategic Defenses

While partially effective defenses may not be effective enough to stop a concerted first strike, they may be effective enough to “mop up” a ragged retaliatory “second strike” force. Therefore, large-scale defenses, if used in conjunction with offensive forces, could appear to give the side possessing them a so-called first strike capability.

Although a massive U.S. first strike against Soviet strategic nuclear forces does not represent U.S. strategic planning, it is a scenario a prudent Soviet planner must consider. If the U.S. attacks first, the Soviets must consider the possibility that they would lose much of their bomber, submarine, and ICBM forces. After suffering the ravages of a U.S. attack, the Soviets might not be able to retaliate effectively with the remainder of their forces in the face of a U.S. Phase I. The Soviets may also have lost the ability to attack the vulnerable space-based elements of Phase I.

Would this not give America a perceived first-strike capability? President Reagan raised the issue in his original SDI speech:

“I clearly recognize that defensive systems have limitations and raise certain problems and ambiguities. If paired with offensive systems, they can be viewed as fostering an aggressive policy, and no one wants that.”

Understandably, many were concerned by the January 1988 SDI Organization report to Congress that outlined a command structure for Phase I that would provide for “integrated operations with strategic offensive forces.”

If the Soviets were extremely concerned about the potential offensive use of Phase I, they might announce to the world that they will not tolerate U.S. space-based defenses and that they will shoot them down as we are putting them up. This is, according to most analysts, a difficult problem for us and would engender dangerous superpower confrontation.

Another option is deployment by the Soviets of defenses of their own. When combined with the hair-trigger needed for space-based systems, we can see that mutual deployment of defenses similar to Phase I could make escalation to nuclear war during a crisis significantly more likely. This would create a condition of crisis or first-strike instability, which deserves closer inspection because it goes to the heart of the question of the possible effect of Phase I on deterrence.

The Effect of Phase I on Stability and Deterrence

Phase I is designed to protect a fraction of our important military targets, primarily our ICBMs, from a Soviet first strike. In this way, it is said, Phase I will complicate a Soviet attack and thus enhance deterrence.

On the subject of “enhancing deterrence through protection of assets,” General Kent told the Task Force, “It’s a very complicated and wrong idea. I don’t think it has merit.” **General Scowcroft told the Task Force that Phase I “would enhance deterrence only in the sense that it would force a very heavy attack” by the Soviets. He said, “I think there is a real problem with enhancing deterrence at the cost of increasing crisis instability or at least arms race instability.”** Former DARPA director Robert Cooper told the Task Force, “I just don’t see that there is a useful military mission that can be fulfilled with such (Phase I] technology.”

Moreover, an analysis of strategic defenses that assumes only the United States has deployed defensive weapons is incomplete. History shows that the Soviets can and do match our strategic deployments, and we must consider what will happen when the Soviets deploy their own Phase I.

In a world of mutual defense deployments, if the Soviets launch a first strike, our Phase I might well increase the number of U.S. ICBMs that survive the attack. But if our Phase I can shoot down several hundred of their attacking ICBMs, then their Phase I can shoot down several hundred of our retaliating ones. In this scenario, it is possible that very few U.S. ICBMs would land in the Soviet Union—a worse situation than we are in today.

This is potentially an extremely serious problem. General Kent considered the effect on stability of mutual defensive deployments in a 1988 paper and concluded,

“There is no validity to the concept of deploying nationwide defenses to gain some sort of an optimum balance between offense and defense and

thus, presumably, to enhance stability. In the grand scheme, there is no place for so-called partial nationwide defense.”

Dr. Cooper said he doesn't believe the system would increase Soviet uncertainty in the outcome of an attack on our ICBM force “one iota.” On the same subject, General Kent said, “How can we increase the uncertainty?” He pointed out that the Soviets already do not know how many of our ICBMs they would destroy in a first strike, or if we will launch some or all of our ICBMs before theirs land. There is “little problem with stability today,” he said, and “no incentive to strike first.”

In April 1983 the Scowcroft Commission reached a similar conclusion in its analysis of the possibility of a massive Soviet surprise attack on U.S. ICBMs, the so-called “window of vulnerability”:

“To deter such surprise attacks we can reasonably rely both on our other strategic forces and on the range of operational uncertainties that the Soviets would have to consider in planning such aggression.”

General Scowcroft told the Task Force that his primary conclusion today is the same as it was five years ago . . . mobile missiles and arms control are better ways of enhancing deterrence and stability than deploying defenses. Dr. Cooper also told the Task Force that he felt the U.S. planned strategic modernization “would give the Soviet military planner a much harder heartache” than Phase I. Dr. Cooper (and General Kent) told the Task Force that effective defenses would be viable only if offensive forces were drastically reduced. As General Kent wrote,

“The matter of deploying strategic defenses is clearly subordinate to the more encompassing matter of reducing ballistic missiles to zero or near zero.”

Strategic defense could be considered at some point in the future when arms control negotiations have reduced the number of nuclear missiles to a few hundred. Until then, the deployment of a partially effective defense in a world of tens of thousands of nuclear warheads would not enhance deterrence, increase stability, or make nuclear war less likely. The proliferation of nuclear systems and counter-systems and the necessary increased reliance on hair-trigger computerized responses would increase the chances of intended or unintended nuclear war.

Several of the experts who spoke to the Task Force indicated that bilateral deployment of more advanced technologies would likely exacerbate the destabilizing effects of Phase I--even if such technologies achieve perfect accuracy, deception-resistance, and lethality. Such technologies, if employed by both sides, would increase rather than decrease the Soviet incentive for a nuclear first strike. According to the recent OTA report, however, **“SDIO and its contractors have conducted no serious study of the situation in which the United States and the Soviet Union both occupy space with comparable [ABMI systems.]”**

An essential requirement for deterring or defending against any first-strike is time. The military temptation of a first strike lies in the possibility that the aggressor can disable the other side's retaliatory or defensive capability before that capability can be employed. If later-phase defensive technologies employ directed energy weapons striking at the speed of light, they provide an aggressor an almost absolute time-advantage: The defense will have no time whatever to respond between firing and impact of the aggressor weapons.

Therefore, the hair-trigger response times that would be created by Phase I would be reduced even further if each side had weapons that could suppress the other side's defenses instantaneously. In theory, the aggressor would be able to annihilate the other side's defense and follow up with a nuclear strike, while maintaining his own space-based systems intact to block the other side's retaliation. In such a world, first strike could appear highly advantageous, making nuclear aggression more probable, and stability more difficult to achieve.

The Role of Arms Control in American Defense

Protecting America and its allies from nuclear attack is our most important national security objective, but the threat of nuclear war is not one which can be eliminated with a technical fix. For the foreseeable future, arms control and unilateral measures such as mobile or transportable ICBMs, not Phase I, offer a more realistic means of increasing stability and hence of reducing the likelihood of nuclear war. **Dr. Cooper said, "You can go a long way in the direction toward comprehensive strategic defense without violating the ABM Treaty." General Scowcroft told the Task Force that adhering to the traditional Interpretation of the ABM Treaty for 10 years "would not hamper very seriously what we need to do."**

As to how we are to use SDI to help achieve stabilizing arms control measures, we agree with the Senate Armed Services Committee, which wrote in 1986 that it was "not necessary to fund the President's entire request for SDI to maintain our negotiating leverage in Geneva," and that "leverage for arms control negotiations only comes from real defense programs which are aimed at realistic objectives."

Congress applauds the recent progress that has been made in arms control with the signing of the INF Treaty and supports the President's efforts to achieve reductions in offensive missile forces, particularly destabilizing silo-based heavy ICBMs. There is, however, great concern about the failure to use the leverage provided by SDI research to reach an agreement with the Soviets based on limiting SDI technologies in return for deep cuts. This failure appears to be a reflection of a mistaken belief that no compromise on Star Wars testing and deployment is desirable because SDI offers a unilateral technological "solution" to the threat of nuclear war.

Nuclear deterrence based on the threat of retaliation is not a strategic **policy** that can be adopted or discarded at will. It is a strategic **reality** existing because nuclear weapons exist and because their destructive power is so great that even a small-scale nuclear war would destroy the ability of both the United States and Soviet Union to function as modern technological societies. Instead of trying to avoid this reality through premature deployment of defenses, the U.S. must take bold and serious steps to reduce the threat of nuclear war by enhancing the survivability of our forces, either through arms control agreements or through the deployment of inherently survivable weapons, thus enhancing deterrence by ensuring our ability to retaliate against any Soviet attack.

To achieve this end, Democrats support:

- **Preserving and strengthening the 1972 ABM Treaty.** Continued observance of the ABM Treaty is in the best national security interests of the United States. By constraining the testing, development, and deployment of ABM systems and components, the ABM Treaty prevents a defensive arms race and reduces pressures on both sides to build additional offensive missiles. Several issues need to be addressed in the face of changing technologies. These include so-called "rules of the road" issues, such as negotiating specific threshold limits that would clarify the Treaty's restrictions on what constitutes an ABM "component," what constitutes "development," and what constitutes a "test in an ABM mode." Compliance issues dealing with problems such as large phased-array radars should be resolved using the Standing Consultative Commission.
- **Negotiation on limiting anti-satellite (ASAT) weapons.** The United States increasingly depends upon satellites for communications, intelligence, and early warning against an attack. If there is an ASAT arms race, these critical satellites will become vulnerable - at great risk to our national security. Democrats believe that the current U.S. ASAT system, the Miniature Homing Vehicle (MHV), is not a good weapon system. The congressionally mandated moratorium on MHV testing should be preserved. Many SDI technologies would have applications as ASAT weapons long before they could be used for missile defense. As a result, a costly and destabilizing ASAT competition could be one legacy of the SDI program. It is widely agreed that continued U.S. and Soviet space weapon testing will introduce new threats to military satellites--including components of any possible space-based defense. This important aspect of the SDI debate has been largely overlooked.
- **Negotiations aimed at increasing the survivability of the nuclear arsenals of both superpowers,** and deployment of inherently survivable weapons in order to increase crisis stability. Such negotiations should seek to reduce or eliminate destabilizing weapons (for example, those that are both potent and vulnerable), to reduce nuclear stockpiles, and to limit their testing. For the foreseeable future, such unilateral deployments and bilateral negotiations together represent our best hope for enhancing deterrence, for reducing the chances of nuclear war, and for achieving a more stable and cooperative world.

NEW DIRECTIONS FOR SDI

While we have seen that Phase I deployment would not be in the nation's security interest, it may be that other, more reasonable goals for the program could be worthwhile.

Keeping America First

What can we reasonably expect to accomplish with SDI?

In 1987 Congress pointed the way toward the kind of research SDI should pursue when it passed a sense of Congress resolution that concluded,

"The primary emphasis of SDI should be to explore promising new technologies, such as directed energy technologies, which might have long-term potential to defend against a responsive Soviet offensive nuclear threat."

American scientists have conducted this type of basic research for many years and have been successful in keeping the United States ahead of the Soviet Union in many key defensive technologies. **The Under Secretary of Defense for Research and Development reported in November 1987 that the United States leads the Soviets in 13 of 16 technology areas crucial to strategic defenses.** While the SDI effort has not yielded any major breakthroughs, there has been steady technical progress in some areas, such as miniaturization and optics.

We should fund this work at a reasonable and stable level in future years in order to protect against military or technologic surprises harmful to United States security. A coherent and balanced defense program would fund SDI in accordance with our other pressing defense needs.

An Advanced Launch System

The problem of putting large payloads in orbit at reasonable cost must be solved. To put objects in low earth orbit now costs about \$3000 a pound, which is almost the price of gold. For this reason, Congress has actively funded the Advanced Launch System (ALS), which the Administration plans to be a reliable launcher that puts payloads in orbit for only about \$400 a pound.

The Defense Science Board said in July 1987 that linking the ALS with the SDI program could cause unnecessary delays in one of the programs. The Board urged a "more conservative approach," saying, "Plans for ALS as briefed to us...predict launch costs and launch rates which appear unlikely," and told SDI officials that they "should recognize the possibility that Phase I may have to be launched with existing vehicle

types.”

The nation's need for a new, inexpensive and reliable space transportation system might suffer if ALS remains linked with SDI. Congress, in fact, has passed a law prohibiting the use of ALS for the early deployment of SDI weapons satellites. The ALS program should be encouraged and developed separate and distinct from SDI.

Guarding Against Soviet Breakout

The 1972 ABM Treaty prevents the Soviet Union and the United States from deploying more than 100 ground-based interceptors at a single site. Periodically, there are concerns in some sectors that the Soviets are preparing to “break out” of the treaty by deploying a large-scale territorial defense. One important purpose of U.S. research on defensive technologies is to help guard against this possibility.

One unilateral U.S. response to this concern is work on advanced missiles, warheads, and penetration aids that would be used to thwart and overwhelm Soviet defenses. The U.S. has been pursuing work on penetration aids for more than 30 years. It did not, however, become a serious program until the late 1960s in response to Soviet ballistic missile defense efforts. According to Lt. General A.W. Betts:

“The best early work on pen aids, from a creative point of view--ideas and capabilities--came out of the ARPA (Advanced Research Projects Agency] guys who were working in the Defender program trying to figure out ways that Defender could be defeated as well as ways our own offense could be stronger.”

This increased effort on the part of the United States resulted in the deployment of Multiple Independent Reentry Vehicles (MIRVs) in the 1970s, in part a U.S. response to the Soviet ABM system around Moscow. This effort has continued throughout the 1970s and 1980s, resulting in the development of various types of penetration aids: Chaff, aerosol, decoys, balloons, and maneuvering re-entry vehicles.

In March 1987, Lawrence Woodruff, Deputy Under Secretary of Defense for Strategic and Theater Nuclear Forces, described U.S. capabilities to the House Armed Services Committee this way:

“The Soviets have been developing their Moscow [ABM] defenses for over ten years at a cost of billions of dollars. For much less expense we believe we can still penetrate these defenses with a small number of Minuteman missiles equipped with highly effective chaff and decoys. And if the Soviets should deploy more advanced or proliferated defenses, we have new penetration aids as counters under development.... We are developing a new maneuvering re-entry vehicle (MaRV) that could evade interceptors....”

Dr. Woodruff continued,

“As long as ballistic missiles play a major role in maintaining deterrence, we will need to ensure the continued capability of our ICBMs and SLBMs [submarine-launched ballistic missiles] to penetrate current and potential Soviet defenses. To

this end we have a vigorous R&D effort under way in the Advanced Strategic Missile System (ASMS) program to develop suitable penetration aids.... For advanced threats we are developing a new maneuvering re-entry vehicle (MaRV) that could evade interceptor missiles....

“At present, there are no convincing signs of Soviet development of ABM systems using optical sensors, but our intelligence community believes that adjunct systems for exo- and endo-optical discrimination are within Soviet capabilities. Should the Soviets deploy such a system, the most promising U.S. response would be to use a MaRV and a thrusted replica decoy.”

The new MaRV is gaining recognition in the Pentagon as an effective counter to Soviet advances in ballistic missile defenses. Initial US technology demonstration flight tests are planned for 1990 and 1991. According to Ashton Carter, associate director for the Center for Science and International Affairs at Harvard University and a former Pentagon systems analyst who worked on the MX missile program, “MaRV would murder the Gazelle [the new Soviet antiballistic missile being deployed around Moscow].”

The most effective way for the United States to guard against a sudden, treaty-violating, Soviet break-out deployment of ABM systems would be to increase our research efforts on decoys and improved penetrating warheads. These can defeat any known or anticipated Soviet land-based ABM system.

Another possible way to guard against Soviet break-out that is often raised is for the U.S. to gain hands-on experience with ground-based interceptors of its own. This could be accomplished by having a more active test program at the U.S. Pacific test range at Kwajalein. The idea that the U.S. can deter Soviet ABM break-out by developing an ABM system of its own needs further study. There has not been enough work done on examining situations where the United States and Soviet Union both have comparable defensive systems.

SDI research should also focus on the development of improved space-based sensors for providing early warning of missile launches and for improving our ability to verify Soviet compliance with negotiated treaties.

PROTECTING AGAINST ACCIDENTAL LAUNCHES

A number of policy-makers have expressed interest in a redirected SD1 program which would also examine near-term options. Senate Armed Services Committee Chairman Sam Nunn raised the issue as part of an overall criticism of the current direction of the SD1 program. He said:

“If carefully redirected, our research efforts could produce options for limited deployments to deal with the frightening possibility of an accidental or unauthorized missile launch... This should be coupled with a rigorous unilateral review by both sides of their respective fail-safe procedures and safeguards.”

This accidental launch protection option needs a great deal of analysis of its technical, strategic, and arms control implications, as well as its cost, before any decision to move toward engineering development should be considered.

To gain a broad perspective on the issue, the Task Force received briefings from contractors, and requested answers to technically relevant questions from the Office of Technology Assessment. In addition, one of our Co-Chairmen, Charles Bennett,

requested a detailed technical analysis of Lockheed's proposed system by Dr. Theodore Postol, former scientific advisor to the Chief of Naval Operations.

These reviews raised technical and legal issues that must be explored further. For example, there are questions of whether even a limited deployment of 100 missiles, such as the ERIS system proposed by Lockheed Corporation, would be in compliance with the ABM Treaty. The Office of Technology Assessment staff report to the Task Force concluded that an ERIS-type system could be effective against a small accidental launching from Soviet territory, if no penetration aids were used, but the system would have trouble dealing with a launch of more than five missiles. Dr. Postol noted that such a system could not defend the major industrial and population centers of the entire Northeast against a missile launched from a submarine off the coast of the United States. Just what kind of coverage is possible is not clear.

Many analysts believe that an accidental launch protection system would require interceptor sites on both coasts. Such a multiple-site system might require several new large radar and would probably be much more expensive than a single site system. It would require an abrogation or amendment of the ABM treaty.

This also raises the issue of a Soviet accidental launch system. The Soviet Union is much larger than the United States. For the Soviets to achieve a nationwide defense against accidental launch might require many more than 3 sites, and upgrades to dozens of their radars. Is this desirable from a U.S. perspective?

Most disturbing, an ERIS-type system deployed by either country would have a very large capability to target satellites. Dr. Postol notes,

Such a system would introduce a qualitatively new scale of ASAT threat to the satellites of other nations. For example, if the U.S. has an ERIS-like defense system with geosynchronous altitude capabilities in place today, it could be used to launch a simultaneous attack on two thirds of the Soviet Union's satellites. A similar Soviet ERIS-type system, in turn, could simultaneously attack more than ninety percent of U.S. satellites."

Another issue is that such systems are extremely dependent on a rapid response time. An ERIS interceptor, for example could be launched 100 seconds after a "threat launch." This leaves almost no time for a human to assess the accuracy of the early warning sensors, and then approve and activate a system launch. False alarms are common. According to a 1981 Senate report, they averaged six a day during 1979 and 1980. This raises the distinct possibility that the system could itself be launched

accidentally, if the system mistakenly thought America was being attacked by a single missile carrying 10 warheads, it might launch 10 or 20 ERIS interceptors. The launch of several such missiles could initially appear to the Soviets as a multiple ICBM launch. We would be put in the same situation if the Soviets deploy a similar system.

If the Soviets viewed the limited nation-wide defense as a foot-in-the-door effort to break out of the ABM Treaty or as a partial defense of our own ICBM fields (a capability noted by several contractors), they could develop methods to overcome it with relative ease. **Harold Brown told the Task Force that if the U.S. deploys such a system and the Soviets do too, then both sides would certainly deploy penetration aids on their missiles.** In that case, our ability to deal effectively with an accidental launch of even a single ICBM would be undermined. (The U.S. now has penetration aids on some of its missiles in response to the limited Soviet defense around Moscow.)

While representatives from Lockheed Corporation testified that they could discriminate warheads from decoys using radars in conjunction with the infrared detectors, the OTA staff concluded "...there are plausible decoy designs that would be very difficult to counter with passive infrared sensors in conjunction with radar." (This issue is discussed in more detail on page 22.) The conclusion of most analysts, including Harold Brown, is that the midcourse discrimination problem remains unsolved.

Ideally, if the U.S. decided to deploy an accidental launch protection system, and the Soviets said they also wanted one, then amendments to the ABM treaty and deployments would be accomplished in a cooperative spirit. If the Soviets want to cooperate, Dr. Postol suggests consideration should be given to a Destruct After Launch system. Some of the components of such a system would utilize existing range safety technology. Senator Nunn links exploration of an accidental launch protection system with a rigorous review of other safeguards. This option deserves greater attention.

Improving Program Management

The next Administration should decide how and where strategic defense research should be conducted. Several experts, including Dr. Cooper, suggested to the Task Force that the research could be better managed and coordinated if the program were not a special entity but part of the normal Defense Department organization. This would ensure a balanced research effort of the type proposed by the Task Force and one that was coordinated with related research in other defense agencies.

Congressional hearings this year have disclosed several management problems and conflicts of interest with the current management structure. Senate hearings, for example, found instances of apparent conflict of interest among SDI advisors and consultants. Members of some advisory boards may have profited from subsequent SDI contracts. House hearings revealed that the SDI program lacked basic defense department internal management controls. As the Inspector General of the Department of Defense discovered, this meant that management information was "fragmented, uncoordinated and lack(ed) integration," and that some SDI consultants were paid by the program long after their appointments expired.

Better management must be imposed on the SDI program. Research should be subject to the normal scientific peer review given all major research programs and the normal checks and balances employed by the Department of Defense and the Joint Chiefs of Staff. Congress may want to give the same detailed attention to the management of the strategic research program that it routinely gives to all research and development (R&D) programs. **While the SDI budget is nearly equivalent to the Army R&D budget, Congress authorizes 186 separate line items in the Army R&D budget -- but only one line item in the SDI R&D budget.**

CONCLUSIONS AND SUMMARY

There is broad support for a realistic, balanced and de-politicized research program into strategic defenses. This research would keep our nation competitive in advanced strategic technologies without precipitously committing to expensive, destabilizing, and high-risk weapons programs.

Such a program would turn away from dangerous illusions and towards the hard reality of the strategic balance. The future is a world not of strategic defenses, but of tough strategic choices. The nation's security is best served by a pragmatic program that allows America's best scientific minds to research advanced technologies, that judiciously allocates our defense dollars, and that is carefully coordinated with our arms control negotiations and offensive nuclear programs.

Congress has provided the Strategic Defense Initiative (SDI) with \$13 billion over five years. With Congressional support the program has grown to account for approximately 10 percent of all military research and 10 percent of all funding (research and procurement) for strategic programs.

The SDI program cannot within the foreseeable future reach the President's goal of eliminating the threat posed by strategic nuclear missiles. Research on advanced technologies such as directed energy weapons holds out the possibility that some day significantly more effective defense systems may be possible. It will be at least a decade before we can make an informed decision whether to build such weapons.

Absent major technological breakthroughs, there is no pressing national security interest that compels a program to deploy strategic defenses in the next decade. America's existing triad of strategic forces, and the great uncertainties Soviet planners confront in considering a surprise first strike, provide a powerful deterrent to an attack. A combination of stabilizing strategic programs and arms reductions could enhance deterrence and lower the chance of nuclear war for far less cost and considerably less risk than the new weapons system proposed by SDI officials.

SDI program managers have set a new goal for the program: the near-term deployment of a partial defense of United States nuclear missile silos and command centers. Contrary to public perception, the goal for the foreseeable future is not a population defense. Last year, SDI officials proposed and the Department of Defense approved the development of Phase I of a "Strategic Defense System," or SDS, consisting primarily of about 300 satellites with interceptor rockets designed to shoot down a small fraction of enemy nuclear weapons.

Unless both nations have agreed to arms control treaties severely reducing their nuclear arsenals, the deployment of the Strategic Defense System would probably trigger a Soviet proliferation of nuclear weapons to overwhelm the system and counter-weapons to defeat the system. SDI officials propose a “phased deployment” in which Phase I of SOS would be launched in the mid-1990s and continually supplemented with new, hopefully more effective, phases. Phase I might be launched without assurance that the follow-on phases would work. Phase I would violate the ABM Treaty, removing all restraints on defense deployments.

A variety of Soviet responses to overcome the deployment of the Strategic Defense System appear feasible. In addition to building up their offensive nuclear missiles to overwhelm the system, probable Soviet responses to the deployment of SDS include deployment of decoys to fool the system, deployment of a variety of anti-satellite weapons to attack the system, and possible deployment of a Soviet SOS.

In the absence of deep arms reductions, the deployment of partially effective strategic defenses by both the United States and the Soviet Union would not enhance deterrence, increase stability, or make nuclear war less likely. The proliferation of nuclear systems and counter-systems and the necessary increased reliance on hair-trigger computerized responses would increase the chances of intended or unintended nuclear war. The Task Force concurs with a Defense Science Board panel and the Congressional Office of Technology Assessment: We could find no evidence that the Defense Department had seriously considered how Soviet deployment of a defensive system comparable to SOS would affect crisis stability.

Because SDS is so poorly defined, no precise cost estimate is possible. But most agree that the costs would be in the hundreds of billion of dollars, even without the logically essential addition of a massive new air defense system.

The Strategic Defense System would not protect the American population or military installations from nuclear cruise missiles launched from Soviet bombers or submarines. Long-range cruise missiles form an increasing part of the Soviet arsenal and, absent negotiated restrictions on their deployment, could grow to become as much of a threat to the United States in the next century as ballistic missiles are today, or as Soviet bombers were in the 1950s. SOS is not designed to defeat this threat.

The major technical problems that remain unresolved are the same obstacles that have ruled out an effective ballistic missile defense for almost thirty years. The basic problems with the proposed SOS are the ability of the enemy to overwhelm a system with offensive missiles; the questionable survivability of space-based weapons; the inability to discriminate among real warheads and hundreds of thousands of decoys; the problem of designing battle management, command, control and communications that could function in a nuclear war; and low confidence in the ability of the system to work effectively the first and only time it is ever used. Scientific review of the research indicates that it will take decades, if ever, to solve many of these problems.

Phase I of Strategic Defense System, particularly its space-based elements, does not appear likely to meet the criteria for military effectiveness, survivability, and cost-effectiveness. Considerable expert opinion, particularly from scientists engaged in research at our nation's weapons laboratories, strongly suggests that SOS would not satisfy these criteria. Moreover, the variety of responses that the Soviets have to SOS mean that space-based interceptors encourage, rather than discourage, Soviet ICBM modernization.

Pursuit of the Phase I of the Strategic Defense System is premature and distorts the direction of needed research into strategic defense technologies. Experts outside the SDI program, including a Defense Science Board panel, do not share the optimism expressed by SDI officials about the feasibility of SOS. Scientists at our national laboratories are increasingly concerned that research on more promising long-term technologies is being sacrificed in an attempt to field something soon, however inadequate.

The United States could continue to adhere to the 1972 Anti-Ballistic Missile Treaty for the foreseeable future without impairing strategic defense research. There is a great deal of basic research that needs to be done before the feasibility of effective ballistic missile defense is determined. This work can be performed within the limits of the ABM Treaty. Proceeding with the development of Phase I of SOS would violate the ABM Treaty.

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