

October 2, 1987

STRATEGIC DEFENSE: HOW MUCH WILL IT REALLY COST?

INTRODUCTION

Opponents of providing the United States with a defense against a Soviet missile attack have been trying to sink Ronald Reagan's Strategic Defense Initiative--SDI, or as it is popularly known, Star Wars--under the weight of a putative \$1 trillion price tag. Some critics warn that SDI actually could cost two and one-half times that. These claims, almost entirely unsubstantiated, have made the cost issue a major stumbling block to development of SDI.

In truth, however, SDI will cost American taxpayers just a fraction of these deliberately inflated estimates. While it is unlikely that SDI will be as cheap as the \$40 billion claimed by some SDI backers, the price tag probably will be in the range of \$115 billion to \$120 billion spread out over ten years.

Some variance in defense program estimates is normal because of the differences in researcher expertise, disagreements over details, or simple miscalculations. In the case of SDI, the huge estimate gap exists because there are fundamental differences in the assumptions, the biases, and very important, the motives of those preparing the estimates.

No Agreement on Mission. Before SDI's cost can be accurately estimated, there must be a common understanding of the mission and parameters of the program. This is missing from the debate. Neither the Reagan Administration nor Congress has focused on a specific SDI proposal. There is no widespread agreement on SDI's mission or on which technologies should be pursued to achieve this mission. In the absence of specific program outlines or technical proposals, SDI critics are free to base cost estimates on the most expensive, and in many cases least likely, strategic defense scenarios. As a result, their estimates are extremely excessive.

With the research conducted so far and the technological breakthroughs coming more rapidly than expected, however, enough is known about the capabilities of

strategic defense technologies to develop reasonably reliable cost estimates for a near-term strategic defense. Such a system would employ:

- 1) a space-based, kinetic-kill vehicle system costing about \$50 billion;
- 2) a ground-based guided missile component costing around \$22.5 billion;
- 3) a guided missile terminal defense costing about \$13.5 billion; and
- 4) the sensors and radar needed for this three-tiered defense, costing about \$32.5 billion.

The price of a longer-term defense is more difficult to estimate because research is only in the initial stages for many of the most potentially useful technologies and costs may either increase or decrease depending upon future developments. Technological breakthroughs and cost-saving modifications, such as further miniaturization of components, may reduce anticipated costs even more for both short- and long-term technologies. In any case, even the most careful estimate will be approximate.

Enough is known, however, to conclude that the estimates by SDI opponents are very excessive. The way to settle the cost issue is for Reagan and the Pentagon to propose a specific near-term anti-ballistic missile program. Only when crucial questions are answered regarding SDI's mission and structure can final cost calculations be made.

THE SDI MISSION

The Strategic Defense Initiative was devised as an alternative to the Mutual Assured Destruction doctrine, which for several decades has based deterrence on the threat of massive retaliation and subsequent destruction of U.S. and Soviet societies. From the outset, the mission of SDI has been to redefine deterrence by giving the U.S. the means to protect its population and assets from Soviet attack.

While the ultimate objective is a defensive system that can protect the U.S. population directly, the more immediate goal, according to the Pentagon's Strategic Defense Initiative Organization's (SDIO) Chief Scientist, Allan Mense, is "to devalue Soviet offensive ballistic missiles in the mind of the Soviet offensive mission planners."¹ A strategic defense that is 90 percent effective, a level of effectiveness most SDI scientists feel is attainable, will certainly cause this devaluation.

Deterring a First Strike. Even if the feasibility of a layered strategic defense of over 90 percent effectiveness can be documented, the value of such a system is doubted by those who argue that a level of protection less than 100 percent is inadequate and undesirable. An SDI system capable of destroying 90 percent of all Soviet intercontinental ballistic missiles (ICBMs) that are launched, while not

1. Dr. Allan Mense, Acting Chief Scientist, Strategic Defense Initiative Organization, briefing on March 20, 1987.

"leakproof," would render the Soviet ICBMs "impotent and obsolete." If Soviet war planners know that 90 percent of the Soviet missile force is going to be destroyed in flight, their confidence in the success of a Soviet first strike is substantially diminished. The Soviet ICBM force will have been so devalued that it is no longer able to accomplish its mission. Realizing this, the Soviets will not launch their ICBMs. Thus, a defense may be much less than perfect and still provide total population protection by deterring a Soviet nuclear offensive.

SDI also could provide an equally valuable and unprecedented secondary protection. If the Soviets do launch a first strike, or if a limited number of ICBMs are launched accidentally or by an unstable smaller nuclear power, SDI could destroy almost all of these incoming missiles. At present the U.S. has no such capability. Any missile launched at the U.S. will hit it. The U.S. today is naked to any missile attack.

The SDI mission is deterrence through defense of populations and strategic forces. Perfect technology and 100 percent effectiveness are not required to accomplish this mission. Estimates of SDI's cost predicated on the requirement of constructing a "leakproof umbrella" add immensely and unnecessarily to the cost of strategic defense.

THE SDI STRUCTURE

Many differing technologies have the potential to fulfill SDI's mission requirements. Some, such as lasers and particle beams, show great promise, but also require ten to fifteen years of research and development before deployment. Other technologies will be available in the next five years for construction and deployment of an effective SDI system at a reasonable cost. The mainstays of such a near-term system will not be lasers or particle beams, but kinetic energy weapons (KEW): space and ground-launched anti-missile rockets.

A layered KEW strategic defense could destroy up to 90 percent of the warheads from a massive Soviet ICBM attack. This near-term system could be upgraded as new technology matured. The U.S. should deploy a near-term KEW system as soon as possible to offset the immense Soviet strategic arsenal and increasing Soviet efforts in ballistic missile defense.²

Kinetic energy weapons are the most promising systems for the immediate future because the technologies they draw on are the most mature. Attempts at cost estimates thus should focus on near-term technologies, the kinetic energy weapons and the associated systems required to weave them into an effective defensive system. Yet SDI critics largely ignore these promising and relatively inexpensive technologies. Instead they base their estimates on far more expensive exotic proposals such as advanced laser technologies, which will not be available for years.

2. The CIA estimates that the USSR has spent \$150 billion on strategic defense (fifteen times the U.S. expenditures) over the last ten years. *Strategic Defense*, December 4, 1986, p. 1.

THE INFLATED ESTIMATES OF SDI OPPONENTS

In addition to failing to accept SDI's deterrent mission and ignoring relatively inexpensive near-term technologies, many of the excessive cost estimates rely on imprecise methodology. Typical of this is developing estimates based on the relationship between past research programs and the systems that developed from them. This type of estimate can produce only the vaguest picture of a new system's cost. In the case of SDI, much of the hardware for a near-term kinetic-kill system either already exists, or is so similar to other current systems that relatively reliable, specific cost estimates can be made. Wherever possible, cost estimates should be based on careful analysis of the specific pieces of hardware needed to carry out the assigned mission.

One of these generic estimates, produced by the Council on Economic Priorities, places the cost of SDI at from \$400 billion to \$800 billion.³ The figures were reached by merely multiplying SDI's research and development budget by an arbitrary percentage that was selected by comparing the relationships between research and development costs and final prices of past defense systems. The inaccuracy of this arbitrary formula is further guaranteed in this case by the unique nature of the SDI research and development phase. Unlike most research and development programs, which are focused and directed at one final outcome, SDI research and development programs are exploratory and encompass a broad range of very different technologies. Such an exploratory research program is inevitably more expensive than a more directed effort. A study by Barry Blechman and Victor Utgoff calculates the cost of a new-term, three-tiered SDI system at \$630 billion to \$770 billion.⁴ This cost estimate of a "comprehensive" defense system charges SDI with the cost of "upgrading" the space shuttle (\$33-\$47 billion) and adds \$159-\$209 billion in "operation costs." In addition to these inflationary factors, Blechman and Utgoff greatly exaggerate the number of defensive missiles and satellites needed to accomplish SDI's mission.

Primitive, Arbitrary Formula. The origin of the most often quoted estimate of SDI cost, \$1 trillion, is hard to trace. This widely circulated figure seems to have originated with former Secretaries of Defense Harold Brown and James Schlesinger--both SDI opponents.⁵ Though Schlesinger will not admit any responsibility for the \$1 trillion figure, Brown says he arrived at that mark by using a "rule of thumb" that involves multiplying the research and development expenses of the program by ten to determine its final cost.

Such a primitive and arbitrary formula cannot produce an accurate or reliable estimate. Brown erred twice more: he repeated the Council on Economic Priorities' error by failing to consider the unique nature of the SDI research and

3. Hartung and Nimroody, "What Price Strategic Defense?" Council on Economic Priorities newsletter, January 1985.

4. Barry Blechman and Victor Utgoff, "The Macroeconomics of Strategic Defense," *International Security*, Vol. 11, No. 3 (Winter 1986-87), p. 49.

5. John Collins, Senior Defense Specialist, Library of Congress, testimony before the Senate Armed Services Committee, January 20, 1987.

development program; and he started with an incorrect figure of \$100 billion for SDI research and development costs. Had Brown plugged the correct numbers into his formula, he would have arrived at a total SDI cost of \$260 billion.⁶ Brown, moreover, did not indicate how many years the program would run.

Had Brown focused his estimate on near-term systems, instead of on long-range high-tech laser and particle beam-based alternatives, he would have come up with a number somewhere in the neighborhood of \$130 billion--a fairly reasonable cost. But he did not. As result, the fictitious \$1 trillion estimate continues to be used by scientists, commentators, and journalists unaware of its shaky foundation. In the hands of budget-conscious Wisconsin Senator William Proxmire, the Brown/Schlesinger figure soars to "several trillion dollars."⁷

REALISTIC ESTIMATES

It is impossible to fix SDI costs over the next decade with precision, just as it is impossible to fix with precision the decade-long cost of such other federal programs as food stamps and welfare. Yet SDI research has progressed far enough for competent scientists to make intelligent cost estimates. These more realistic estimates take into account SDI's near-term requirements and properly assess the costs of available technology.

In 1982, High Frontier, an organization that studies near-term strategic defense, conducted an in-depth study that estimated the total cost of a near-term strategic defense system at \$40 billion.⁸ High Frontier's study based its conclusions on the assumption of a very modest mission for SDI and the system they evaluated relied too heavily on using cheaper "off-the-shelf" technology. Though High Frontier's resultant estimate is thought to be somewhat low by most experts, it was determined by a fundamentally sound method. High Frontier analyzed SDI's near-term requirements and suggested particular types of hardware to meet them. It estimated the cost of each component and the number of each the system would require. Several careful studies since 1982 have exceeded High Frontier's original estimate, but most have used the same sound methodology.

High Level of Protection. Estimates provided by Lt. Col. Simon P. Worden, Senior Policy Analyst at the White House Office of Science and Technology and former assistant to the director of the Strategic Defense Initiative Organization, put the cost of a near-term strategic defense system at "less, perhaps much less, than \$100 billion."⁹ According to Worden, the space-based missiles and ground-based

6. According to the Department of Defense, SDI's total research and development costs are only about \$26 billion--half of which has been devoted to near-term technologies.

7. Senator William Proxmire, "When you talk about 'star wars' you're talking trillions," *The Christian Science Monitor*, May 19, 1986, p. 16.

8. *High Frontier: A New National Strategy* (Washington, D.C.: High Frontier, Inc., 1982).

9. Simon Worden, "SDI: What Can We Do? When Can We Do It?," *National Review*, December 31, 1986, pp. 36-40.

sovereign-area-defense- interceptors that could be purchased and deployed for that amount would provide levels of protection high enough to make a successful Soviet first strike "impossible," thereby deterring any attack. This type of system, explains Worden, could be available by the mid-1990s and could be updated to a "multi-layered system" capable of "making obsolete the Soviets' trillion dollar offensive investment."¹⁰

A detailed study conducted by a panel of strategic defense experts at the George C. Marshall Institute comes to much the same conclusion, placing the end cost of a near-term, layered, kinetic-kill strategic defense system at \$121 billion. The Marshall Institute's study focuses on the most promising near-term SDI architecture: a three-tier system with space- and land-based components, capable of destroying Soviet ICBMs at various stages in their flights.¹¹

THE COST OF A NEAR-TERM STRATEGIC DEFENSE

The most promising near-term system would employ layers consisting of: space-based kinetic-kill vehicles (SBKKVs) targeted at the incoming missile's boost phase and post-boost phase; a ground-based component similar to Lockheed's Exoatmospheric Reentry Interceptor System (ERIS) to shoot down missiles in the mid-course of their trajectories; and a terminal defense, perhaps similar to McDonnell Douglas' High Endoatmospheric Interceptor (HEDI) to destroy those few missiles that get through the other two layers. A strategic defense system of this configuration could achieve effectiveness levels higher than 90 percent and would cost about \$118.5 billion in 1987 dollars, excluding operation and maintenance costs.¹²

SBKKV

Studies by the Department of Defense, relying on information obtained from contractors, indicate that space-based kinetic-kill vehicle interceptors would cost about \$1.5 million each. Each SBKKV would weigh about 500 pounds and cost about \$750,000 to launch. Another \$2.25 million must be added to the cost of each interceptor for building and launching the satellite that would carry the interceptor missiles. Defense Department data indicate that 11,000 SBKKVs would be needed to insure an adequate anti-ICBM force. The total cost for 11,000 SBKKVs, and their launching platforms would be around \$50 billion.

10. *Ibid.*

11. *Deployment of Missile Defense in the 1990's* (Washington, D.C.: The George C. Marshall Institute, December 1986).

12. This estimate and the supporting figures in subsequent paragraphs were derived from discussions with officials at the Department of Defense, the Strategic Defense Initiative Organization, Los Alamos National Laboratory, Lawrence Livermore Laboratory, Lockheed Aerospace Corporation, Rockwell International Corporation, McDonnell Douglas Corporation, High Frontier, Inc. Many of the figures used also appear in the Marshall Institute study, which is considered by many experts in the strategic defense field to be the most careful and most accurate unclassified study to date.

ERIS

Exoatmospheric Reentry Interceptor Systems would cost about \$1.3 million each and about the same amount to launch. Again, about 10,000 would be needed. The total cost of these missiles and their launchers would be approximately \$22.5 billion.

HEDI

High Endoatmospheric Interceptor-type systems, mainly because of the increased speed needed to counter ICBMs in the terminal stage of their flights, would be larger and more expensive, at about \$3 million per interceptor. HEDI launchers would run about \$1.5 million each. Researchers estimate that about 3,000 HEDI-type interceptors would be needed to provide an adequate terminal defense at a total cost of about \$13.5 billion.

Cost of Sensors and Radar

Added to the costs of the interceptors themselves must be the cost of the sensors needed for tracking and targeting Soviet ICBMs. Each of the three layers requires a different type of sensor to aim and guide its projectiles toward incoming targets. For the first layer, ten low-earth-orbit sensor satellites and four geosynchronous satellites (that maintain a position high in orbit over a particular point on the Earth's surface) would be needed to provide complete coverage of potential Soviet launch areas and missile paths. At \$1 billion and \$2 billion respectively, the total cost for the SBKKV layer's sensors would be about \$18 billion. The ERIS layer would require twenty airborne optical system (AOS) sensors at about \$500 million each for a total of \$10 billion. And the HEDI layer would need about thirty ground-based radars at about \$150 million each for a total of \$4.5 billion. The total costs for the sensors and radars needed by such a three-level defense would be about \$32.5 billion. This estimate does not include operation and maintenance costs. In addition to being irrelevant to the costs of building SDI, these costs are more difficult to figure accurately because of their hypothetical nature.

The costs of battle management computers and command, control, communications, and intelligence systems have not yet been studied adequately. Further work is needed in this area. Also, many of the components of the space-based tier of this system likely will require greater space-lift capacities than NASA currently has to put them into orbit. Even when the shuttle program is revived, a larger orbiter, or perhaps a return to large expendable boosters, will be needed to launch most of SDI's space-born components. NASA is currently working on this problem and the cost of the new heavy payload booster will be borne mostly by either the Air Force or NASA as part of the space station and other space projects.

Overall Short-Term Deployment Cost

The total cost to deploy the three-layered SBKKV-ERIS-HEDI system would be around \$118.5 billion. Though a large amount of money, it is reasonable when spread out over a ten-year period. At an average yearly expenditure of \$11.85

billion, this would amount to less than .01185 percent of the yearly federal budget and only .0028 percent of the annual GNP.

Given the cost of offensive systems, such as the B-1 bomber at \$27.3 billion, the MX ICBM at \$22.3 billion, and battle-ready nuclear aircraft carriers at \$6 billion each, a ten-year \$120 billion expenditure on a strategic defense system, which would actually defend the United States, should not be regarded as too expensive.¹³

Future systems will be based largely on the emerging technology of lasers, particle beams, or other advanced systems. Their costs thus are impossible to estimate accurately. Among the most promising and most talked about is the space-based laser. Estimated by SDI opponents to cost "trillions," reliable estimates on the cost of developing and deploying an effective space-based, anti-ballistic missile-laser place it as low as \$200 million. Though this estimate by the Department of Defense and scientists at Los Alamos National Laboratory in New Mexico is the best now available, these experts acknowledge that costs are likely to fluctuate greatly in the years before deployment of such a system becomes possible.¹⁴

EFFORTS TO MINIMIZE COST

The Strategic Defense Initiative Organization is working to minimize the cost of research and development by issuing competitive contracts. SDI planners are considering such cost-saving measures and concepts as the use of available, proved technology for the first phased deployments of the system and utilization of small "combat cells" rather than a large centralized command, control, and communication apparatus. Unexpected cost-saving technological advances may result from current SDI research.

An effective SDI system will eventually decrease U.S. offensive strategic expenditures by reducing reliance on offensive systems. Furthermore, research conducted for SDI will undoubtedly yield computer, sensor, and rocket technology useful in conventional and strategic military programs as well as in the space program and other industries.¹⁵

Finally, the cost in lives, land, and property of a Soviet nuclear attack on the United States would be incalculably higher than the \$100 billion to \$150 billion it would take to buy an effective strategic defense system. The cost of the damage caused by even a couple of accidentally launched intercontinental ballistic missiles or submarine-launched ballistic missiles dwarfs any reasonable estimate of SDI's cost.

13. Based on statistics from the Air Force and Navy.

14. Telephone conversation with Greg Canovan, Scientist, Los Alamos National Laboratory, May 1987.

15. Lt. Gen. James Abrahamson, Director of the Strategic Defense Initiative Organization, *Boston Globe*, January 14, 1987, p. 17, and Charles Bridge, Chief Scientist, Litton Industries, Inc., *Fort Worth Star Telegram*, January 14, 1987, p. 8B.

CONCLUSION

Until the Reagan Administration and Congress agree on the SDI mission and settle on a specific SDI system, the cost of an effective strategic defense cannot be calculated with precision. Realistic estimates by experts, however, indicate that SDI's cost will be well within reason--far below the \$1 trillion estimated by many of those determined to stop SDI. The costs, moreover, become even more reasonable when spread over ten years. The several hundred billion dollars that it may take to deploy strategic defense in the next ten years pales when compared to the over \$700 billion that the federal government will spend on Medicare and the \$260 billion on farm subsidies over the next decade (and these figures even assume that spending on these programs will remain at current levels).

The potential cost of SDI is a legitimate national concern, but the "cost issue" has become just another tactic by SDI opponents to derail the project. This focus on SDI's cost will continue to linger as long as SDI remains a vaguely defined research project. The President and the Pentagon must address this fundamental issue by developing a specific proposal for a near-term anti-ballistic missile program. The Soviet ICBM threat must be clearly defined, SDI's mission must be precisely delineated, and the structure and hardware proposed must be appropriate to both.

When the crucial questions regarding the SDI mission and structure are answered, accurate cost calculations can be made and SDI can be debated and judged on its merits. No doubt an effective defense against Soviet offensive ICBMs will be expensive. But when the benefits of SDI in terms of enhanced national security and increased U.S. foreign policy flexibility are added to the equation, SDI's benefits will outweigh its costs.

Grant Loeb
Policy Analyst