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1.0 Introduction

Two years have passed since President Bush directed that the SDI program be refocused on providing a missile defense system to protect the United States, its forces deployed abroad, and its friends and allies against accidental, unauthorized, and/or limited ballistic missile strikes. During this time, international events such as the Gulf War Scud attacks, the break up of the Soviet Union, and continuing proliferation of ballistic missiles and weapons of mass destruction have validated the President's decision. The Missile Defense Act exhibits the growing bipartisan consensus on our fundamental missile defense goals and on an acquisition strategy for achieving our missile defense goals. Discussions with Russia and our Allies on moving toward a cooperative Global Protection System are showing both progress and promise.

1.1 Background

In January 1991, the President redirected the SDI program away from its previous focus--deterrence of a massive Soviet ballistic missile attack--to providing protection to the United States, its forward deployed forces, and its allies and friends, against limited ballistic missile strikes, whatever their source. On the basis of that change, the United States began concentrating its ballistic missile defense activities in several broad areas.

During 1991 the role of ballistic missile defenses was identified within the new U.S. military strategy which focused on meeting regional threats and challenges; discussions were renewed with allies and friends on their participation in our ballistic missile defense program; the then-Soviet Government was approached to join us to permit the limited deployment of defenses and; a program strategy and acquisition approach was developed to support our revised policy objectives and to permit the deployment of ballistic missile defenses by the end of the decade.

Since January 1992 the United States has been developing a concept for a Global Protection System in response to Russian President Boris Yeltsin's announcement that Russia was ready to participate in a global system of defense against ballistic missiles. We also began intensive discussions with allies and friends, both individually and in multilateral fora, seeking their views on our proposed response to President Yeltsin and inviting their participation in a Global Protection System. At the June Washington Summit, the sides agreed to work together with allies and other interested states to develop a concept for a Global Protection System against limited ballistic missile attack and to develop the legal basis necessary for such a system. Presidents Bush and Yeltsin also agreed to appoint representatives to lead a High-Level Group to develop the concept for a Global Protection System. The High-Level Group conducted detailed and constructive meetings in July and again in September, which reflected the new strategic relationship. Subsequently, working groups were convened in October to begin working on the means and methods for implementing a Global Protection System. The United States is continuing discussions with the Russians and our allies and friends to consolidate progress toward the implementation of a concept for a Global Protection System.

And finally, we have worked to implement Congressional direction detailed in relevant legislation. A consensus has been established between the Congress and the Executive Branch on the role of missile defense in protecting the U.S., its friends and allies, and our forces abroad against limited ballistic missile attacks. As set forth in the 1991 Missile Defense Act and its amendment in the FY 1993 Defense Authorization Act, the Department is planning with Congressional approval to deploy the initial (UOES)[1] elements of advanced theater missile defenses by the mid-1990s and to provide an option to deploy an Anti-ballistic Missile (ABM) Treaty compliant defense (UOES) located at a single site around the turn of the decade as the initial step toward a highly effective defense of the United States.

1.2 Missile Defenses In U.S. Military Strategy

As described in the May 1991 and July 1992 Report To Congress on the Strategic Defense Initiative and other Departmental reports, the President's decision to refocus the SDI program was based on almost two years of intensive review of the changing international security environment. This new defense concept stressed continuous protection of the U.S., its forces abroad and allies against limited ballistic missile strikes, whatever their source. The rationale for the refocused program was twofold:

- First, while changes in the East-West relationship reduced the risk of conventional and nuclear war with the Soviet Union, political instability in the then-Soviet Union caused concern over the potential for accidental or unauthorized use of ballistic missiles.

- Second, concern about the increasing proliferation of ballistic missiles and weapons of mass destruction throughout the Third World and the growing threat that these weapons would be used in regional conflicts.

The program elements in SDIO that related to this concept were grouped together under the title GPALS, for Global Protection Against Limited Strikes. The purpose of a GPALS system is to protect, on a continuous basis, the American people and U.S. worldwide interests against both strategic and theater range threats. We are designing the defense to meet a threshold requirement to protect against ballistic missile threats of up to a few tens of warheads, with an objective of high confidence of very low or no leakage against up to 200 attacking ballistic missile warheads in a variety of scenarios.

Ballistic missile defense contributes to U.S. military strategy in a number of critical areas, including strategic deterrence and defense; forward presence; crisis response; and reconstitution.

[1] The User Operational Evaluation System (UOES) can best be thought of as exploiting operational assessment prototypes, providing, in case of an urgent operational need, a "system" capability during the demonstration and validation stage of development. While the UOES undergoes field testing and early operational assessment, the underlying or core acquisition program continues through the engineering and manufacturing development phase.

1.2.1 Strategic Deterrence and Defense

The United States will continue to rely on its strategic nuclear deterrent capability, including a survivable command, control, and communications system and a modified version of the traditional nuclear Triad. Ballistic missile defenses--including space- and ground-based interceptors and sensors--will provide protection for the United States against actions that are by definition undeterrable--accidental and unauthorized launches. They also can provide protection against limited, deliberate ballistic missile strikes which may threaten regional stability or the interests of U.S. allies and friends. Ballistic missile defenses could extend protection to our forward deployed forces and allies. Defenses will become an increasingly important indicator of American strategic capability and military strength--a tangible sign that we remain committed to providing security assistance to our friends and allies.

1.2.2 Forward Presence

The forward presence of U.S. forces can take many forms. Stationing forces in selected forward bases or aboard naval vessels is perhaps the most visible demonstration of U.S. commitment in key areas. Theater ballistic missile defense systems operating in concert with U.S. early warning systems will provide point and wide area defense and early warning to U.S. forward-based and expeditionary forces; space-based interceptors could provide continuous, global coverage against tactical missiles that exit the atmosphere for those forces against longer-range theater ballistic missiles. U.S. defenses, in combination with those its allies and coalition partners might deploy, would provide protection, on short notice, of U.S. forces, host nation forces, and ports and airfields for arriving forces. These defenses would also be capable of protecting population centers and would permit those at risk additional warning to undertake civil defense measures. Such a capability will become increasingly vital to the U.S. leadership role in the world as ballistic missiles proliferate and aggressors attempt to deter the formation of defensive coalitions through the threat of missile attacks.

1.2.3 Crisis Response

The need to respond to regional contingencies and crises, and do so on very short notice, is one of the key elements of the new regional strategy. Defenses, in addition to protecting targets, could also serve to defuse regional crises by deterring the employment of ballistic missiles. This combination of defense and deterrent capabilities increases the likelihood that, in regional crises, potential adversaries could not use ballistic missile attacks to gain an advantage or to deter the United States and its allies or coalition partners from pursuing political, diplomatic, or military initiatives designed to resolve a crisis. By thus reducing the military utility of ballistic missiles, such defenses would contribute directly to the accomplishment of U.S. non-proliferation objectives.

Active defenses[2] can also reduce pressures on U.S. military and political leaders involved in a regional conflict to alter their campaign or war plans because of the threat (or actual use) of ballistic missiles. In the absence of effective defenses, carefully laid plans could be disrupted or delayed. With an effective defense in place, our military leaders are better able to execute their well-constructed plans, thereby retaining the initiative in battle.

[2] In additon to active defense, the Theater Missile Defense mission is comprised of counterforce or attack operations; passive defense; and battle management / command, control, communications and intelligence. Further details of the Department's TMD plans are addressed in the TMDI Report To Congress.

1.2.4 Force Reconstitution

The reconstitution concept is not simply to recreate or expand existing forces, but to consider what new forces are most needed to meet a new or reemerging threat consistent with U.S. strategy. The capability to protect against limited strikes represents an appropriate level of defense within our strategic forces structure, based on our current planning assumptions. Forces under consideration for deployment in the GPALS concept should provide the base level of capability to carry us into the foreseeable future in support of our forward presence and crisis response missions. If more ambitious missile defense capabilities are required in the future as a result of changes in the international environment, the SDI program will have developed the systems and technologies required to respond, should a decision be made to do so in the future.

1.3 The Ballistic Missile Threat

1.3.1 Accidental and Unauthorized Strikes

With the collapse of the Soviet Union the danger of a large scale war in Europe leading to nuclear conflict has vastly diminished. Nonetheless, the end of the Cold War confronts us with new challenges. The states of the former Soviet Union face internal crises and the possibility of civil disorder, while they continue to possess thousands of strategic and tactical nuclear warheads. While the strong central government of the former Soviet Union had a robust nuclear command and control system that provided us with high assurance that an accidental or unauthorized launch was highly unlikely, this command and control system was not designed in anticipation of the dissolution of the Soviet Union and the potential fragmentation of political and military authority. While the U.S. intelligence community believes an accidental or unauthorized launch remains unlikely, the dramatic political changes in this region could betray weaknesses in Russia’s command and control system that neither we nor the Russians could have anticipated and has resulted in heightened concern over this risk.

Political turmoil in the former Soviet Union, however, is not the only reason for concern about accidental and unauthorized strikes. The ability of ballistic missile proliferators to maintain command and control of the modern weapons they are acquiring is questionable. Command and control of these systems is technically demanding and it is unclear that appropriate communications networks, safeguards, and clearly delineated decision-making authority will exist to prevent accidental or unauthorized use of the weapons by these third countries.

1.3.2 Ballistic Missile Proliferation

Ballistic missile defenses will support our broader efforts to discourage the spread of ballistic missile technologies and weapons of mass destruction by providing a means to deter the use of such weapons. Should deterrence fail and ballistic missiles be used against the U.S., its forces, or our friends and allies, missile defenses would be able to destroy the attacking missiles. In this way, missile defenses would help undermine the military and political utility of such systems, and discourage countries from acquiring them.

Ballistic missiles continue to be deployed in areas beset with regional conflicts, particularly in the Middle East and Southwest Asia -- regions where ballistic missiles have been used in four of the last six major wars. A major implication for future regional contingencies that clearly emerged from the Gulf War is the political and military importance of possessing a capability to counter defensively the threatened or actual use of ballistic missiles and weapons of mass destruction. The United States cannot accept a situation in which these capabilities are allowed to constrain a U.S. President's flexibility in employing military power when necessary to support U.S. national security objectives and commitments abroad.

Today, over 20 non-NATO nations have ballistic missile capabilities (See Figure 1-1). Many of the countries that are developing and/or acquiring ballistic missiles are also acquiring weapons of mass destruction. These weapon systems pose a threat today that is largely regional in character. However, the trend is clearly in the direction of systems of increasing range, lethality, and sophistication. Several nations with space launch capabilities could modify those launchers to acquire a long-range ballistic missile capability. In the past, space launch capabilities emerged simultaneously with ballistic missile achievements. Historically, when a country decided to build an SLV, it generally derived the initial version from a ballistic missile.

After the turn of the decade, some nations hostile to the U.S. could acquire ballistic missiles that could threaten the United States. Over the next ten years we are likely to see several Third World nations establish the infrastructure and develop the technical knowledge required to undertake ICBM and space launch vehicle development, although testing and production of these missile systems would take some time.

Through purchase of entire weapons and long-range delivery systems, nations that are potentially hostile to the U.S. could quickly acquire the means of attacking the continental United States. Also, the sale of production technology and technical expertise can significantly shorten development time. Attempts to control this spread are challenged by the already widespread availability of ballistic missile technology. Significant technical data is available from open source literature and many of the necessary technologies and techniques have been around for several decades. Some of the trade in ballistic missiles and their technology remains essentially outside the bounds of existing control mechanisms.

1.4 Building A Consensus On Ballistic Missile Defenses

The United States has been working intensively in several areas to develop the foundation--both nationally and internationally--that would permit moving forward on our goals for ballistic missile defenses. First, we have been pursuing discussions on a Global Protection System concept in detail with the Russian Government. Second, we have been involved in frequent consultations with our allies and other states on the concept for a Global Protection System and we have kept them fully informed of our discussions with the Russians. And finally, we have worked to implement the Missile Defense Act.

1.4.1 Challenge from President Yeltsin on Missile Defenses

Following the President's decision in 1991 to refocus the SDI program, the United States began a review of U.S.-Soviet arms control objectives. This resulted in President Bush's September 27, 1991 call "on the Soviet leadership to join us in taking immediate, concrete steps to permit the limited deployment of non-nuclear defenses to protect against limited ballistic missile strikes--

whatever their source." Several days later, on October 3, the U.S. presented a new proposal in the Defense and Space Talks (DST), which was consistent with our GPALS concept. On October 5, 1991, then-president Gorbachev signaled a clear change of previous Soviet thinking on this issue when he replied to the President's invitation by stating that "we are ready to discuss the U.S. proposal on non nuclear ABM systems." In meetings in October and November, U.S. representatives met with senior representatives of the Soviet Union, Russia, Ukraine, Belarus, and Kazakhstan and explained in detail our concept for limited ballistic missile defense. We also discussed the possibility of defense cooperation in response to former President Gorbachev's July proposal to the leaders of the G-7 for "development of joint ABM early warning systems to prevent unauthorized or terrorist operated launches of ballistic missiles."

President Bush's initiative for cooperation in the deployment of defenses was followed by President Yeltsin's January 29, 1992 announcement that "We are ready jointly to work out and subsequently to create and jointly operate a global system of defense in place of SDI." Two days later, in a speech to the United Nations Security Council, President Yeltsin reiterated his proposal for the "creation of a global system for protection of the world community" which "could make use of high technologies developed in Russia's defense complex." President Yeltsin's remarks represented a major breakthrough. For the first time, a Russian leader publicly acknowledged a shared interest in developing defenses against ballistic missiles while at the same time calling for further reductions in offensive nuclear weapons - breaking with former arguments that defenses are not compatible with offensive reductions.

During their meeting at Camp David on February 1, Presidents Bush and Yeltsin had a constructive discussion about the proposal on global defenses. They agreed to continue this dialogue. When Secretary of State Baker met in Moscow in February with President Yeltsin and Foreign Minister Kozyrev, he stated that the U.S. shared Yeltsin's bold vision on the need for a global ballistic missile defense system, and that we were prepared to work together toward this goal. Secretary Baker proposed that we begin this cooperation by concrete steps in three areas:

- The sharing of early warning information on ballistic missile launches through a Joint Ballistic Missile Early Warning Center that would integrate and display early warning information from all participants;

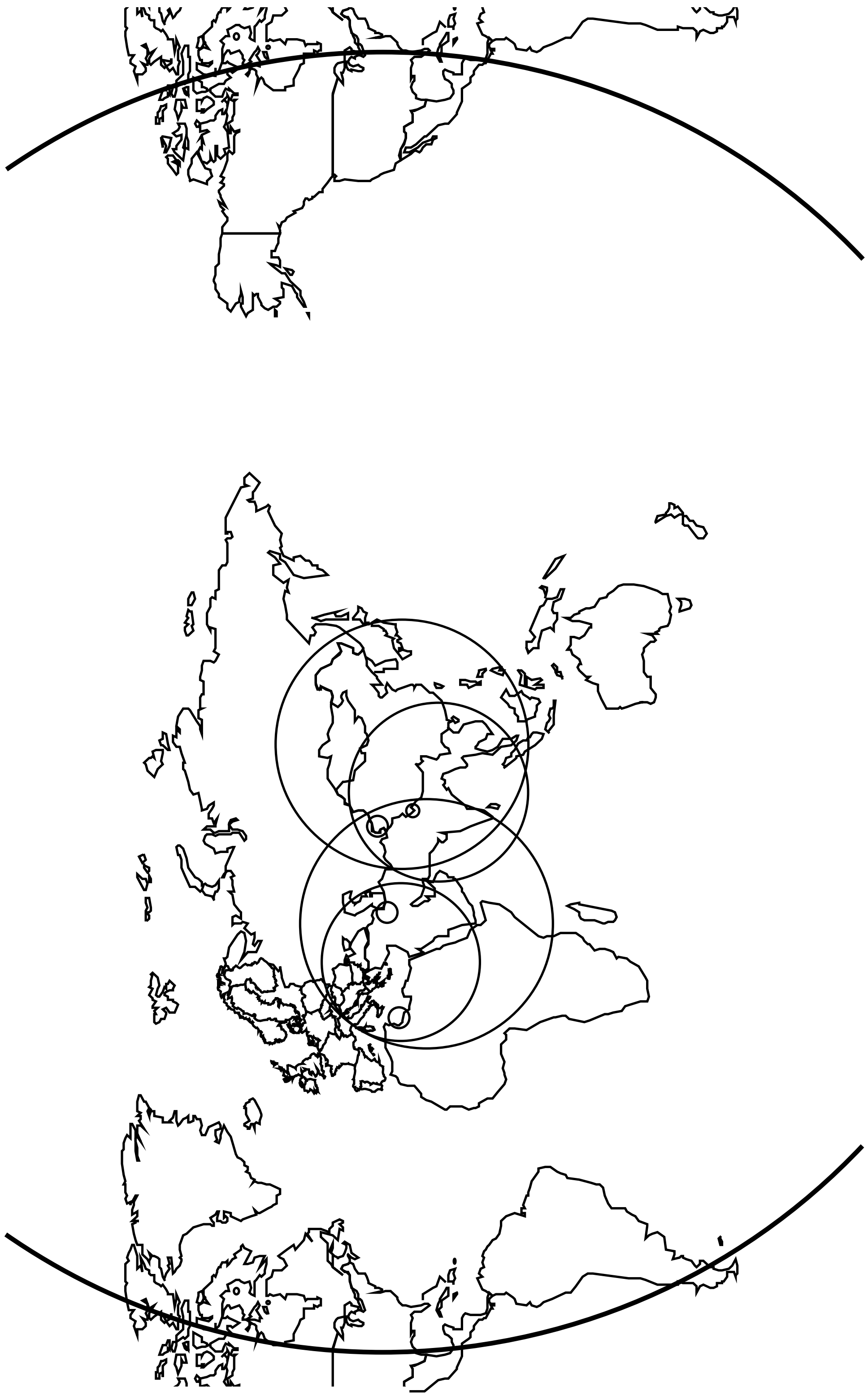
- The discussion of areas for possible technology exchange, especially the acquisition of former Soviet technology and hardware; and,

- The development of a concept for a global ballistic missile defense system.

At the June 16-17 Summit in Washington, Presidents Bush and Yeltsin issued a Joint Statement on a Global Protection System:

"The Presidents continued their discussion of the potential benefits of a Global Protection System (GPS) against ballistic missiles, agreeing that it is important to explore the role for defenses in protecting against limited ballistic missile attacks. The two Presidents agreed that their two nations should work together with allies and other interested states in developing a concept for

Figure 1-1. The Current Third Country Ballistic Missile Capability



such a system as part of an overall strategy regarding the proliferation of ballistic missiles and weapons of mass destruction. Such cooperation would be a tangible expression of the new relationship that exists between Russia and the United States and would involve them in an important undertaking with other nations of the world community. The two Presidents agreed it was necessary to start work without delay to develop the concept of the GPS. For this purpose they agreed to establish a high-level group to explore on a priority basis the following practical steps:

- The potential for sharing early warning information through the establishment of an early warning center.

- The potential for cooperation with participating states in developing ballistic missile defense capabilities and technologies.

- The development of a legal basis for cooperation, including new treaties and agreements and possible changes to existing treaties and agreements necessary to implement a Global Protection System."

The High Level Group first met in July and again in September. During the 13-14 July meeting in Moscow, both sides outlined their broad positions on a concept for a Global Protection System. They also agreed to establish three working groups to further develop the concept: a Concept Working Group; a Technology Cooperation Working Group; and a Non-Proliferation Working Group. The High Level Group retained responsibility for discussing the legal issues associated with moving toward a Global Protection System.

During the September meeting of the High Level group in Washington, the two sides addressed four topics: 1) technology cooperation, 2) non-proliferation activities, 3) further elaboration of the Global Protection System concept and 4) further discussion about the issues associated with the legal basis for a global protection system. At the conclusion of the meetings, the sides agreed that the Working Groups would begin work to "develop the means and methods for implementing" a Global Protection System.

The Non-proliferation Working Group began its first meeting in Moscow on October 5th. They began a candid and comprehensive dialogue on non-proliferation issues, including the problem of ballistic missile proliferation and the role of defenses in addressing this problem.

The Concept Working Group on a GPS met for the first time in Moscow October 27-30 while the Technology Cooperation Working Group met October 29-30. The U.S. and Russia exchanged detailed presentations and conducted extensive discussions on a wide range of issues related to establishing a GPS. The agenda included discussion of the overall GPS concept, the strategic dimension of the ballistic missile threat, command and control issues associated with a GPS, participation in a GPS, early warning information and a Global Protection Center, sensor contribution to a GPS and joint Anti-tactical Ballistic Missile (ATBM) activities. The work of the High-Level Group and its Working Groups suggest that Russian views on a number of important elements of a GPS have moved closer to those of the United States.

1.4.2 The ABM Treaty

The ABM Treaty was negotiated at the height of the Cold War. At that time, there was intense hostility between the United States and Soviet Union and high levels of defense expenditures, both offensive and defensive. Recent events have drastically changed the world security environment and have transformed the relationship between the U.S. and the countries of the Former Soviet Union (FSU) from one of competition to one of cooperation. The growing partnership between the U.S. and the FSU States including the potential for joint efforts to meet common security concerns offers the opportunity to take a thoroughly new approach to stability and to the contribution ballistic missile defenses can make. In fact, without the changed security environment, a Global Protection System would not be possible.

In light of the changed security environment and in the context of developing a concept for a Global Protection System, the U.S. has stated to the Russians that the ABM Treaty needs to be updated to reflect current realities and to implement a Global Protection System. The proposed updates would provide a clear legal basis for an effective Global Protection System. The United States has proposed updating the ABM Treaty in five ways. These are:

-- First, to provide early warning and cueing information necessary for defense against ballistic missile strikes, neither sensors nor the use of the information they provide should be limited.

-- Second, to allow the potential for advances in the technology to be applied in the future to increase the effectiveness and to reduce the cost of missile defenses, development and testing of ABM systems must be allowed without regard to basing mode or physical principle.

-- Third, to realize the goal of a Global Protection System--to defend entire populations from limited strikes--limits on the number of deployment areas and deployed interceptors must be relaxed; the U.S. has proposed up to six ABM sites with no more than 150 ABM interceptors per site.

-- Fourth, to allow deployment of fully effective ATBM systems (and their support by space-based sensors) that are necessary to defend against the existing and growing threat posed by intermediate-range ballistic missiles with weapons of mass destruction, ABM Treaty ambiguities that result in legal impediments to the development, deployment, sale, or export of ATBM systems must be clarified.

-- Fifth, to provide for the exchange of technical data and hardware that would be characteristic of activities among participants in a Global Protection System, the ABM Treaty restriction on these transfers would have to be lifted.

Modification of the ABM Treaty would be in keeping with the new relationship between the U.S.

and Russia because it would clarify ambiguities and eliminate areas of contention that could lead to misunderstanding and tension between the two countries. For example, due to the improvements in technology, it will become increasingly difficult to distinguish between sensors deployed on the ground or in space for an ABM purpose and those employed for other purposes. Likewise, deployment by the U.S. or Russia of advanced ATBM systems and their support by high quality space-based sensors, which are consistent with both countries' security needs, could raise Treaty concerns and tensions because of the above-mentioned ABM Treaty ambiguities.

The updates to the ABM Treaty proposed by the U.S. would substantially resolve issues relating to succession as well as existing compliance concerns and eliminate other Treaty ambiguities which could lead to future compliance issues. For example: with the demise of the Soviet Union, certain key ABM-related facilities are now located in non-Russian states, including early warning radars, the Sary Shagan ABM test range, and ABM-associated development and production facilities. The proposed updates would resolve concerns about Large Phased Array Radar (LPAR) support of the Moscow ABM system and the ABM potential of advanced Soviet SAMs and ATBMs.

Thus, it is clear that if the ABM Treaty continues in its present form, it will not only present an obstacle to achieving the Global Protection System, but it is likely to be a source of serious contention, completely inconsistent with the cooperative relationship now developing between the U.S. and Russia.

On the future of the dialogue on GPS, the United States and Russia have seen no insurmountable problems, including the ABM Treaty, to implementation of a GPS. The Russian government has made clear its desire to continue the dialogue on the GPS concept which it views as part of a broad range of new and important contacts which will fundamentally alter the strategic relationship between Russia and the U.S. and its allies. We hope to continue these discussions even as we continue to pursue the development of a core baseline program that is ABM Treaty compliant.

1.4.3 United States And Its Allies

The U.S. has been discussing the GPALS concept with its NATO allies and other allies and friends for over two years, both bilaterally and in NATO fora. These discussions have included the objectives of a limited deployment of ballistic missile defenses--including, in our view, that such defenses would not undermine the credibility of existing deterrent capabilities--and the willingness of the U.S. to extend protection to allies. We have also discussed the possibility of providing allies information from sensors for both early warning of an attack and to improve the effectiveness of theater-based (U.S. or allied) ballistic missile defenses. Additionally, our discussions included an invitation to participate in the development and operation of those defenses. (See Chapter 6 for a discussion of allied participation in SDIO research projects.)

When President Yeltsin raised the idea of a Global Protection System in January 1992, the United States immediately began to develop a concept for a GPS and initiated discussions with our allies on our thinking on the subject. In these discussions, the United States emphasized that in its view this Global Protection System would not replace or supersede existing security arrangements or agreements; that the U.S. would do nothing with the Russians that undermine our defense commitments to our traditional allies; that not all cooperative projects undertaken with our allies will be open to Russia; and that we are prepared to include interested allies in any activity we undertake with the Russians.

At the June 1992 Summit, Presidents Bush and Yeltsin specifically agreed to work with allies and other interested states in developing the concept for a Global Protection System. Since then, we have discussed GPS in greater detail with our friends, our allies in NATO, in the Pacific, and in Israel, and high-level representatives of Russia and other former Soviet republics. While still in the early stages of basic concept development for a GPS, the United States has discussed with our allies the three basic components of GPS: (1) sharing of early warning information; (2) planning for use of nationally controlled ballistic missile defense forces; and (3) technology cooperation. We will continue our bilateral and multilateral efforts with our allies to develop a mutually agreeable GPS.

1.4.4 The Global Protection System Concept

The United States views the GPS concept as a voluntary association of sovereign states committed to assisting one another in meeting the challenge to their national security and international stability that is posed by the proliferation of ballistic missiles and weapons of mass destruction. Participation in this system would be open to all interested states that are members in good standing of the community of nations and that have embraced the objectives of stemming the proliferation of advanced military technology.

Under this approach, the U.S. contribution to the GPS concept would be its GPALS program as described in this report. The United States would be willing to make available the benefits of its GPALS deployment to participants in the global protection system. For example, we would be prepared to make available processed early warning information from our existing and planned early warning systems for use with ballistic missile interceptors of all types. We would be prepared to cooperate with other participants for coordinated missile defense operations as our capabilities for ballistic missile defense mature. A fundamental element of the GPS concept is that while national forces could be used in support of the GPS, those forces would remain under sovereign national control. The use of such forces in support of a GPS would be governed by agreed “rules of engagement”. And finally, we would be prepared to assist through technical cooperation and other activities the development by other participants of the means to defend their own homeland and forces.

The participants in a Global Protection System would establish and operate a Global Protection Center, within which the participants would cooperate on developing and operating a GPS, including efforts to:

- share information on the sources of proliferation and the use being made of proliferated technology,
- share certain specified information on all launches of missiles detected by national sensors, including such information as time of launch, the location of launch, and the direction of flight,

- assist one another to develop their own capabilities for warning and defense against limited ballistic missile attacks, and

- undertake planning activities, engage in exercises and develop models to support cooperative defensive operations against ballistic missile attacks.

The Global Protection Center could be a forum in which individual states could develop military plans to execute cooperative agreements by which the assets of one nation might be used to defend the territory of another against limited ballistic missile attacks. At the same time the participants would retain control of the national assets they had committed to the support of a Global Protection System.

1.4.5 The Missile Defense Act

In the two years since the U.S. shifted the focus of its ballistic missile defense goals to provide protection against limited strikes, the Administration and Congress have moved toward a consensus on fundamental missile defense goals. The Missile Defense Act of 1991, which was part of the FY 1992 Defense Authorization Act, established two basic missile defense goals that were reaffirmed in the FY 1993 Defense Authorization Act:

(1) deploy an anti-ballistic missile system that is capable of providing a highly effective defense of the United States against limited attacks of ballistic missiles; and

(2) provide highly effective theater missile defenses to forward-deployed and expeditionary elements of the Armed Forces of the United States and to friends and allies of the United States.

The MDA stated that the limited deployment of defenses should be “designed to protect the United States against limited ballistic missile threats, including accidental or unauthorized launches or Third World attacks.” Congress and the Administration continue to agree on the need for a defensive capability to protect against these threats.

The MDA directed the Administration to take several measures to implement the Act’s goal of a highly effective defense against limited ballistic missile strikes. The Department is moving forward on each of these. The Department laid out its acquisition strategy towards this goal in its Plan For Deployment of Theater and National Ballistic Missile Defenses forwarded to Congress in June 1992. In the Conference Report accompanying the FY 1993 Defense Authorization Act, the Conferees stated they “believe[d] that the baseline programs for TMD and the limited defense system (LDS) as set forth in this report constitute a low-to-moderate technical risk and low-to-moderate concurrency program as directed...”

The Administration and Congress share the determination to provide, as soon as feasible, protection against limited ballistic missile attack. It remains for the Administration and Congress to agree on the appropriate combination of forces, and for the Congress to provide the funding needed to achieve this common objective. The Congress has endorsed developing space-based sensors for deployment, but it has mandated that space-based interceptors such as Brilliant Pebbles not be included in the initial plan for the limited defense system architecture described in the MDA. However, it explicitly endorsed robust funding for research and development of promising follow-on technologies, including Brilliant Pebbles. The Department will vigorously pursue the development of space-based sensors for deployment and, as funding permits, continue to develop technologies such as Brilliant Pebbles as a follow-on option to the deployment specified in the MDA as revised in the FY 1993 Defense Authorization Act.

The Conference Report on the FY 1993 National Defense Authorization Act also urged the President to continue to pursue the changes to, and clarification's of, the ABM Treaty that were recommended in the Missile Defense Act of 1991. As discussed above, the United States is continuing its dialogue with Russia on obtaining relief from the current ABM Treaty regime in order to pursue the missile defense goals stated in the MDA and a Global Protection System.

1.5 Theater Missile Defense Initiative

The FY 1993 Defense Authorization Act directed the Secretary of Defense to establish a Theater Missile Defense Initiative (TMDI) office within the Department of Defense (DoD) to carry out all activities in the Department which involve active defense against theater and tactical ballistic missiles. The Secretary of Defense has assigned the TMDI to SDIO to ensure the benefits of complementary technology development and to preclude duplication of effort. For example, strategic and theater interceptor functions such as guidance, propulsion and target kill can be researched using joint technology base efforts. Over 90 percent of the SDIO TMDI system builds on previous SDI initiatives. The efficiencies of closely coordinated theater and strategic defense technology development programs is gained through SDIO management. Additionally, SDIO management will serve to involve all the military services and war fighting Commander in Chiefs (CINCS) in the process of developing missile defenses and assure their efforts are integrated into a coherent, cost-effective program that produces a truly joint service missile defense system.

In accordance with a Memorandum of Agreement between SDIO and the Services in the spring of 1992, a new SDIO acquisition structure has been established under a GPALS General Manager (GM). Reporting to the GM is the Assistant Gerneral Manager for Theater Defense, who has been designated as the DoD office to execute the Theater Missile Defense Initiative (TMDI).

As per the FY 1993 Defense Authorization Act, a separate TMD Initiative Report will be forwarded to Congress. To the extent that SDIO programs and activities contribute to the TMDI mission, they will be discussed in this report. Discussion of our TMDI master plan, which includes TMD doctrine and acquisition strategy, is reserved for our TMDI Report To Congress.

1.6 Deployment Planning

The Department has planned, programmed, and budgeted its resources to support the goals of the MDA and established military requirements. With regard to military requirements, the Joint Requirements Oversight Council (JROC) recently validated key performance parameters for ballistic missile defense systems which are necessary to protect the United States against limited ballistic missile attacks. At this time, the JROC also reaffirmed the requirement for wide-area theater missile defense against the most capable theater ballistic missile threats.

In response to Congressional direction, DoD is developing for deployment a defensive system located at an initial site. In our negotiations with the Russians, we are seeking relief from the restrictions on the location and number of U.S. ABM sites, including the number of interceptors in the United States, as well as the prohibition on the deployment of space-based ABM sensors. In this eventuality, the site at Grand Forks would be redundant. However, without appropriate updates to the ABM Treaty, the single site it permits would remain at Grand Forks. Because the capability provided by this single site is constrained by the ABM Treaty, it cannot defend the United States against the full range of threats to the required level of effectiveness. In addition, several Treaty issues have not yet been resolved. The capability of this Treaty-limited deployment would be restricted to intercepting a few tens of reentry vehicles (RVs) launched by Intercontintental Ballistic Missiles (ICBMs) or long-range Submarine Launched Ballistic Missiles (SLBMs) aimed at the center of the nation and would be much less effective against RVs aimed at the periphery of the U.S. and not effective at all against those heading for Alaska or Hawaii. Additional sites, prohibited by the ABM Treaty, are needed to provide the required level of defense for the entire U.S. against the full range of threats.

After ABM Treaty compliance issues are resolved, we can undertake, if appropriate, and after consultation with our allies who would be affected, improvements to existing early warning sensors to bridge the gap until the space-based Brilliant Eyes sensors become operational.

1.7 Summary And Conclusions

Two years ago, in response to the dramatic changes in the international security environment, the objective of the Strategic Defense Initiative was refocused to provide protection against limited ballistic missile strikes -- whatever their source. The plan proposed in this Report to Congress represents the Department’s effort for achieving U.S. national ballistic missile defense goals, given the budgetary constraints imposed by the Congress.

As stated in last year’s Report to Congress, the passage of the Missile Defense Act represented a major step toward a consensus between the Administration and Congress on U.S. ballistic missile defense goals. The national goal identified in the MDA is to deploy a ballistic missile defense system, consistent with stability, that is capable of providing a highly effective defense of the United States against limited ballistic missile attack, and provide highly effective theater ballistic missile defenses for U.S. forward-deployed and expeditionary forces, allies and friends. This goal, and our acquisition strategy, was reaffirmed in the FY 1993 Defense Authorization Act. While there is a consensus on our broad missile defense goals, the challenge we face is achieving the funding levels from the Congress required to achieve those goals.

Finally, last year we saw a significant break from past Soviet policy on ballistic missile defenses that opened a historic opportunity for cooperation in this area. We continue to work with our allies, Russia, and other countries toward the goal of creating a Global Protection System. The elements being developed under the TMDI and SDI programs will comprise the U.S. contribution to this system. Such a cooperative undertaking holds the promise of enhancing U.S. security, as well as that of our Allies, Russia and other states.

Chapter 2

Strategy And Objectives

Chapter 2
Strategy And Objectives

This chapter responds to subparagraph (b)(1) of Section 224 of the National Defense Authorization Act for 1990 and 1991 (Public Law 101-189), which requests "A statement of the basic strategy for research and development being pursued by the Department of Defense under the Strategic Defense Initiative (SDI), including the relative priority being given, respectively, to the deployment of near-term deployment options and research on longer-term technological approaches." and to subparagraph (b)(3) which requests "A clear definition of the objectives of each planned deployment phase of the Strategic Defense Initiative or defense against ballistic missiles."

2.1 Introduction

The Missile Defense Act of 1991 (MDA), contained in the FY 1992 Defense Authorization Act, was a major milestone in establishing a consensus between the Administration and Congress on the necessity for ballistic missile defenses for the United States, U.S. forces deployed worldwide, and its allies as soon as technologically feasible. While the MDA focused on a single, ABM Treaty-compliant site for national defense, it acknowledged the need to be able to provide effective protection for the entire U.S. and called for the President to pursue discussions regarding ABM Treaty amendments to permit additional sites. A defense consisting of multiple sites in the U.S. and ground- and space-based elements is necessary to achieve this goal.

These multi-layered defensive systems are funded in the different SDIO Program Elements: Limited Defense System (ground-based weapons and ground- and space-based sensors); Space-Based Interceptors which could be added to the Limited Defense System to make it more effective; Other Follow-on (technologies for improved defense capabilities); and Research and Support activities. Similar concepts of multiple defensive layers are integral to the Theater Missile Defense Initiative (TMDI), which are discussed in a separate report.

To distinguish between TMDI and the Strategic Defense Initiative programs discussed here, the term Strategic Defense will be used to denote those programs directed toward defense of United States territory.

On July 2, 1992, the Secretary of Defense sent to Congress his plan to implement the MDA, indicating that he had directed the Department to execute that plan as a top national priority. The Department's event-driven acquisition strategy accommodated Congressional direction to field defensive capabilities in the mid-1990's with the concerns it expressed about limiting concurrency and risk by remaining close to a core standard defense acquisition model. The core acquisition strategy for national missile defense (NMD) described in this plan provides for deployment of production hardware beginning in FY 2002; options are also provided for fielding an NMD User Operational Evaluation System (UOES) using demonstration and validation hardware as early as FY 1997.

As indicated in Secretary Cheney's July 2, 1992 transmittal letter accompanying this plan, the Secretary's Defense Planning Guidance (DPG) backs up that commitment with instructions that these programs be carried out as a top national priority, consistent with prudent management of cost, schedule, performance, and technical risk factors.

This chapter addresses the impact of the 1993 Defense Authorization and Appropriations bills and conference committee reports on the Strategic Defense Initiative. The discussion of the impact on TMDI is included in a separate document based upon Congressional guidance to separate the two initiatives. In keeping with Congressional guidance, there are a number of programs that support both the defense of the U.S. and TMDI, including the Ground Based Radar (GBR), Brilliant Eyes (BE), System Engineering and Integration (SE&I), Battle Management, Command, Control and Communications (BM/C3) and System Test and Evaluation.[1] In addition to offering cost reductions through dealing with common problems, these joint programs maintain the concept of defense layering to achieve the very highest levels of protection possible.

2.1.1
Revisions to the Missile Defense Act

In actions associated with the FY 1993 Defense Authorization and Appropriation Acts, Congress supported the Department's missile defense acquisition strategy (presented in the July 2, 1992 Report To Congress) which, if appropriately funded, would provide an initial deployment of production hardware as early as the year 2002 and could be categorized as a low-to-moderate risk program. While approving planning for fielding the UOES option as early as the end of FY 1997 to provide a contingency defense with test-proven dem/val hardware, Congress did not approve spending funds for fabrication and fielding of UOES hardware -- but noted no such funding would be needed before at least 1995. The FY 1993 Defense Authorization Conference Report did, however, endorse the department's plans to field a THAAD UOES by 1996. Congress also removed the 1996 target date for fielding the initial site defense system in the U.S. that was the driver for obtaining OSD approval for accelerated contracting actions.[2]

With regard to both the Space-Based Interceptor layer and the next generation technologies to increase strategic defense effectiveness, Congress, in fact, directed the removal of technology

[1]The FY 1993 Defense Authorization Conferees indicated that while they intended that the TMDI be separate from SDI, they also directed that "TMDI and SDI programs, projects, and activities that share common technologies or requirements be closely coordinated, including the use of combined or joint funding and management where appropriate. This direction is designed to ensure the avoidance of redundancy to obtain both technological and financial efficiencies, and to maximize the incorporation of common technologies in specific theater and strategic missile defense systems."

[2]The requirement stated in the FY 1992 Defense Authorization Act to develop for deployment a treaty compliant initial site "by the earliest date allowed by the availability of the appropriate technology or by FY 1996" was deleted by the FY 1993 Defense Authorization Act. In the FY 1993 Defense Authorization Conference Report, the conferees stated that the development program should be structured with the objective of deploying "by the earliest data allowed by the availability of the appropriate technology and the completion of adequate integrated testing of all system components." They further stated that the program should be conducted "consistent with sound acquisition procedures and in accordance with a low-to-moderate technical risk and low-to-moderate concurrency program."

The Defense Authorization conferees identified the Secretary's July 2 Plan as being such an acceptable low-to-moderate risk / concurrency plan.

programs from SDIO that had weapon applications beyond 10 to 15 years unless the Secretary of Defense determines and certifies that transfer of a particular far-term follow-on technology currently under the SDIO would not be in the national security interests of the United States.

More important than the changes in language were the resulting budget reductions. A summary of the actions on the FY 1993 budget is given in Figure 2-1. The $5.425B overall budget request, which contained $4.365B for implementation of the strategic defense portion of the MDA, was provided in the July 1992 Report to Congress, which updated the President's budget request submitted to Congress in January 1992. As shown in the Figure, this budget contained about $2.4B for the Limited Defense System, $0.6B for Space-Based Interceptors, $0.6B for Other Follow-on Technology, and $0.8B for Research and Support. It was noted in the July report that a substantial majority of the Research and Support line directly supported the LDS acquisition program with targets, test and evaluation support, data centers, and government staff personnel costs.

Figure 2-1. FY 93 Strategic Defense Budget History[1]

RDT&E / MILCON

($s In Millions)

	180 Day Report[2] (July 1992)	Authorized	SDIO Apportionment[3]
Limited Defense System	2,397	2,045	1,699
Space Based Interceptors	576	300	270
Other Follow-on	637	300	309
Research And Support	755	400	424
Total	$4,365	$3,045	$2,702

[1] Does Not Include TMDI Funding

[2] Provided In July 1992 180-day SDIO Report To Congress: *Plan For Deployment Of Theater And National Ballistic Missile Defenses* Which Updated The President's Budget Request Submitted To Congress In January 1992

[3] SDIO Apportionment After Accommodating An Additional $250M Cut By The Defense Appropriations Conference, Which Funded Both Strategic Defense And TMDI At $3.805B

The Defense Authorization Conference reduced funding for strategic defense by approxiamately $1.3B, $350 million of which came from the LDS line. In fact, the cut to activities that support the LDS was in excess of $700 million because essential programs in support of LDS carried in the Research and Support line had to be moved to the LDS line and accommodated within the reduced funding authority there. The “SDIO Apportionment” column in Figure 2-1 represents the current allocation of funds against the strategic defense activities, further reduced as a result of reprogramming within the Director’s 10% authority and accommodating the additional $250M cut by the Defense Appropriations conference, which funded both strategic defense and TMDI at $3.8B.

2.1.2 Programmatic Realignment for LDS

Realignment of those programs directed toward defense of the United States homeland involved some very difficult management and technical decisions. The overall Congressional language gave first priority to TMDI and the Department has emphasized the TMDI programs accordingly, maximizing the FY 1993 funding within the reallocation authority permitted by the Defense Authorization Act. However, to accommodate the $1.6 billion of FY 1993 budget cuts the date for the initial site had to be slipped.

The removal of the 1996 target date negated the requirement that would justify a sole source contract to continue the present System Engineering and Integration (SEIC) contractor. Reduced funding and the recompetition effort contribute to an up to 18 month delay from the acquisition plan in the July 2 Report to Congress. Thus, the allocation of FY 1993 funds and the programming of outyear funding requirements sought to hold the schedule slip to 18 months.

The new schedule for the core baseline program, shown in Figure 2-2, would provide hardware for the initial, ABM Treaty- compliant, anti-ballistic missile defense site in FY 2004 -- some 18 months later than could have occurred in the Department’s 2 July acquisition plan in the absence of executing any of the three UOES contingency fielding options. In response to Congressional directions that fabrication and fielding costs for a UOES option were not authorized at this time, we have budgeted only for planning to provide such an option -- as explicitly permitted by the Authorization Conferees. Should the Congress decide later to exploit such an option, funding would be required in FY 1997 to fabricate and field the initial site in the year 2000 -- some 18 months later than the moderate risk/concurrency option described in the Department’s July 2 Report to Congress. Thus, in structuring our response to the FY 1994 - FY 1999 POM guidance from OSD, which preserved the outyear funding stream, we have maintained the core strategy presented in the July 2, 1992 plan, while reprioritizing and rescheduling major elements of the program to take account of Congressional direction and priorities, as well as the substantially reduced FY93 appropriated funding. Maintaining the basic event-driven strategy for the program is essential because that strategy represents an approach on which the Department and Congress agree.

We intend to proceed with the basic element contracts (BE, GBI, and GBR) while competing for a systems integration contractor who, as the lead associate contractor on the team, would be accountable to SDIO for Total System Performance Responsibility (TSPR). In being accountable for TSPR, the contractor would be responsible for overall systems engineering and integration, integrated systems test, the development of the Battle Management, Command, Control, and Communications (BMC^3), and site integration. This quasi “prime” contractor status for the BMC^3/SE&I contractor is essential for the success of this complex multi-service program. During the 18 month interval before the full contractor team is in place, the management and integration responsibilities to continue the integration activities will rest upon the SDIO/Service management team with support from the current SEIC and support contractors as needed.

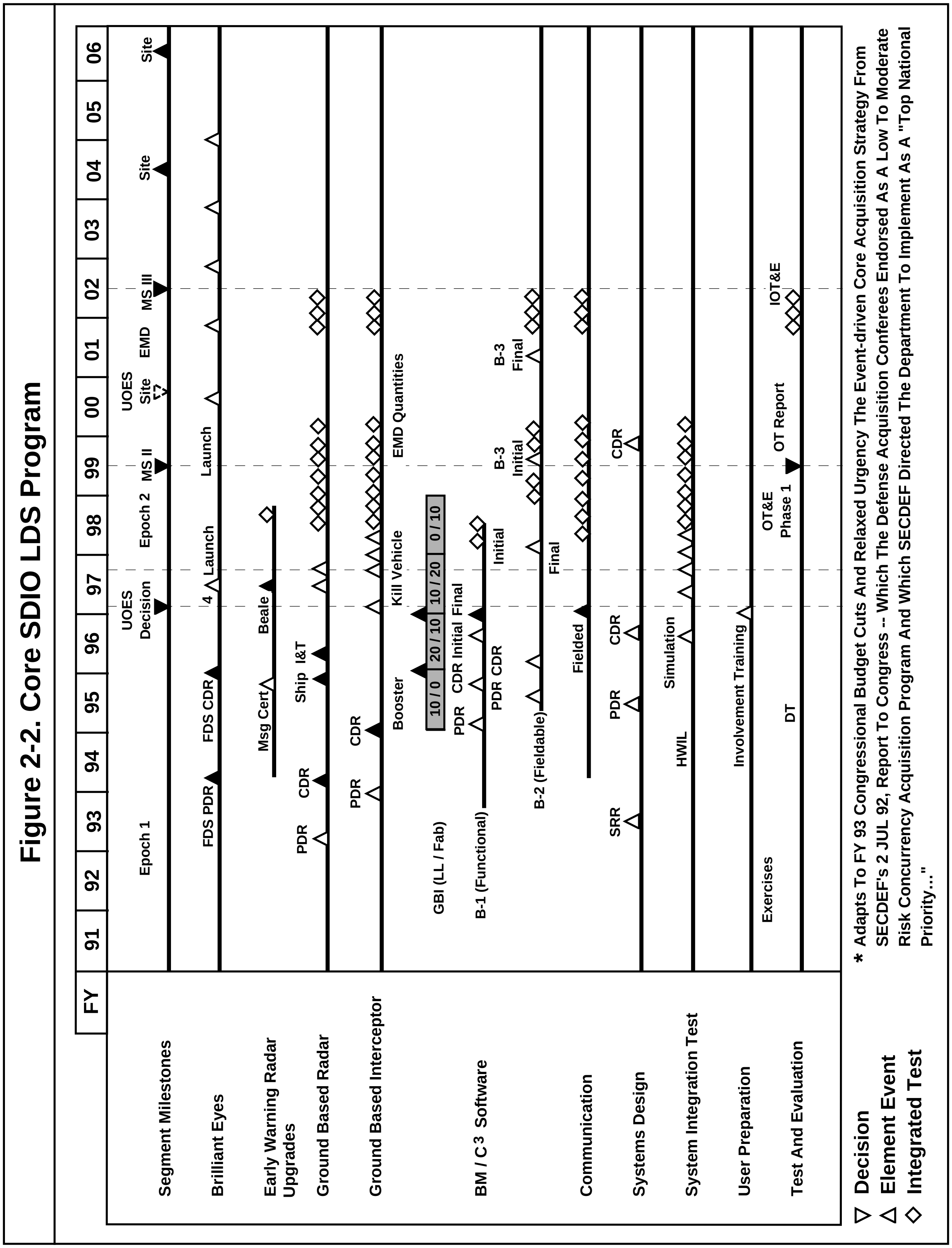


Figure 2-2. Core SDIO LDS Program

2.1.3 Programmatic Realignment of Follow-On Activities

Out-year funding for Space-Based Interceptors (SBI), Other Follow-on (OFO), and Research and Support (R&S) has been substantially reduced to a level of effort reflecting the implicit priorities of the FY 1993 Congressional action. Within SBI, this provides for a Brilliant Pebbles (BP) technology demonstration program which would delay consideration of this concept for inclusion in the future architecture until nearly the end of the decade. OFO and R&S will focus on only the most important long-term technologies supporting advanced capabilities that might be required to respond to future threat evolution. R&S also continues to fund salaries and other support activities.

2.1.4 Overall LDS Program Strategy

SDIO has created a core acquisition strategy to obtain an ABM Treaty-compliant missile defense site as the initial step toward a multi-site Limited Defense System (LDS) as defined in the MDA. This strategy is depicted in Figure 2-2. An option also exists to obtain needed near term contingency capabilities while creating a base to support an evolutionary improvement of capabilities in the mid and far term. Figure 2-3 shows these architecture concepts. Plans are fashioned to meet key management challenges such as acquiring a complex, multiservice system of systems, while coping with geopolitical, technical, and budgetary uncertainties, fully realizing performance goals in the long term.

Part of this strategy is a cooperative management approach between SDIO, the users, and the Services that provides appropriate responsibility and accountability for developing, fielding and operating the various service elements of an integrated, multiservice system of systems. Sustained stable funding is also an essential part of this strategy.

Also, it is extremely important to maintain a sound technology base program to provide options for technology insertion into systems under development, and to create new system elements to improve system effectiveness and/or to mitigate risk during the accelerated fielding of the initial site and to respond as necessary to threat evolution. Risk mitigation is an important result of creating this robust technology base. In addition to providing options for technology insertion, the technology base provides for alternative solutions at component or system level. This is an essential feature to allow rapid system response to threat changes in an uncertain world without the expense of maintaining formal development programs to deal with all contingencies. FY 1993 funding reductions strongly impact the technology program.

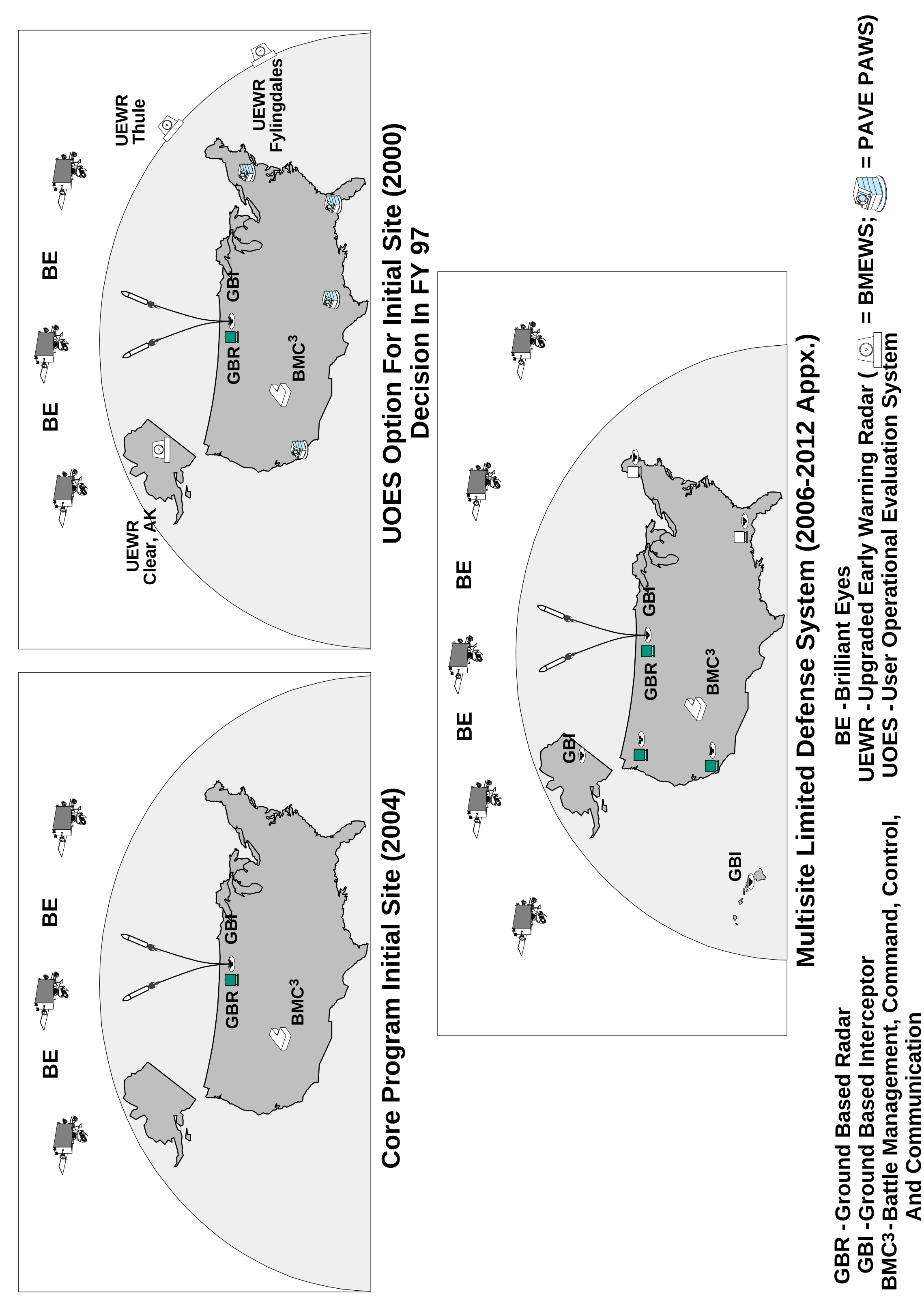
2.2 The Limited Defense System

This section is divided into three subsections that discuss plans for the initial site deployment based on the core acquisition strategy, the UOES contingency option, and deployment of the overall multisite Limited Defense System. Figure 2-4 depicts the schedule for these objectives.

2.2.1 The Initial Site of the Limited Defense System -- Core Program

As the initial step toward deployment of a system capable of fulfilling the goals of the MDA and meeting existing military requirements, the Act, as revised in the FY 1993 Defense Authorization

Figure 2-3. Strategic Defense Architecture Concepts



Chapter 2

Strategy And Objectives

Chapter 3
Program Element Descriptions

This chapter responds to subparagraph (b)(2) of Section 224 of the National Defense Authorization Act for Fiscal Years 1990 and 1991 (Public Law 101-189), which requests "A detailed description of each program or project which is included in the Strategic Defense Initiative or which otherwise relates to defense against strategic ballistic missiles, including a technical evaluation of each such program or project and an assessment as to when each can be brought to the stage of full scale engineering development (now engineering and manufacturing development) (assuming funding as requested or programmed)" and to subparagraph (b)(4) which requests "An explanation of the relationship between each such [deployment] phase and each program and project associated with the proposed architecture for that phase."

3.1 Introduction

Four major program elements are used to integrate all Strategic Defense Initiative projects. A description of the four Program Elements is provided in section 3.2, and Table 3-1 summarizes the programs, projects, and activities funded through these program elements, with a description of their mission, functions and deployment phase.

3.2 SDI Program Elements

3.2.1 Program Element: 0603215C - Limited Defense System

The Limited Defense System (LDS) PE includes programs, projects, and activities (and supporting programs, projects, and activities) which have as a primary objective the development of systems, components, and architectures for a deployable anti-ballistic missile system that is capable of providing a highly effective defense of the United States against limited ballistic missile threats, including accidental or unauthorized launches or Third Country attacks. For purposes of planning, evaluation, design, and effectiveness studies, such programs, projects, and activities take into consideration both the current limitations of the Anti-Ballistic Missile (ABM) Treaty and modest changes to the Treaty's numerical limitations and its limitations on the use of space-based sensors.

Activities within the LDS PE are focused on developing highly effective defenses including possibly several ground-based interceptor sites and space-based sensors to protect the entire United States, including Alaska and Hawaii, against ballistic missile attacks consisting of up to several tens of reentry vehicles (RVs). Within this LDS framework, an ABM Treaty- compliant ballistic missile defense system located at a single site within the U.S. will be developed in accordance with the Missile Defense Act of 1991 and its amendment in the FY93 Authorization Act. Development for follow-on sites and Brilliant Eyes is also included.

Within this Program Element there are essentially three categories of activity: System Development; Risk Mitigation, Hedges, and P^3I; and Threat Evaluation, Phenomonology, and Other Support.

The Systems Development category is made up of those activities that directly constitute formal development of the LDS system, including systems engineering, command and control, systems testing, and site preparation and construction. These are the principal activities that comprise the Major Defense Acquisition Programs (MDAPs) subject to oversight by the Defense Acquisition Executive.

The second category of Risk Mitigation, Hedges and P^3I constitutes the technology program in direct support of the LDS development effort. These activities include efforts to develop improved passive sensors, enhanced signal processing techniques, and lighter and smaller interceptor components. Development of the Ground-Based Surveillance and Tracking System (GSTS) was included in this category. This program, a risk mitigation alternative sensor for the cueing of Ground Based Interceptors, could not be continued within the funding levels provided.

The remaining category, Threat Evaluation, Phenomonology, and Other Support, is to evaluate the threat, to improve the understanding of key phenomonology, particularly with respect to the discrimination problem, and to provide other critical support activities, including necessary targets and sensors required for testing. These efforts focus on improved sensor technologies for target discrimination and for developing realistic targets for testing the system.

3.2.2 Program Element: 0603214C Spaced-based Interceptors

The Space-Based Interceptor Program Element includes programs, projects, and activities that have as a primary objective the conduct of research on space-based, kinetic kill interceptors, such as Brilliant Pebbles, that could provide an overlay to ground-based ABM interceptors.

Although not a part of the initial limited defense system, space-based interceptors offer the potential for a cost-effective means of providing highly effective protection, on a global basis, against limited missile attack. This Program Element, which previously included systems development, risk mitigation and scientific studies towards spaced-based interceptors, has been realigned to continue Brilliant Pebbles (BP) research as an extended demonstration/validation program geared towards a future, follow-on option for ballistic missile defense.

3.2.3 Program Element: 0603217C Other Follow-On Systems

The Other Follow-On Systems Program Element includes programs, projects, and activities that have as a primary objective the development of technologies capable of supporting systems, components, and architectures that could produce highly effective defenses in the future. Projects funded in this Program Element lay the foundation to develop defensive systems that provide significant added performance capabilities for countering potential future threats that may well increase in both number and sophistication. This Program Element includes two categories of effort: Directed Energy and Other Advanced Technologies.

The Directed Energy efforts are pursuing high-energy laser and particle beam technologies which will support the development of systems capable of near-speed-of-light intercept, interactive target discrimination, and continuous worldwide coverage.

Included in the technologies being investigated are advanced sensors and interceptors. The sensor efforts focus on demonstrating acquisition, tracking, and discrimination capabilities from small sensor platforms. Advanced interceptor technology includes research in the field of hypervelocity projectiles with a focus on gun-launched projectiles that use electricity and magnetism to accelerate projectiles to very high speeds sufficient to destroy an attacking missile on impact. This technology offers a multiple-shot capability, a reusable launcher, and low-cost projectiles.

Other FY1993 efforts will focus on advanced power and power conditioning systems, and Single Stage Rocket Technology (SSRT), previously known as Single Stage To Orbit (SSTO).

3.2.4 Program Element: 0603218C Research and Support Activities

The Research and Support Program Element contains three categories of activities: Research; General Test And Evaluation; and Program Support for activities in one or more of the other program elements. The Research category was markedly reduced in 1992 by aligning the efforts more closely with program objectives of the other Program Elements and funding that research from those Program Elements. The remaining efforts focus on exploring innovative science and technologies of potential interest to ballistic missile defense and continued intelligence efforts to characterize the evolving ballistic missile threat and potential countermeasures to missile defense systems.

General Support includes general studies and overall management support. This category pays for management support to SDIO as well as salaries, buildings, and basic management support within the executing services and agencies. In compliance with Congressional limitations on support services imposed in the 1993 Authorization Act, management support was reduced by 15% from requested levels.

3.2.5 Program Element Status Summary

Table 3-2 provides a summary listing of the programs and projects by Program Element and the realigned FY1993 planned budget levels. A narrative description and a technical assessment of each program and project is provided in Appendix to this report. Table 3-3 provides a summary relating the next program milestones for major programs and the estimated costs to achieve these milestones.

Table 3-1
Correlation Of GPALS Functional Areas And SDI Program Support Activities With Projects, Program Elements, And Possible Deployment Phases

GPALS Functional Areas And Program Support Activities	Projects	Program Elements				GPALS Deployment Phases	
		LDS	SBI	Follow-on	Research And Support	Initial	Potential Follow-on
Sense An Attack	1101 Passive Sensor	●				●	
	1102 Radar	●				●	
	1103 Laser Radar Technology	●					●
	1104 Signal Processing	●				●	
	1105 Discrimination	●				●	
	1106 Sensor Studies	●				●	
	1110 Sensor Integration	●					
	1601 IST				●		●
	2102 Brilliant Eyes	●				●	
	2103 GSTS	●				●	
	2104 GBR	●				●	
	3109 System Security	●				●	
	3110 Survivability Eng	●				●	
	3111 Surveillance Eng	●					
	3307 AOA / AST	●				●	
Control, Operate, And Integrate	1403 Computer Eng	●				●	
	1405 Communications Eng	●				●	
	1601 IST				●		●
	2300 Command Center	●				●	
	2304 Software Eng	●				●	
Engage And Destroy - Strategic	1208 Discriminating Interceptor	●				●	
	1209 Endo Tech	●				●	●
	2202 GBI	●				●	
	2205 Brilliant Pebbles		●				●
Engage And Destroy - Follow-on	1201 Int Comp Tech	●		●			●
	1202 Exo LEAP	●		●			●
	1204 Int Study & Analysis	●					●
	1212 D-2 Program			●			
	1301 FEL			●			●
	1302 Chem Laser			●			●
	1303 NPB Tech			●			●
	1305 ATP / FC			●			●
	1307 DE Demo			●			●
	1601 IST						●
	1602 SBIR						●
Support With Key Technology	1502 Lethality		●	●		●	
	1503 Power Cond	●		●	●	●	●
	1504 Mats & Structs	●		●		●	●
	1601 IST			●			●
	2106 ATS				●		

Table 3-1
Correlation Of GPALS Functional Areas And SDI Program Support Activities With Projects, Program Elements, And Possible Deployment Phases (Cont'd)

GPALS Functional Areas And Program Support Activities	Projects	Program Elements				GPALS Deployment Phases	
		LDS	SBI	Follow-on	Research And Support	Initial	Potential Follow-on
Perform System Analysis, Engineering And Testing	1501 Survivability	●				●	
	1502 Lethality	●	●	●		●	●
	1504 Materials & Structures			●	●	●	●
	1701 Launch Services	●					●
	1702 Spec Test Acts			●			●
	1703 Tech Sat			●			●
	2304 Software Engineering	●				●	
	3102 Sys Engineering	●				●	
	3103 SDI Metrology	●					
	3104 ILS	●				●	
	3105 Prod & Manufacture	●				●	
	3107 Environmental Siting & Facilities				●	●	
	3108 Operational Environments	●				●	●
	3109 Sys Sec Engineering	●				●	
	3110 Survivability Engineering	●				●	
	3111 Surveillance Engineering	●				●	
	3112 Systems Engineering Mod	●				●	
	3113 Ground Common	●				●	
	3201 System Arch	●					
	3202 Ops Interface	●				●	●
	3203 Threat Development				●	●	●
	3204 Countermeasures				●	●	●
	3206 System Threat				●	●	
	3207 Systems Analysis	●				●	
	3301 Data Center	●		●		●	●
	3302 System Test Environment	●				●	
	3303 Ind T / E Oversight	●				●	
	3304 Targets	●			●	●	
	3306 ARC	●				●	
	3307 AOA / AST	●				●	
	3308 System Simulator	●				●	
	3309 System Test Plan / Exec	●				●	
	3313 Test Range	●				●	
	3314 Op Test Support	●				●	
Manage	3310 Test Facility	●				●	
	3311 Mob Test Assets	●		●		●	
	3312 NTB Support	●				●	
	4000 Op Support	●	●	●	●	●	●
	4302 Tech Transfer				●		
	4305 Min Acc For PET			●			

Table 3-2
Program Element Key Activities
(In Millions Of Then Year Dollars)

PMA	Title		FY 93
Limited Defense System			
Systems Development			
3102	System Engineering		71.184
3103	SDI Met		2.350
3104	ILS		2.920
3105	Manufacturing & Producibility		8.839
3109	Systems Security		12.295
3110	Survivability Engineering		.400
3111	Surveillance Engineering		4.950
3308	System Simulator		7.398
3309	System Test / Plan		31.215
2300	Command Center		52.348
2304	Software Engineering		6.425
3112	System Engineering Modeling		10.770
2102	BE		241.000
2104	GBR		90.355
2202	GBI		142.400
4201	System Engineering Mgmt		12.273
		Subtotal	697.122
Risk Mitigation, Hedges And P I^3			
1101	Passive Sensors		21.780
1102	Radar		10.305
1104	Signal Processing		18.510
1201	Interceptor Component Tech		14.985
1202	Interceptor Integration		141.242
1204	Interceptor Studies		7.500
1208	Discriminating Interceptor		0.200
1209	Endo Technology		18.910
1405	Comm Engineering		11.285
1503	Power		0.825
1504	Materials & Structures		11.065
2103	GSTS		10.500
1403	Comp Engineering		3.720
1701	Launch Services	Subtotal	30.075
			300.902
Threat Evaluation, Phenomenology And Other Support			
1105	Discrimination		88.633*
1106	Sensor Studies & Exp		141.744
1110	Sensor / Integration		48.670
1501	Survivability		25.160
1502	Lethality		4.725
3102	System Engineering		21.075
3304	Targets		67.370
3307	AST		37.830
3207	System Analysis		12.200
4000	Operational Support	Subtotal	31.993
			479.400

* Includes MILCON

Chapter 3

Program Element Descriptions

Table 3-2 (Cont'd)
Program Element Key Activities
(In Millions Of Then Year Dollars)

PMA	Title	FY 93
Limited Defense System (Cont'd)		
Critical Support Activities		
3115	System Engineering	5.020
3201	Arch Studies	4.170
3202	Ops Interface	8.191
3301	Data Centers	10.000
3302	NTB	91.060
3303	T & E Planning	3.758
3306	ARC	17.020
3310	Test Facility	25.320
3311	Mobile Test	16.410
3312	NTB Support	7.446
3313	Test Range	19.965
3314	Op Test Support	0.925
4000	Op Support	12.015
	Subtotal	221.300
	LDS Total	1,698.724
Space Based Interceptors		
Systems Development		
2205	Brilliant Pebbles	245.960
4000	Operational Support	20.040
	Subtotal	266.000
Threat Evaluation, Phenomenology, And Other Support		
1502	Lethality	4.000
	Subtotal	4.000
	SBI Total	270.000

Table 3-2 (Cont'd)
Program Element Key Activities
(In Millions Of Then Year Dollars)

PMA	Title		FY 93
Other Follow-on Systems			
Directed Energy			
1301	FEL		14.182
1302	Chemical Laser		69.414
1303	NPB		38.146
1305	ATP/FC		19.367
1307	DE Demo		22.408
4000	Operational Support		5.000
		Subtotal	168.517
Other Advanced Technologies			
1201	Interceptor Components		2.500
1202	Interceptor Integration		44.023
1212	D-2 Program		10.000
1502	Lethality		1.551
1503	Power		22.879
1504	Materials And Structures		2.400
1702	Spec Test Act		32.260
2106	ATS		20.435
3301	Data Centers		2.990
3311	Test Assets		.850
4305	PET		.500
		Subtotal	140.388
		OFO Total	308.905
Research And Support			
Research			
1503	Pwr And Pwr Conditioning		21.600
1504	Materials And Structure		10.150
1601/2	IS & T/SBIR		127.157
3203	Intel Threat		14.875
3204	Countermeasures		17.296
3206	System Threat		9.631
4302	Technology Transfer		2.239
		Subtotal	202.109
Test And Evaluation			
3304	Targets		13.150
Support			
3107	Environmental Siting		5.600
4000	Operational Support		203.212
		Subtotal	208.812
		R&S Total	424.071

Table 3-3
Estimated Funding Required To Meet Next Milestone
(In Millions Of Then Year Dollars)

Program / Project		Required After FY 1995	Description Of Next Milestone	Date
2102	Brilliant Eyes	668	Milestone II	1998
2104	National Missile Defense-Ground Based Radar	67	Milestone II	1998
2202	Ground Based Interceptor	1469	Milestone II	1998
2300	Command Center	714	Milestone II	1999

Chapter 4
Program Funding

This chapter responds to subparagraph (b)(8) of the National Defense Act for Fiscal Years 1990 and 1991 (Public Law 101-189), which requests "Details regarding funding of programs and projects for the Strategic Defense Initiative (including the amounts authorized, appropriated and made available for obligation after undistributed reductions or other offsetting reductions were carried out), as follows:

(A) The level of requested and appropriated funding provided for the current fiscal year for each program and project in the Strategic Defense Initiative budgetary presentation materials provided to the Congress.

(B) The aggregate amount of funding provided for previous fiscal years (including the current fiscal year) for each such program and project.

(C) The amount requested to be appropriated for each such program and project for the next fiscal year.

(D) The amount programmed to be requested for each such program and project for the following fiscal year.

(E) The amount required to reach the next significant milestone for each demonstration program and each major technology program."

4.1 Introduction

Table 4-1 provides the requested SDI budget summary. All programs and projects directly supporting strategic defense are listed. Included are those technology efforts which support both strategic and theater missile defense. The funds indicated reflect the total funds directed towards the technology effort. As with all chapters of this report, funding associated exclusively with Theater Missile Defense is not included but is addressed in the separate TMDI Report to Congress.

Table 4-1
Project Funding Profile
(In Millions Of Then Year Dollars)

Project Number And Title	Funds Expended Through FY 1992	FY 1993 Current SDI*		FY 1994 Request SDI*		FY 1995 Request SDI*	
1101 Passive Sensors	451	22		44		37	
1102 Microwave Radar	115	10		13		17	
1103 Laser Radar Technology	445	0		13		13	
1104 Signal Processing	534	19		32		34	
1105 Discrimination	1093	74		105		115	
1106 Sensor Studies And Experiments	960	142	(6)	168	(5)	120	(5)
1110 Sensor Integration	21	49		49		37	
1201 Interceptor Component Technology	530	17		16		37	
1202 Interceptor Integration Technology	591	185		65		60	
1204 Interceptor Studies And Analysis	662	8		10		11	
1208 Discriminating Interceptor	0	1		50		55	
1209 Endoatmospheric Interceptor Technology	50	19		65		85	
1212 D-2 Program	6	10		10		0	
1301 Free Electron Laser	1042	14		0		0	
1302 Chemical Laser Technology	869	69		43		38	
1303 Neutral Particle Beam Technology	725	38		20		39	
1305 Acquisition, Tracking, Pointing And Fire Control Technology	1452	19		20		25	
1307 Directed Energy Demonstration	0	22		15		24	
1403 Computer Engineering	2	4		1		1	
1405 Communications Engineering	22	11		22		20	
1501 Survivability Technology	552	25	(3)	68	(6)	80	(5)
1502 Lethality And Target Hardening	479	10	(28)	4	(37)	5	(37)
1503 Power And Power Conditioning	486	45		70		60	
1504 Materials And Structures	162	24		20		20	
1601 Innovative Science And Technology	645	83		86		88	
1602 New Concepts Development	183	44		54	(32)	85	(47)
1701 Launch Services	83	30		128		123	
1702 Special Test Activities	54	32		5		0	
1703 Techsat	0	0		25		36	
2102 Brilliant Eyes	436	241		170	(136)	189	(154)
2103 Ground Based Surveillance And Tracking System	230	11		0		0	
2104 Ground Based Radar	349	91	(112)	379	(195)	283	(143)
2106 ATS	32	21	(69)	0	(53)	0	(88)

* ( ) TMDI Funding For Project

Table 4-1
Project Funding Profile (Cont'd)
(In Millions Of Then Year Dollars)

Project Number And Title	Funds Expended Through FY 1992	FY 1993 Current SDI*		FY 1994 Request SDI*		FY 1995 Request SDI*	
2202 Ground Based Exoatmospheric Interceptor Development	882	110		571		772	
2205 Brilliant Pebbles	909	246		336		339	
2300 Command Center	727	52		53	(6)	262	(32)
2304 System Software Engineering	8	6		7		20	
3102 System Engineering	281	97		82	(7)	117	(11)
3103 SDIO Metrology	2	2		2		3	
3104 Integrated Logistics Support	48	3		4		6	
3105 Producibility & Manufacturing	38	9		10		20	
3107 Environment, Siting & Facilities	63	6		17		22	
3108 Operational Environments	3	0		1		1	
3109 System Security Engineering	19	12		13		24	
3110 Survivability Engineering	3	1		2		9	
3111 Surveillance Engineering	16	5		5		13	
3112 System Engineering Modeling	27	11		15		32	
3113 Ground Common	14	0		5		3	
3201 Architecture And Analysis	194	4		5		6	
3202 Operations Interface	37	8		9		10	
3203 Intelligence Threat Development	80	15		10		11	
3204 Countermeasures Integration	126	17	(1)	23		24	
3206 System Threat	15	9		10		11	
3207 Systems Analysis	39	12		7		8	
3301 SDIO Test Data Centers	13	13	(0)	12	(7)	13	(9)
3302 System Test Environment	627	91		61		63	
3303 Test & Evaluation Planning	20	4		7		7	
3304 Targets	432	132	(21)	228	(71)	187	(77)
3306 Computer Resources And Engineering	68	17		24		29	
3307 Airborne Surveillance Test Bed	663	38		45		0	
3308 System Simulator (Level 1 And 2)	15	7		5		10	
3309 System Test Planning And Execution	24	31		111		292	(9)
3310 T&E Facilities And Launch Support	44	25	(1)	21	(10)	15	(15)
3311 Mobile Test Assets	12	18		16	(7)	12	(12)
3312 System Test Environment Support	12	7		8		8	
3313 Test Ranges	0	21		31	(15)	22	(23)
3314 OP Test Support	0	1		0		0	
4000 Operational Support Costs	1437	285		382	(61)	414	(81)
4302 Technology Transfer	3	2		3		3	
4305 Miniaturized Accelerators For PET	60	1		0		0	

* ( ) TMDI Funding For Project

Chapter 5

ABM Treaty Compliance

Chapter 5
ABM Treaty Compliance

This chapter responds to subparagragh (b)(6) of Section 224, National Defense Authorization Act for Fiscal Years 1990 and 1991 (Public Law 101-189), which requests "A statement of the compliance of the planned SDI development and testing programs with existing arms control agreements, including the 1972 Anti-Ballistic Missile Treaty."

5.1 Introduction

The 1972 Anti-Ballistic Missile (ABM) Treaty addresses the development, testing, and deployment of ABM systems and components. It should be noted that nowhere does the ABM Treaty use the word "research." Neither the United States nor the Soviet delegation to the Strategic Arms Limitation Talks (SALT I) negotiations chose to place limitations on research, and the ABM Treaty makes no attempt to do so. The United States had traditionally distinguished "research" from "development" as outlined by then-U.S. delegate Dr. Harold Brown in a 1971 statement to the Soviet SALT I delegation. Research includes, but is not limited to, conceptual design and laboratory testing. Development follows research and precedes full-scale testing of systems and components designed for actual deployment. Development of a weapon system is usually associated with the construction and field testing of one or more prototypes of the system or its major components. However, the construction of a prototype cannot necessarily be verified by national technical means of verification. Therefore, in large part because of these verification difficulties, the ABM Treaty prohibition on the development of sea-, air-, space- or mobile land-based ABM systems, or components for such systems, applies when a prototype of such a system or its components enters the field-testing stage.

The ABM Treaty regulates the development, testing, and deployment of ABM systems whose components were defined in the 1972 Treaty as consisting of ABM interceptor missiles, ABM launchers, and ABM radars. ABM systems based on other physical principles and including components capable of substituting for ABM interceptor missiles, ABM launchers, or ABM radars are addressed only in Agreed Statement D. In order to fulfill the basic Treaty obligation not to deploy ABM systems or components except as provided in Article III, this agreed statement provides that in the event that ABM systems based on other physical principles and including components capable of substituting for ABM interceptor missiles, ABM launchers, or ABM radars are created in the future, specific limitations on such systems and their components would be subject to discussion in accordance with Article XIII and agreement in accordance with Article XIV of the Treaty. The Agreed Statement does not proscribe the development and testing of such systems, regardless of basing mode. The SDI Program will continue to be conducted in a manner that fully complies with all U.S. obligations under the ABM Treaty.

Research and certain development and testing of defensive systems are not only permitted by the ABM Treaty but were anticipated at the time the Treaty was negotiated and signed. Both the United States and the Union of Soviet Socialist Republics supported this position in testimony to their respective legislative bodies. When the Treaty was before the Senate for advice and consent to ratification, then-Secretary of Defense Melvin Laird advocated, in his testimony, that the United States “vigorously pursue a comprehensive ABM technology program.” In a statement before the Presidium of the Supreme Soviet, Marshall Grechko said the ABM Treaty “places no limitations whatsoever on the conducting of research and experimental work directed toward solving the problem of defending the country from nuclear missile strikes.”

5.2 Existing Compliance Process For SDI

The Department of Defense (DOD) has in place an effective compliance process (established with the SALT I agreements in 1972) under which key offices in DOD are responsible for overseeing SDI compliance with all the United States arms control agreements. Under this process, the SDI organization (SDIO) and DOD components ensure that the implementing program offices adhere to DOD compliance directives and seek guidance from offices charged with oversight responsibility.

Specific responsibilities are assigned by DOD Directive 2060.1, July 31, 1992, “Implementation of, and Compliance With, Arms Control Agreements.” The Under Secretary of Defense (Acquisition), USD(A), ensures that all DOD programs are in compliance with United States arms control agreements. The Service secretaries, the Chairman of the Joint Chiefs of Staff, and agency directors ensure the internal compliance of their respective organizations. The DOD General Counsel provides advice and assistance with respect to the implementation of the compliance process and interpretation of arms control agreements.

DOD Directive 2060.1 also establishes procedures for ensuring the continued compliance of all DOD programs with existing arms control agreements. Under these procedures, questions of interpretation of specific agreements are to be referred to the USD(A) for resolution on a case-by-case basis. No project or program which reasonably raises a compliance issue can enter into the testing, prototype construction, or deployment phase without prior clearance from the USD(A). If such a compliance issue is in doubt, USD(A) approval shall be sought. In consultation with the office of the DOD General Counsel, Office of the Assistant Secretary of Defense for International Security Policy, and the Joint Staff, USD(A) applies the provisions of the agreements, as appropriate. DOD components, including SDIO, certify internal compliance periodically and establish internal procedures and offices to monitor and ensure internal compliance.

In 1985, the United States began discussions with allied governments regarding technical cooperation on SDI research. To date, the United States has concluded bilateral SDI research Memoranda of Understanding (MOUs) with the United Kingdom, Germany, Israel, Italy, and Japan. All such agreements will be implemented consistent with the United States’ international obligations, including the ABM Treaty. The United States has established guidelines to ensure that all exchanges of data and research activities are conducted in full compliance with the ABM Treaty obligations not to transfer to other states ABM systems or components limited by the Treaty, nor to provide technical descriptions or blueprints specially worked out for the construction of such systems or components.

5.3 SDI Experiments

All SDI field tests must be approved for ABM treaty compliance through the DOD compliance review process. The following major programs and experiments, all of which involve field testing, have been approved and are to be conducted during the remainder of FY 1993 and FY 1994: Laser Atmospheric Compensation Experiment (LACE); flights throughout FY 1993-1994 in the Airborne Surveillance TestBed (AST) program, a revision of the Airborn Optical Adjunct project; the Lightweight Exoatmospheric Projectile (LEAP) III and IV flight experiments; Navy LEAP FTV 2-3; SRAM (Short-Range Attack Missile) LEAP flight tests 1-2; Brilliant Pebbles Flight Experiments 1M and 1T, Brilliant Pebbles Tether Tests, and Brilliant Pebbles target development flight tests; High Altitude Balloon Experiments (HABE) and Kestrel experiments; Patriot Pre-Planned Product Improvements (P3I); Extended Range Interceptor (ERINT) program flight experiments; Airborne Atmospheric Compensation and Tracking TestBed (AACT) experiments in the Airborne Laser project; Single Stage Rocket Technology (formerly called the Single-Stage-To-Orbit) experiment; TechSat-A satellite bus; the Midcourse Space Experiment (MSX); AEGIS SPY-1 radar and Standard Missile SM II (Block 4) modifications; RAPTOR unmanned aerial vehicle (UAV) D-1 platform testing; the Pathfinder Solar Electric aircraft Test Platform (SETP) in the RAPTOR/TALON project; Electrothermal Chemical (hypervelocity) Gun integration field-tests at Yuma Proving Grounds; Miniature Seeker Technology Integration (MSTI) Satellite Development Program MSTI flights 2-3; and the Israeli Arrow interceptor development program known as the Arrow Continuation Experiments (ACES).

The following major projects and experiments have been approved for later years, subject, in some cases, to review of more completely defined experiments: Deep Space Program Experiment (Project Clementine flights II and III); the Ground-Based Radar (NMD GBR-T demval); Topaz II Flight Tests; and the Neutral Particle Beam Space Experiment (NPBSE).

In addition, the following data collection activities continue to be approved: the Optical Airborne Measurement Program (OAMP) and High Altitude Observation aircraft (HALO and ARGUS); Cobra Judy; Godiva; Cobra Ball; Red Gemini VII-VIII; Aerothermal Reentry Experiments (ARE-2H and ARE-3); Ultraviolet Plume Instrument (UVPI) and Army Background Experiment; Zodiac Beauchamp; Red Tigress II-IV; Polar Ozone Aerosol Measurements (POAM) II experiment; TMD Countermeasures Mitigation Program (TCMP); Space Power Experiments Aboard Rocket (SPEAR) III; Combined Optical Measurements Experiment Tests (COMET); Rapid Optical Beam Steering (ROBS) System (formerly called the Transportable LADAR System); Project Caeser; Deep Space Program Experiment (Project Clementine Flight I); and Shuttle Pallet Satellite (SPAS) III. The following projects have been approved but are not funded for FY 1993-94: Sounding Rocket Measurement Program (SRMP); the Firebird/Firefly experiments; and the Vehicle Interactions Program (VIP). The System Integration Test (SIT 1) planned for FY 1993 utilizes data collected by a variety of sensor systems for simulation and integration planning purposes; follow-on SITs will be examined for Treaty compliance as their experiments are better defined.

The following projects have approved activities that are not considered to be in field testing: Average Power Laser Experiment (APLE); Alpha/LAMP Integration; and Hypervelocity Gun (HVG) projects. Also, the National Test Bed including the Experiment Control Center (CERES) has been determined to be compliant with the ABM Treaty.

The following target development projects have been approved: Strategic Target System (STARS); Operational and Developmental Experiments Simulator (ODES); STORM Ballistic Tactical Target Vehicle (BTTV) flights (formerly called the ERINT Target System development project); and the Target Development Tests. The Brilliant Pebbles Target Launch Vehicle Demonstration has been approved and may be re-conducted. All SDI launches are reviewed for compliance with the research and development launch provisions of the 1987 Intermediate-Range Nuclear Forces Treaty. Such launches will be notified to the Nuclear Risk Reduction Center of the former Soviet Union as required.

The following programs, some of which have not been sufficiently defined for compliance review, are not yet approved: Brilliant Pebbles flight tests 2M, 3M, 4M, 2T, and 3T; Navy LEAP FTVs 4-11; SRAM (Short Range Attack Missile) LEAP flight tests 3-5; Bowshock III; the Ground-Based Interceptor (GBI) (formerly the Exoatmospheric Reentry Vehicle Interceptor Subsystem or ERIS) flight experiments; Theater High Altitude Area Defense (THAAD); the Ground-Based family of radars (NMD-GBR UOE and TMD-GBR); Corps SAM; Brilliant Eyes flight tests; Miniature Seeker Technology Integration (MSTI) 4 experiment; RAPTOR UAV D-2 testing, and TALON kinetic-energy kill vehicle (KKV) “tethered” ALPHA TALON testing and BETA atmospheric flight-tests; TechSat-A satellite testbed platform experiments; and the Theater Missile Target Program. Software upgrades for U.S. Early Warning Radars are currently under compliance review.

We are planning to develop and deploy theater/tactical missile defense systems to counter the projected threat to our forces abroad and to our allies. Although the objective of the ABM Treaty is to limit defenses against strategic ballistic missiles, there may be conflicts between the Treaty and the development and deployment of some of the theater/tactical defense systems under consideration. We are currently studying this issue.

Currently, no experiment has been approved that would not fall within the categories used in Appendix D to the 1987 Report to Congress on the Strategic Defense Initiative. Changes to previously approved experiments require compliance review.

Chapter 6

Other Nation Participation

Chapter 6
Other Nation Participation

This chapter responds to subparagraph (b)(5) of the National Defense Authorization Act for Fiscal Years 1990 and 1991 (Public Law 101-189), which requests "The status of consultations with other member nations of the North Atlantic Treaty Organization, Japan, and other appropriate allies concerning research being conducted in the Strategic Defense Initiative Program."

6.1 Consultations

Since the beginning of the SDI program, the U.S. has consulted with allied and friendly nations on SDI research, development, testing, and deployment plans. When the SDI program was refocused toward GPALS in 1991, U.S. officials conducted numerous briefings abroad and in the U.S. to inform and to consult with our allies and friends on this new direction for ballistic missile defense. This consultation, including discussions on the Global Protection System (GPS) concept agreed at the June 1992 U.S.-Russian Summit, continues. Following that Summit, meetings and discussions were held with both allies and friends on the GPS concept and its relationship to the GPALS program. Details of these consultations are addressed in Chapter 1.

6.2 Research Participation

From the beginning of allied and friendly nation participation in the SDI research effort in 1985, the U.S. technology base has reaped many benefits over a wide range of technologies. As in prior years, the success of such participation is demonstrated through present and new contractual efforts. Currently, trends in allied involvement in the SDI program are toward theater missile defense-related activities, and test bed and technology experiments. This continuing and comprehensive involvement with allies will help underpin future efforts, particularly if and when allied and friendly nations take their own decisions to begin the development of missile defenses.

6.3 Summary Of Past, Present And New Efforts

Using established ground rules for participation, such as laws and policies governing rights to research results, SDIO has engaged and continues to engage in a wide variety of efforts with allied and friendly nations' governments and research entities. A summary of the past, present and recently begun efforts follows:

Country	Past And Present Efforts	New Efforts
France	Sensors, Theater Defense Architectures, Free-electron Lasers, Klystrons, Rocket Propulsion Components And Casings	Extended Air Defense Simulations
Germany	Pointing / Tracking, Optics, Lethality And Target Hardening, Electron Lasers, Theater Defense Architectures, Infrared Phenomenology	None (Discussions On Extended Air Defense Test Bed)
Israel	Electrochemical Propulsion, Magnetohydrodynamics, Shortwave Chemical Lasers, ATBM Interceptors (ARROW), Test Bed, Theater Defense Architectures	ARROW Continuation Experiments (ACES), Test Bed Experiments
Japan	Superconducting Magnetic Energy Storage, Josephson Junction Microprocessor, Diamond Optics, Electric Propulsion, Western Pacific Architecture Study	---
Netherlands	Theater Defense Architecture, Electromagnetic Launchers	Extend Electromagnetic Launcher MOA For Another Five Years
UK	Optical / Electron Computing, Thyratrons, Ion Sources And Power Conditioning, Electromagnetic Launchers, Optical Logic Arrays, Countermeasures And Penetration Aids, UK Test Bed, Theater Defense Architecture Analysis	Advanced Lethality Technology
Belgium	Theater Defense Architecture, Laser Algorithms, Mosaic Array Data Compression And Processing Module	---
Canada	Power System Material, Particle Accelerators, Theater Defense Architecture, Sounding Rockets	---
Denmark	Magnetic Optics For Free Electron Laser Beam Steering	---
Italy	Cryogenic Induction, Superconducting Magnetic Energy Storage, Millimeter-wave Radar Seeker, Theater Defense Architecture, Smart Electro-optical Sensor	---
Russia	(No Previous Efforts)	Electric Thrusters, TOPAZ Thermionic Nuclear Reactor, Tacitrons

6.4 Summary Of Participation

The annual funding for all research efforts with allied and friendly nations constitutes 2-3% of SDIO's budget. Cumulatively, since this participation began in 1985, almost $800 million have been invested in these programs. About 20% of this total value has been funded by foreign participants through various cooperative research programs. The SDIO is currently engaged in a number of additional exploratory discussions with the goal of promoting continued foreign technical contributions to the ballistic missile defense effort.

Chapter 7

Countermeasures

Chapter 7
Countermeasures

This chapter responds to subparagraph (b)(7) of Section 224 of the National Defense Authorization Act for Fiscal Years 1990 and 1991 (Public Law 101-189), which requests "A review of possible countermeasures of the Soviet Union to specific SDI programs, an estimate of the time and cost required for the Soviet Union to develop each such countermeasure, and an evaluation of the adequacy of the SDI programs described in the report to respond to such countermeasures."

7.1 Introduction

In recognition of the changing international security environment, the countermeasures program has intensified its focus on the Third World while continuing to investigate potential Commonwealth of Independent States (CIS) responses to U.S. BMD architectures. The SDI Countermeasures Integration (CMI) Program has directed most of its efforts to examining the less sophisticated counters that could be taken to defeat ground-based missile defense systems. Central to these efforts has been the gathering of data on the technologies and resources available to the world at large, particularly with the demise of the Soviet Union. Having identified several potential relatively simple countermeasures, the CMI Program is moving to evaluate and verify their credibility and impact on the GPALS elements. The emphasis in this report, however, is on the strategic missile systems and the countermeasures they might employ, principally against the NMD segment of GPALS. Work on theater missile defense countermeasures is discussed in the separate report on the Theater Missile Defense Initiative.

7.2 The Commonwealth Of Independent States

While the breakup of the Soviet Union has reduced the likelihood of a deliberate massive ballistic missile attack against the United States, continuing turmoil in the former Soviet Union has increased the risk of ballistic missile and related technologies proliferation. To date, the major emphasis of the non-TMD countermeasures effort has been on analyzing the capabilities of the Russian Federation as the principal successor nuclear power. Continuing studies of Russian industrial capabilities have shown a decreasing ability to field advanced countermeasures on current and projected missile systems in the next decade. Expectations are that only those countermeasures postulated to be on currently fielded systems, with perhaps minor changes, will be available in the GPALS deployment epoch. Should relations between the United States and Russia deteriorate, Russia may consider and possibly pursue countermeasures leading to a future capability to reconstitute their offensive forces.

The earlier export of such missile systems as the Scud, along with the general availability of ballistic missile technology, have made Russian expertise in system modification a valuable commodity in the Third World. The result of these circumstances is a growing concern, even by the Russians themselves, that such technologies and expertise may be the source of missile defense countermeasures in the Third World for years to come.

7.3 Countermeasures Evaluation And Criteria

The CMI Program has begun identifying potential countermeasures to the NMD architecture during 1992. The initial round of the Red/Blue exercise has commenced with the Red Team doing a vulnerability analysis of the NMD architecture. A small number of potential counters have been identified and further analysis to determine their credibility is underway. An additional round of the NMD Red/Blue exercise will be conducted in 1993. By understanding the full range of possible counters to BMD, measures can be taken to improve the performance and effectiveness of the defense.

During 1992 the CMI Program conducted several successful experiments to test countermeasure concepts. Most notable was the FIREBIRD 1B and the Countermeasures Demonstration Experiment missions. These experiments included the use of reentry vehicle masking and deception objects and provided significant data on flight dynamics, high altitude physics and chemical environments.

7.4 Summary And Conclusions

During 1992, the SDI Countermeasures Program continued to analyze potential countermeasures to BMD systems and architectures but in a new context from previous years. While a drastically different world situation faces us, there are still significant numbers of strategic systems of concern to the United States. These systems and the potential countermeasures that could be used with them in an accidental or intentional attack remain a serious threat to the United States and the effectiveness of a national missile defense system. The CMI Program will continue to coordinate with GPALS element and system designers to ensure that deployed defenses can respond effectively to a wide variety of counters.

Chapter 8

Relation Of SDI Technologies To Military Missions

Chapter 8
Relation Of SDI Technologies To Military Missions

This chapter responds to subparagraphs (b)(9) of Section 224 of the National Defense Authorization Act for Fiscal Years 1990 and 1991 (Public Law 101-189), which requests "Details on what Strategic Defense Initiative technologies can be developed or deployed within the next 5 to 10 years to defend against significant military threats and help accomplish critical military missions. The missions to be considered include the following:

(A) Defending elements of the Armed Forces abroad and United States allies against tactical ballistic missiles, particularly new and highly accurate shorter-range ballistic missiles of the Soviet Union armed with conventional, chemical, or nuclear warheads.

(B) Defending against an accidental launch of strategic ballistic missiles against the United States.

(C) Defending against a limited but militarily effective attack by the Soviet Union aimed at disrupting the National Command Authority or other valuable military assets.

(D) Providing sufficient warning and tracking information to defend or effectively evade possible attacks by the Soviet Union against military satellites, including those in high orbits.

(E) Providing early warning and attack assessment information and the necessary survivable command, control, and communications to facilitate the use of United States military forces in defense against possible conventional or strategic attacks by the Soviet Union.

(F) Providing protection of the United States population from a nuclear attack by the Soviet Union.

(G) Any other significant near-term military mission that the application of SDI technologies might help to accomplish."

and subparagraph (b)(10) which requests that "for each of the near-term military missions listed in paragraph (9), the report shall include the following:

(A) A list of specific program elements of the Strategic Defense Initiative that are pertinent to such missions.

(B) The Secretary's estimate of the initial operating capability dates for the architectures or systems to accomplish such missions.

(C) The Secretary's estimate of the level of funding necessary for each program to reach those initial operating capability dates.

(D) The Secretary's estimate of the survivability and cost-effectiveness at the margin of such architectures or systems against current and projected threats from the Soviet Union."

8.1 Introduction

This chapter discusses the application of SDI technologies to critical and/or significant military missions.The chapter also addresses the issue of the survivability of proposed defensive systems.

8.2 SDI Technologies And Illustrative Military Missions

This section addresses significant military missions that SDI technologies might help to accomplish. Significant military missions include air, maritime, ground, and space defense.

8.2.1 Air Defense

The North American air defense mission encompasses surveillance, warning, interception, and identification or negation of unknown aircraft and cruise missiles that penetrate the air defense identification zone. Systems that contribute to the air defense mission in the North American continent include the Joint Surveillance System network or Air Force and Federal Aviation Administration radars, the Distant Early Warning Line/North Warning system radars across Alaska and Canada, Over-the-Horizon Backscatter radar, Airborne Warning and Control System (AWACS) aircraft, and fighter-interceptors on continuous alert. SDI technologies could significantly improve air defense mission efficiency and effectiveness, especially against future threats.

North American air defense assets operate as a system, with one type of surveillance asset compensating for the deficiencies of others. Interceptor aircraft assist fixed surveillance sensors in identifying all tracks of incoming aircraft. In some cases, AWACS aircraft and interceptors perform surveillance when transient gaps occur in radar coverage. If fixed or aircraft-based sensors had greater capability, interceptors could be employed more effectively and efficiently. Improvements in sensor range, data processing, and operating efficiency would greatly facilitate the air defense mission.

Because aircraft can be diverted to many possible targets, discerning the objectives of an air-breathing attack is difficult. However, broad patterns of mass raids can be revealed if information from multiple sensors can be assimilated simultaneously. SDI's advances in survivable communications and distributed computation could significantly improve raid recognition, attack assessment, and efficient assignment of interceptors.

The North American air defense surveillance mission could obtain substantial benefit from a variety of SDI efforts. SDI electrical power projects could provide long-term energy sources for unattended ground-based radar systems. Battle management and communications systems within the SDI Program could facilitate sensor data fusion and attack assessment. Improvements in aircraft-based compact data processing and sensor operations could greatly enhance airborne surveillance of air-breathing threats. Survivable, high-data-rate communication systems could help maintain connectivity among the air defense regions and improve the allocation of interceptors and sensors within and among regions.

Tactical air defense in a theater of operations is closely integrated with Theater Missile Defense (TMD) and includes sensors such as the AWACS and other (non-TMD) mobile ground-based radars. These sensors provide early warning and engagement control of Air Force air defense and Army anti-aircraft surface-to-air missile systems such as the PATRIOT (in its anti-aircraft role), HAWK, Stinger, and Chaparral, as well as Vulcan gun systems. The current air defense sensor/weapon configuration results in a highly decentralized command and control environment, which is further constrained by limitations in battle management/command, control and communications (BM/C3) technology.

Theater air defense operations depend on limited sensor and BM/C3 architectures, which are in turn affected by electronic countermeasures and raid size. Sensors incorporating sophisticated SDI technology would ensure sustained theater air defense operation and would preclude the operation's being hampered by countermeasures.

Theater air defense operations could also benefit from the development of SDI weapon technologies. For example, the extension of air defense systems to a more robust role could be derived from hypervelocity gun (HVG), laser, and kinetic-kill vehicle experiments. Early-warning attack assessment functions could benefit from sensor developments. Missile lethality enhancements could be based on improved lethality and vulnerability analyses. Command, control, and data processing could be improved as a result of the software development and signal data processing work being accomplished for the SDI Program. Reductions in size and weight of the missile components and better rocket motors and gun launch components would result in both increased range and higher probability of kill.

At the global level, SDI computer technologies and simulation display advances could help integrate air-breathing and missile threat information necessary to respond to combined attacks. SDI kinetic energy interceptor technologies may allow more intercepts with fewer aircraft. Sensor, kinetic energy interceptor, and battle management technologies pursued by the SDI Program could all be applicable to the strategic air defense missions.

8.2.2 Maritime Operations

The global maritime operations of U.S. naval units and fleets in peacetime and wartime are critically dependent on surveillance, communications, and the ability to intercept hostile forces beyond the range at which the forces can actively threaten fleet units.

Advances in communications, multiprocessors, intelligence interfacing, and software, from projects now under development in the SDI Program, should greatly benefit U.S. fleet operations. For example, the SDI battle management software developed to track and intercept hundreds of ballistic missiles and reentry vehicles (RVs) should be readily adaptable to the Navy's requirements to perform similar operations involving seaborne and airborne friendly and hostile objects. Furthermore, SDI software development tools employing artificial intelligence and knowledge-based technology should markedly reduce the cost and time required to develop and manufacture secure and fault-tolerant software for tactical use in maritime operations.

The SDI advanced infrared sensor technology, if applied in naval aircraft and air defense missiles, could help fleet defenses keep pace with advances in the anti-ship missile (ASM) threat. Space-based radar, employing major advances in high-frequency and sophisticated signal processing techniques for extending sensor performance, will offer a valuable mix for confronting hostile forces with a multispectral surveillance, tracking, and targeting capability.

Spinoffs from HVG and laser technology could result in highly effective ship-based weapons for close-in defense. For example, a rapid-fire electromagnetic gun (rail gun) that propels a low-cost guided projectile could be very effective for defending against ASMs launched from bombers, ships, or submarines. Additionally, electromagnetic coil launchers, with the potential to launch much heavier aircraft from an aircraft carrier than currently is possible, offer a replacement for steam catapults.

Applications of SDI laser weapon technology could provide the quick-kill defense capability needed to counter even the most advanced ASMs. Advances in developing high-power microwave technologies for strategic defense may be applied to seaborne tactical weapons in defense against missiles and targeting satellites, and may be applied to suppression of enemy ship- and land-based defensive radars and command, control, and communications systems.

8.2.3 Ground Forces

For conventional ground force operations enemy forces may deploy a vast array of weapons, including tanks, mobile artillery, armored personnel carriers, and attack helicopters. These weapons are designed to provide the mobility and firepower necessary to defeat allied forces. To counter these capability, U.S. forces require a continued infusion of new technologies to provide improved capabilities in the areas of firepower, fire control, and command control, and communications, as well as improved power supplies to enhance the mobile operations of advanced weapons.

The SDI Program is developing a range of advanced technologies that could be used to develop advanced weapons, support systems, and control systems for conventional forces. For example, previous SDIO investment in HVG technologies could provide significant improvements in anti-armor operations. The HVG could be capable of long-range, rapid, lethal response to conventional attack. In addition, the ability to engage more than one target at a time is being developed through advances in computer-aided and controlled multi-target fire control systems. This ability would enhance the battle management functions of all forces and enhance their efficiency in the use of resources.

The development of high-power-density power supplies could provide a significant benefit to the modern ground force, especially command and control and support elements. Improvements in power technology have led to the development of systems that can provide sufficient power with low noise and/or thermal signatures. Lightweight, quiet power systems would reduce the signature of critical units, thus enhancing survivability while meeting power needs.

The SDI Program also is developing technologies to automate the collection, fusion, and processing of massive amounts of intelligence data on a near-real-time basis. These technologies can help ensure the timeliness and availability of reliable intelligence required to support mobile forces on a battlefield.

8.2.4 Space Defense

U.S. space defense requirements include space surveillance and tracking, space defense weapons, and space system survivability. Particularly relevant are SDI systems (Brilliant Eyes, Brilliant Pebbles technology, Ground-Based Interceptor, Ground-Based Radar) and technologies for maneuvering and hardening space platforms.

Additionally, multi-spectral focal plane arrays and on-board processing are being developed to provide global coverage and multiple track file maintenance. Short-wavelength lasers have direct potential for tracking and providing rapid images of satellites.

8.3 Cost Effectiveness At The Margin

In past years, the focus of the SDI Program has been deterrence of a massive intentional Soviet missile strike. In the former U.S.-Soviet relationship, U.S. planners evaluated prospective defenses using the Nitze Criteria of military effectiveness, survivability, and cost effectiveness at the margin (CEATM).

Public Law 99-145, Section 222 (dated November 8, 1985) stated that “(B) the system is cost effective at the margin to the extent that the system is able to maintain its effectiveness against the offense at less cost than it would take to develop offensive countermeasures and proliferate ballistic missiles necessary to overcome it;...”

In the context of the previous U.S.-Soviet strategic balance, to prevent the Soviets from adding systems to overcome a deployed defense, the defense had to be less expensive to upgrade than the offensive weapons the Soviets deployed. In this context, the Soviets would have a reduced incentive to deploy extra systems, since the U.S. could counter these additions at less expense.

CEATM, while a key criterion for considering the possible deployment of a defense against a massive Soviet attack, is not relevant when applied to Global Protection Against Limited Strikes (GPALS). Additionally, the CEATM criterion was originally applied to avoid an unfavorable long-term, offense-defense, cost competition with the Soviet Union. Since a massive strike from the ex-Soviet, nuclear-capable republics is considered extremely unlikely, ensuring favorable CEATM is no longer an appropriate or relevant criteria.

Nor is CEATM a useful criteria in the context of accidental or unauthorized launches from the former Soviet Union republics, or limited intentional strikes from other nations. The former Soviet Union has no incentive to modify its forces to ensure the success of accidental or unauthorized launches--this would be contradictory. And, with regard to intentional or other attacks by other nations, the defensive capabilities envisioned under the GPALS concept should be sufficient to handle the limited inventory of ballistic missiles these nations are likely to have in the near future.

A cost tradeoff more applicable to the mission of defending against limited strikes is the cost of the defense relative to the value of the protected assets. For a strike against the continental United States (CONUS), this means weighing the cost of GPALS against the value destroyed by an attack in the absence of a defense--potentially tens of millions of lives and hundreds of billions or trillions of dollars.

8.4 Survivability

A critical requirement of the Nitze criteria from Public Law 99-145 is to ensure the functional survivability of potential ballistic missile defense elements in a hostile environment. Public Law 99-145, section 222 states: “A strategic defense system development, test, and evaluation conducted on the Strategic Defense Initiative program may not be deployed in whole or in part unless - (1) the President determines and certifies to Congress in writing that - (A) the system is survivable (that is, the system is able to maintain a sufficient degree of effectiveness to fulfill its mission, even in the face of determined attacks against it).” The U.S.’s former principal concern was the possibility of defense suppression attacks by the Soviet Union on elements of a U.S. ballistic missile system. To address this concern, the SDI program pursued vigorous development of both passive and active survivability technologies, methods and tactics. Passive measures included: hardening the defensive systems against nuclear, kinetic energy, laser, and RF/microwave threats; redundancy; and autonomy. Active measures included options such as attack warning, on-board survivability management options, and evasion/deception tactics.

The defense suppression threat was an acknowledged critical factor in the design of defenses when the SDI program was focused on deterring and disrupting a massive Soviet attack. With the program focus changed to defense against a third country ballistic missile threat and protection against limited accidental or unauthorized attack by the former Soviet Union, it has been incorrectly assumed by some that the concern over a defense suppression attack can be completely relaxed. This position presupposes that defense suppression capability is currently beyond the technical and economic capability of most, if not all, of these countries. Additionally, a defense suppression attack has been viewed only as a precursor to a major Soviet attack. Since this major Soviet defense suppression threat was by far the most stressing, both SDIO threat definition efforts to define the threat and survivability efforts against it were formerly focused entirely in the Soviet direction.

However, an unauthorized limited attack by a ‘rogue’ commander or republic of the former Soviet Union could be accompanied by defense suppression measures if such an already existing capability was available to the commander or republic. Even without an accompanying defense suppression attack, the destruction by U.S. defenses of ballistic missiles and warheads in space may detonate the nuclear warhead(s) and produce a hostile (enhanced radiation and prompt nuclear) space environment in which remaining defensive systems would have to operate. In addition, modest defense suppression attacks by third countries are feasible, especially at the theater and tactical level. Therefore, the design of SDI systems and architectures, even under the GPALS concept, continues to incorporate survivability measures.

The survivability of potential ballistic missile defense systems is ensured through a two-fold approach. First, broad-based SDI survivability programs are maintained to support the development of all potential BMD systems. These efforts include:

- A Balanced Hardening Program, which develops survivability technologies such as: electronics that operate in hostile environments; hardened communications systems; and laser/radio frequency-jamming mitigation tactics. Once validated, these technologies are available for system developers to tailor them to satisfying system-unique requirements.

- An Environment/Analysis and Simulation program, wherein computer environment models are developed and made available to system developers. Operability demonstrations are conducted, and cost-effectiveness and functional assessments are performed.

- A special Theater Missile Defense survivability program which investigates theater-specific issues such as radar cross-section reduction techniques and protection from chemical/biological threats.

- A Test and Evaluation program, wherein proposed systems, subsystems, and components are subjected to simulated threat environments in test simulators, underground nuclear tests, and space flight tests.

Secondly, the formal DOD acquisition process demands that survivability requirements be developed and validated for each military system, and that adequate operational testing be conducted to ensure that systems satisfy those requirements before they are fielded. For SDI, survivability requirements are developed for both the individual defensive elements and for the overall defensive system. Operational testing or appropriate simulation is likewise required and will be conducted at both levels.