# SDI
# A TECHNICAL PROGRESS REPORT


## SUBMITTED TO
## THE SECRETARY OF DEFENSE

JUNE 1985

BY

THE DIRECTOR
STRATEGIC DEFENSE INITIATIVE ORGANIZATION

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# I. INTRODUCTION

The President's Strategic Defense Initiative addresses his deep conviction that "...certainly, there should be a better way to strengthen peace and stability, a way to move away from a future that relies so heavily on the prospect of rapid and massive retaliation and toward greater reliance on defensive systems which threaten no one." On March 23, 1983, the President announced his decision to take an important first step toward this goal by directing the establishment of the Strategic Defense Initiative (SDI) research program. This vigorous program emphasizes advanced, nonnuclear defensive technologies, with the aim of finding better ways of deterring aggression, strengthening stability, and increasing the security of the United States and its allies. The research will provide to a future President and a future Congress, possibly in the early 1990s, the technical knowledge required to support a decision on whether to develop and later deploy advanced defensive systems. SDI offers to the United States, our allies, and the world in general the hope of moving to a better, more stable, basis of deterrence--of allowing us to move away from sole reliance on the threat of nuclear retaliation to deter aggression, and towards an enhanced deterrence based upon defensive capability that threatens no one.

The SDI Organization (SDIO), which has been in existence for a little more than a year, has made significant progress in conducting technology programs oriented towards examining overall concepts for defense against ballistic missiles. Examples, but not a thorough accounting, of recent technical results are given in this report. The SDI research program is continuing to focus on the exploration and validation of key technologies that support concepts for defensive systems. Candidate systems concepts to meet existing and future threats are being analyzed, using expertise available in the U.S. Government, as well as the university and private sectors. SDI research projects are being conducted in accordance with U.S. treaty obligations, including the 1972 ABM treaty. Currently, a wide range of technology projects are being pursued, with the intention that this range will be reduced as we learn more about defensive systems concepts. In addition, a framework has been established for structuring the various research projects according to an evolutionary defensive capability that could meet changing offensive threats.

Two categories of technology research activities exist. The first contains conventional technology efforts, which include, for example, kinetic-energy weapons and surveillance satellite experiments. These technologies could be used to develop initial defensive architecture options. The second category contains innovative technologies such as those associated with directed-energy weapons research. These technologies could be useful for developing architectural options designed to meet both today's threat and future responsive threats such as fast-burn boosters. These newer technologies also have great potential for breakthroughs that could lead to effective defenses even sooner than was thought possible a few years ago. Both types of research are being pursued concurrently.

In the FY 1985 Appropriations Conference Report (98-1159), the conferees of the House and the Senate agreed to a general reduction for the SDI program from the President's budget request of $1,777 million to $1,400 million. After careful consideration of the alternatives, the SDIO reallocated the available funds in a manner that delayed some planned new starts and stretched out several existing projects.

However, in making the adjustment necessary to meet the appropriation by Congress, the SDIO sought to maintain as best possible the program goals, time lines, and tasks described to Congress in 1984 testimony.

## II. SIGNIFICANT TECHNICAL ACHIEVEMENTS

This report gives examples of significant technical achievements, arranged according to the two technology categories mentioned in the introduction, that occurred in the SDI research program over the past year. It is important to note, however, that many of these achievements resulted because of previous Department of Defense research programs that were incorporated into the SDI program.

Technology programs in SDI are intended to provide the basis for a future defensive system. Systems studies now under way represent the first step in defining candidate architectures with the potential to achieve the SDI goal of defense against ballistic missiles.

Ten contractors were awarded a Phase I contract in December 1984 to perform SDI systems studies--an activity known as the "Horserace Acquisition" (derived from the emphasis on timely competition). The purpose of this procurement is threefold:

- Provide an initial definition and assessment of several alternative systems concepts that can detect, identify, discriminate, intercept, and negate ballistic missiles in their boost, postboost, midcourse, and/or terminal phases.

- Provide a complete and balanced set of technological and functional requirements by identifying the basic requirements for sensors; weapons; command, control, and communications ($C^3$); and supporting subsystems, such as space power, that are necessary to determine the feasibility of a viable and cost-effective strategic defense system.

- Define and prioritize critical technical issues that must be resolved before decisions can be made on whether or not to implement a given defensive strategy.

The "horserace" studies are designed to develop expertise in U.S. industries by introducing competition in the search for ways of developing a strategic defense system. In the first phase, which is now in progress, 10 contractors are competing to establish a basic understanding of the SDI

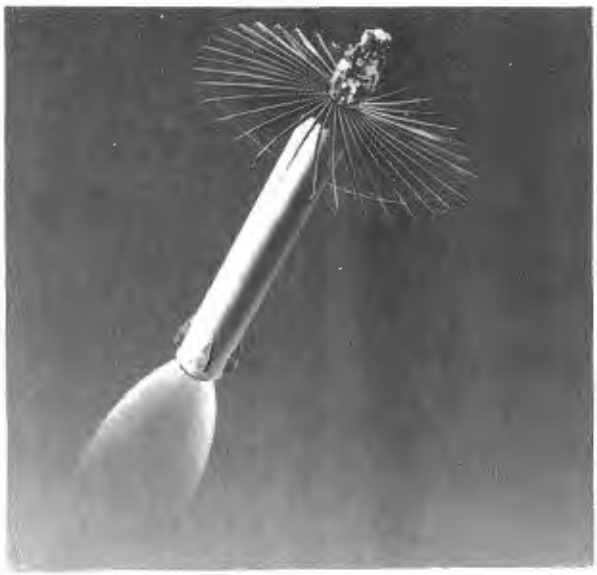
program, its objectives, and its requirements. In the second phase, which will begin in the summer of 1985 and last less than a year, the field of 10 contractors will be narrowed to approximately 4. They will compete in efforts to define concepts for an effective strategic defense system. These efforts will be judged on technical understanding and timeliness. The ultimate product of these studies will provide an improved framework for conducting technology research and defining system architectures that may meet the President's goals for strategic defense.

A. Conventional Technologies

Kinetic-energy weapons and surveillance satellite research are major conventional technology activities in the SDI program. This research builds on the Army's long involvement in developing ballistic missile defenses and the Air Force's capability to design, produce, and deploy surveillance satellites. Recently, significant SDI technical accomplishments have occurred in the experimental proof-of-concept of interceptors and the design and validation of surveillance satellite subsystems. Some examples follow.

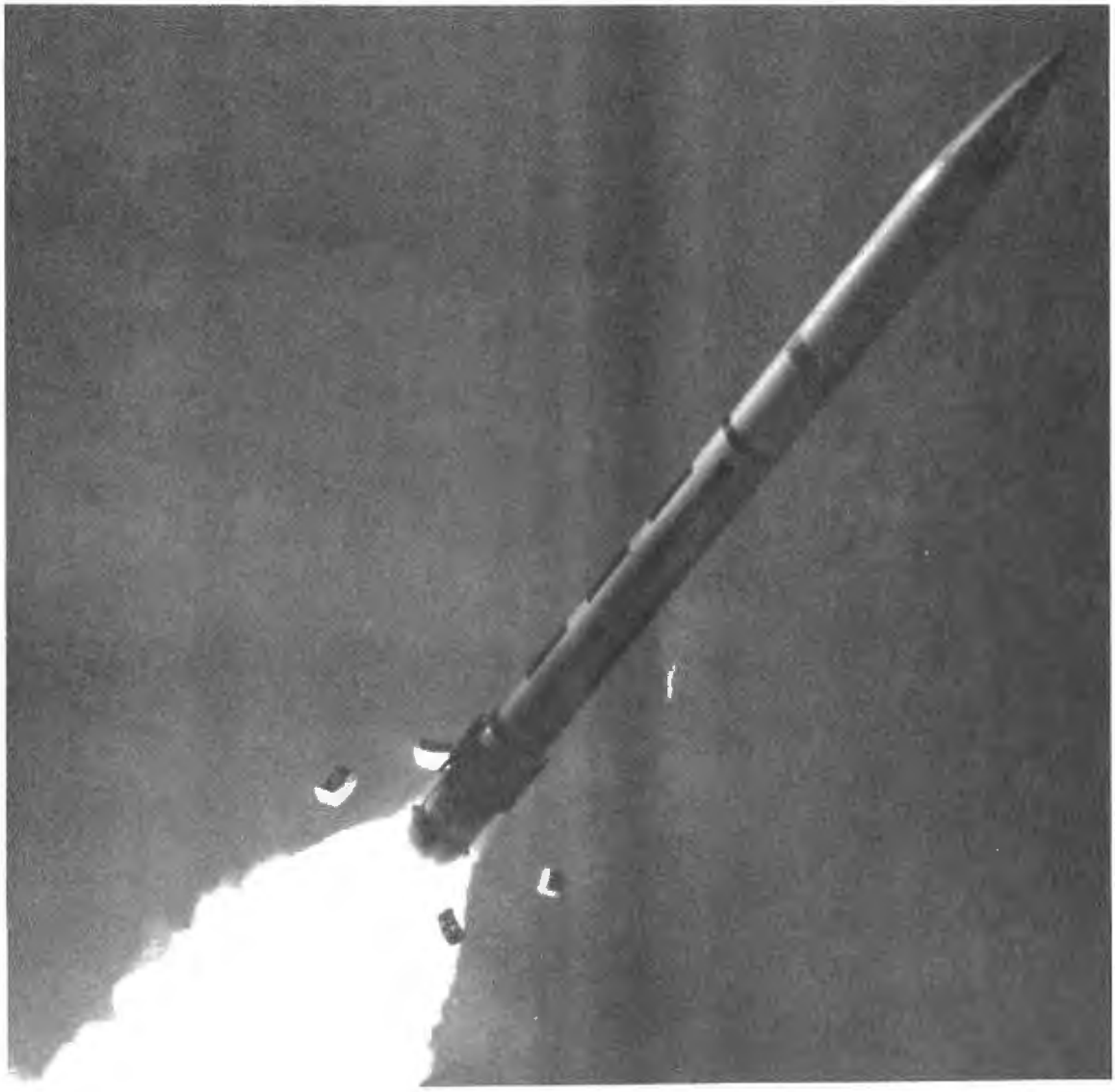
1. In June 1984 the Homing Overlay Experiment (HOE) proved the capability of a nonnuclear interceptor launched from a fixed ground base to destroy an incoming ballistic missile outside the earth's atmosphere. This intercept is significant in that it shows the kill capability available in the late boost through midcourse phase of defense in space. Ultimately, such kinetic-energy weapons, which destroy their targets by simply colliding with them in space, could be an essential part of a multilayered defense system. Shown below is the HOE's homing stage en route to intercept, guided by an on-board sensor. The ribbed array is deployed just before impact and maximizes the likelihood of a successful intercept. The closing speed of the interceptor and target, which was over 20,000 miles per hour, results in the target's being literally demolished.

HOMING OVERLAY EXPERIMENT
AND KILL MECHANISM



2. Another type of kinetic-energy weapon is one that can strike an incoming warhead inside the earth's atmosphere in the final or terminal phase of a layered defense. In late 1984 a successful test of a small radar homing interceptor guidance and control system demonstrated the potential to bring an interceptor to a specified point in the atmosphere where it would have been able to hit an incoming warhead. Fully guided tests against nonballistic-missile targets are expected in the summer of 1985. This guidance system, if mated with an interceptor missile, could destroy targets by direct hit.

SMALL RADAR HOMING INTERCEPTOR TEST VEHICLE



3. Should a decision be made to develop strategic defenses, the critical task of identifying and tracking warhead targets, as well as guiding ground-based interceptors to a target, might be done in part by an airborne sensor system. The Airborne Optical Adjunct (AOA) will validate the technology to optically acquire targets at long ranges, track, discriminate, and hand over to a ground-based radar. It will also provide a data base that would support future evolutionary development of airborne optical systems for use in a defense system. As part of the AOA technology verification efforts, wind tunnel tests have been conducted to evaluate the effect of sensor configuration on aircraft performance and to measure the associated wind effects on sensor performance. The initial detectors for the sensors have been fabricated and are being tested, moving us closer to validating the feasibility of this idea. The model below shows the sensor compartment on the top and crew stations in the interior of the aircraft.

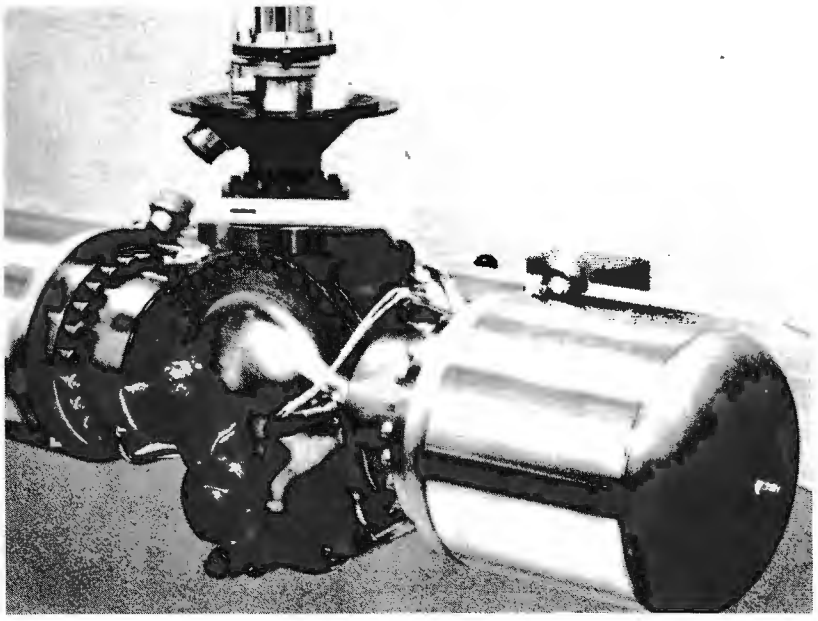
AIRBORNE OPTICAL ADJUNCT

4. In addition to airborne sensors, future multilayered defense systems may use space-based sensors to identify and track missiles and warheads from the time they are launched to the moment they are intercepted. Significant achievements have occurred in technology research projects that support surveillance platforms.

a. To ensure that sensors are properly controlled and information from them is effectively processed, there is a need for computer systems that have many ways, or "nodes," to do their tasks. If one node fails, others could take over. An advanced signal processor has been demonstrated in multinodal operation, including fault-tolerant recovery of the system after failure of one of the nodes. Fault-tolerant operations are essential if computer processors are to be reliably based in space.

b. Many of the advanced "heat-detecting" infrared sensors that are necessary to identify and track missiles and warheads in space must be cooled in order to function properly. Special refrigerators called cryocoolers are needed to produce the low temperatures required for such sensors. Cryocooler life, reliability, and performance experiments designed to demonstrate the capability to cool long-wave infrared detectors have resulted in almost 1 year of successful operation at speeds designed to accelerate life-testing.

CRYOCOOLER FOR SPACE SENSOR APPLICATIONS



c. Currently, computer circuits are very susceptible to radiation from nuclear explosions. New radiation-hardened circuits are needed to meet operating specifications in such hostile environments. Radiation-hardened large-scale integrated circuits, which provide the memory for on-board computers, have been fabricated and tested, demonstrating that new-technology nonvolatile memories have the potential to reduce costs by 90 percent over those made using previous silicon technologies.

5. In addition to research associated with space-based surveillance platforms for future defensive systems, technology efforts are underway to improve data collection capabilities on ships that can view Soviet missile tests and determine ways of identifying missiles and warheads. These same technologies will also help us understand how to improve ground-based radars for future defensive systems.

A new radar has been developed and installed on the COBRA JUDY ship. This improves the U.S. capability for making measurements on reentry vehicles. Following a short test period the COBRA JUDY will resume data collection.

COBRA JUDY THREAT DATA COLLECTION SHIP

6. Battle Management/$C^3$ is one of the three SDI major technology research thrusts, along with weapons and surveillance efforts. This area is faced with the challenge of providing new approaches to a vastly more complex set of requirements than previous weapons systems incurred.

A distributed computer, which uses a large number of small computers linked together to perform as a single large machine, has become operational. In this way, the overall system can still function even if some of the individual computers fail. This networking of several standard commercial computers into a virtual memory system will provide a testbed capability for BM/$C^3$ system and hardware concepts. Progress in hardware concepts includes an effort at the Jet Propulsion Laboratory called the Hypercube project, an interesting approach to coupling many small computers to form an extremely fast single computer.

The Knowledge Based Software Assistant (KBSA), a project to create a new capability for software development based on artificial intelligence techniques, was initiated during the past year. This research project seeks to provide an automated way to rapidly produce trusted complex software. These new techniques should increase software development productivity for large projects, such as SDI, and significantly reduce the time and effort required to make major modifications as well as evolutionary changes to large, complex software systems.

HYPERCUBE CONCEPT

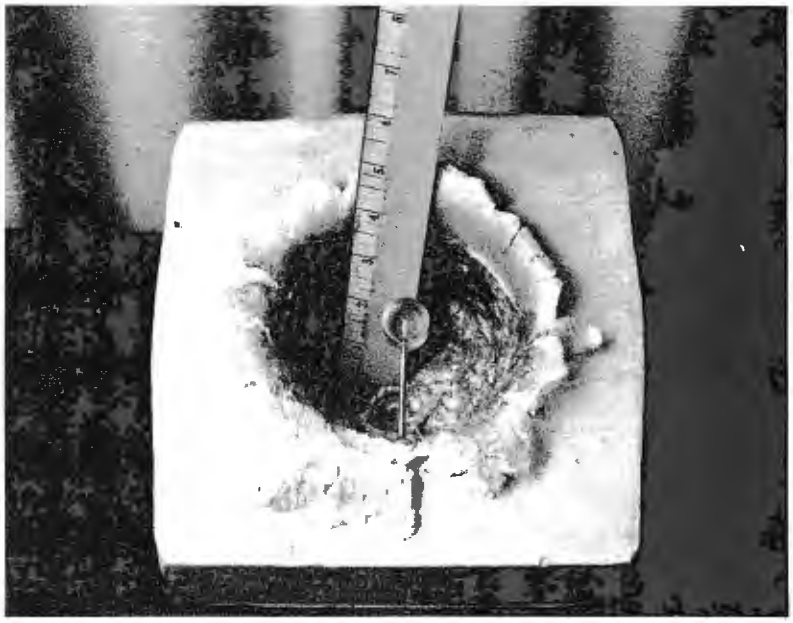
7. The Lethality and Target Hardening (LTH) project was established to determine the vulnerability of offensive systems to potential SDI weapons. To achieve this goal, the LTH project is in the process of defining the physical principles of kill mechanisms against current and potential target materials, the damage done to targets, and the hardening that an adversary could apply to targets to resist these effects.

A series of tests was performed to measure the effects of prompt X-rays on high-energy laser mirrors. Similar types of X-rays could be generated by X-ray lasers. The results will be used to define X-ray damage levels that can destroy attacking missiles and warheads.

Construction of a low-power microwave facility has recently been completed. This facility will be used to study the physics of microwave weapons and to obtain data on microwave interactions with targets. Microwaves may be able to damage electronic components of missiles and warheads.

The picture below shows the lethal effect of a small plastic projectile, traveling at 7 km/sec (about 4 mi/sec), impacting on a cast aluminum block. This illustrates the potential of a projectile, such as the one shown in the center of the block, to damage targets.

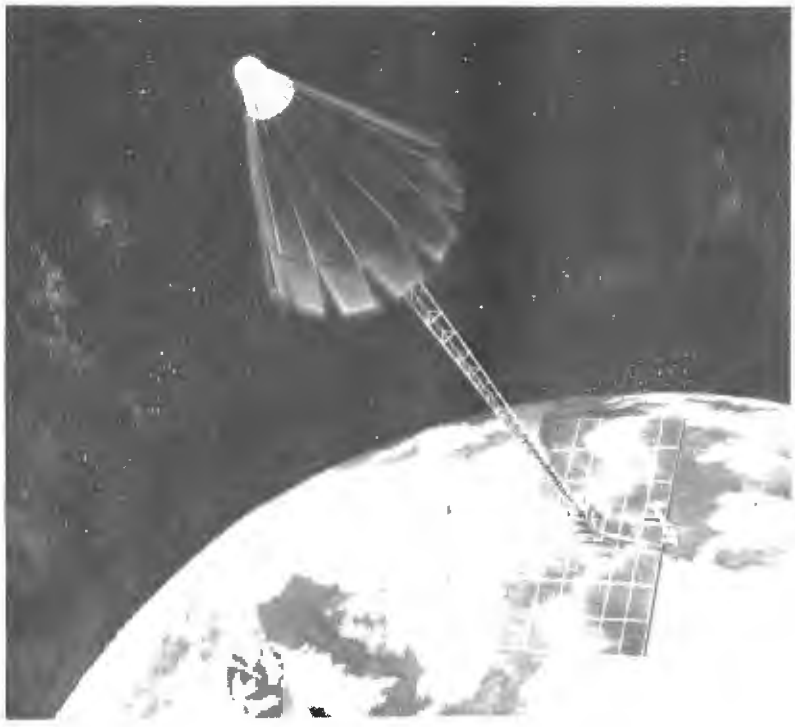
KINETIC PROJECTILE TEST



8. Space-based electrical power is a key technology for the SDI and other future military missions. Power-generation requirements ranging from tens of kilowatts to hundreds of megawatts have been identified for possible future strategic defense systems. Plans have been formulated for conducting power-system concepts studies and for evaluating concepts obtained from industry and national laboratories.

A conventional way that has been used on a small scale to produce electrical power required for space-based platforms involves nuclear reactors. Because the technology needed exceeds our current capability, the United States has established a tri-agency (NASA, DOE, DOD) program called the SP-100 effort. Management of the SP-100 space reactor program has been transitioned successfully from DARPA to SDIO with no schedule impacts. Significant advances in power technology have been achieved, including (1) verification of long-term performance of candidate high-temperature reactor materials, (2) a 25-percent performance improvement in a thermoelectric material used for the direct conversion of heat to electricity, and (3) long-term unattended operation of high-efficiency dynamic power conversion. The figure below is an artist's conception of a 100 kWe SP-100 powering a large-scale space-based surveillance system.

SPACE POWER



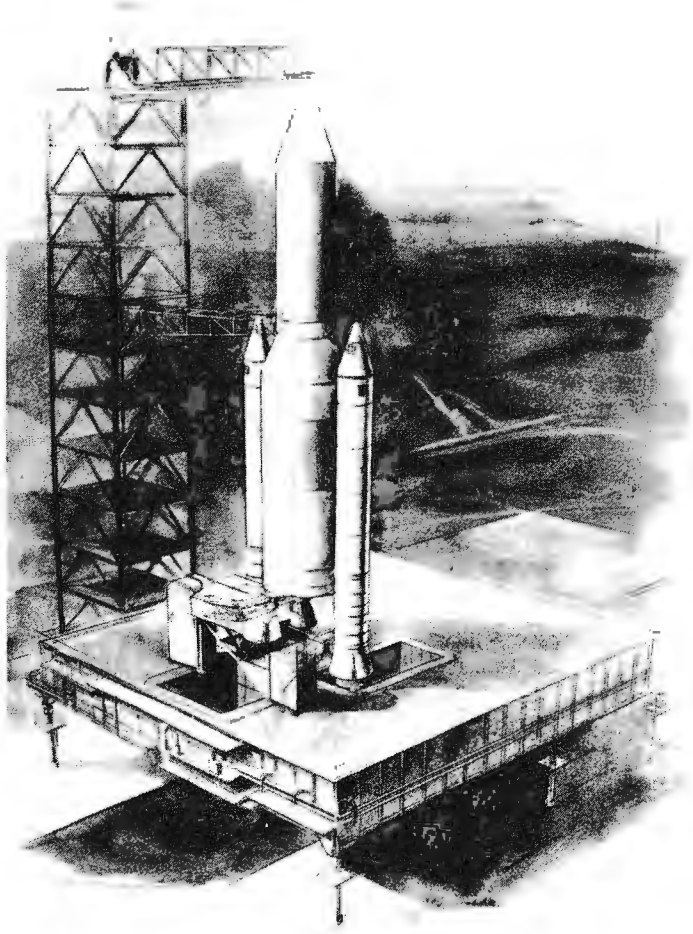
9. The economic feasibility of a multitiered ballistic-missile defense depends on our ability to reduce the cost of establishing and maintaining defense systems in space. Progress has been made towards developing affordable launch capabilities.

a. A cooperative program between DOD and NASA has been established to define needs and capabilities and to provide options.

b. SDIO has begun the task of identifying common logistic requirements of strategic defense systems and potential experiments to be performed in space.

c. The SDIO has reserved two half bays per year on the Space Transportation System Shuttle, beginning in 1987, for SDI technology validation experiments.

CONCEPTUAL DESIGN OF SHUTTLE-DERIVED LAUNCH VEHICLE



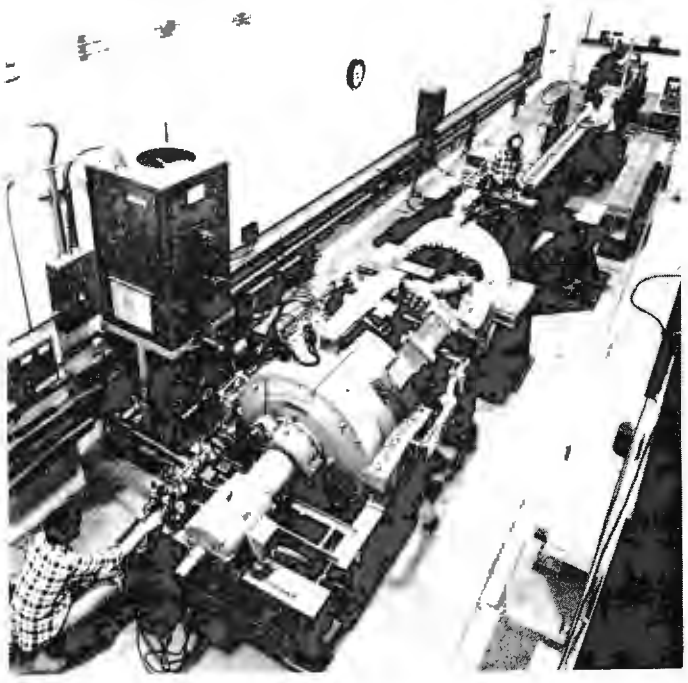
B. Innovative Technologies

Techniques for accelerating kinetic-energy projectiles by means other than chemical propulsion, as well as directed-energy research both for weapons and for discrimination purposes, are examples of more advanced methods for defending against responsive threats designed to defeat strategic defenses.

1. The research associated with hypervelocity projectile accelerators (rail guns) is rapidly progressing. A primary goal of these programs is to develop low-mass, extremely high velocity projectile interceptors, which could defeat fast-burn boosters that cut off after about a minute at low altitudes. The first demonstration of a rapid-fire switch capable of directing almost one-half million amperes of electrical current occurred in the fall of 1984. In other experiments, bursts of five projectiles fired within 0.5 seconds have been achieved. Low-mass particles in dense metallic plasmas have been accelerated to hypersonic speeds of 40 km/sec.

2. New power system designs to store the energy needed for these accelerators have resulted in an increase of about 300 percent in storage-energy density over previous designs.

HYPERVELOCITY PROJECTILE ACCELERATOR, PICATINNY ARSENAL



3. The Directed-Energy Weapons research program has accomplished a number of significant technical achievements that demonstrate the potential of lasers and particle beams in advanced weapons concepts.

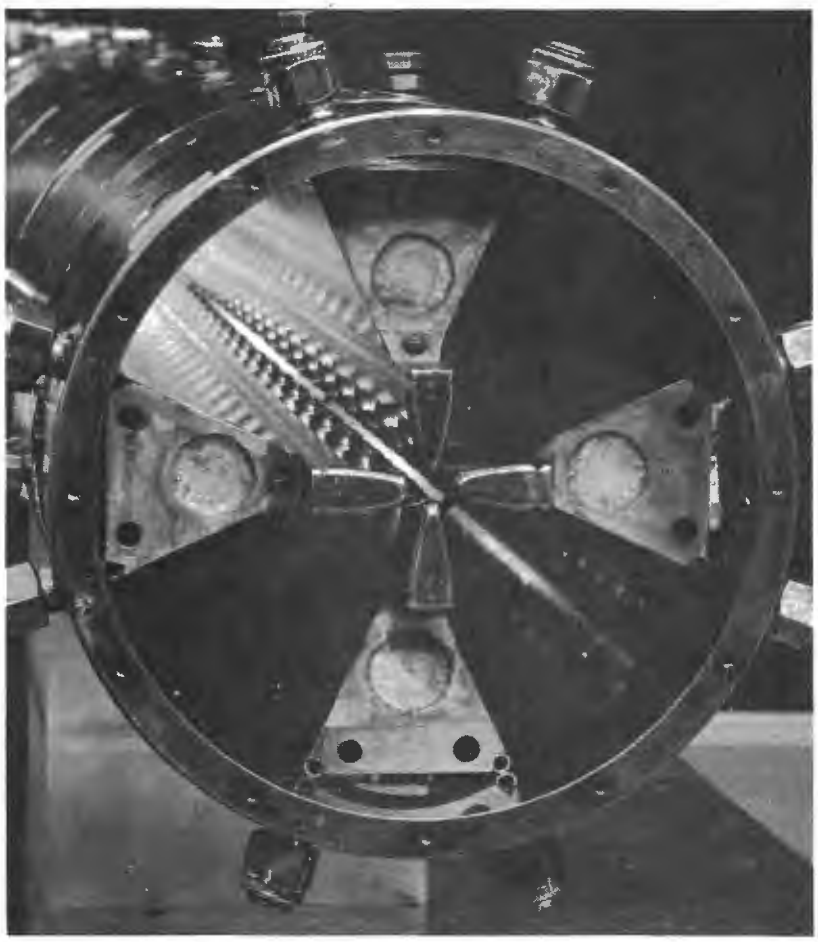
a. The Lawrence Livermore National Laboratory (LLNL), with DARPA and SDIO support, has made significant progress in showing the potential for using charged-particle beams as strategic defense weapons. It has been demonstrated that charged-particle beams can be guided by a laser-created channel in a low-pressure environment such as is found in the earth's upper atmosphere. Previously, it was thought that charged particles could not be used in beam weapons because of the bending of particle trajectories caused by the earth's magnetic field. Electron beams were propagated for 60 meters in the Advanced Test Accelerator (ATA) at LLNL and for an additional 30 meters outside the ATA. This experimental success has important implications in producing charged-particle-beam weapons for use at altitudes ranging from 85 to 600 km.

ADVANCED TEST FACILITY AT LAWRENCE LIVERMORE NATIONAL LABORATORY

b. Substantial progress has been made in FY 1985 in the research associated with high-brightness ion sources that can be used as the first stage of a neutral-particle-beam device. These devices are being used to study the feasibility of using neutral-particle beams to destroy the important electronic circuits that might be found on a ballistic missile. Oak Ridge National Laboratory has produced ion-beam currents exceeding 100 mA with durations lasting up to 5 seconds.

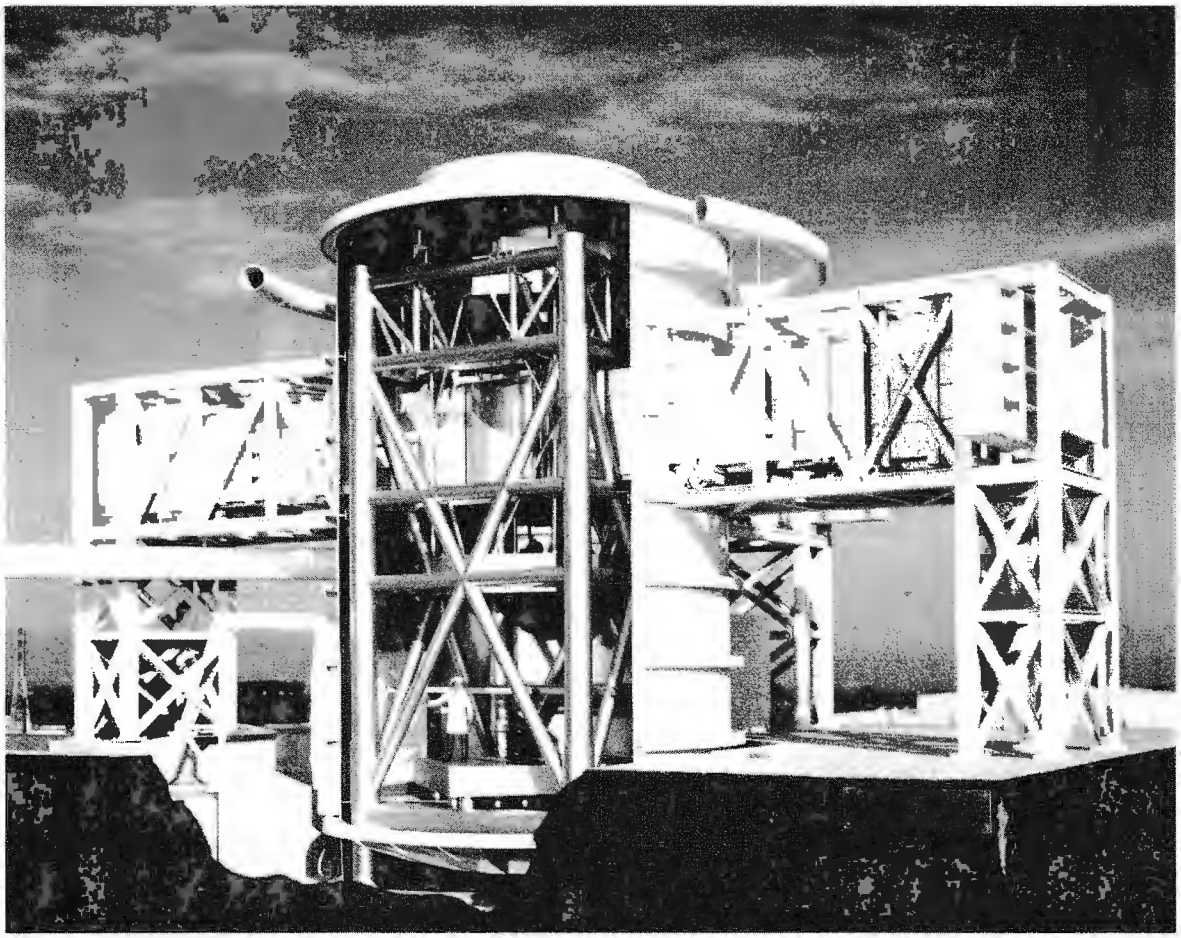
At Los Alamos National Laboratory (LANL), the White Horse Advanced Test Stand has met an initial goal of producing a 100 mA beam using a radio frequency quadrupole accelerator, which is the second stage of a neutral-particle-beam device. This acceleration technique, which was first developed by the Soviets, may make low-weight, space-based neutral-particle-beam weapons feasible.

ION BEAM ACCELERATOR FOR NEUTRAL PARTICLE BEAM EXPERIMENT AT LOS ALAMOS NATIONAL LABORATORY



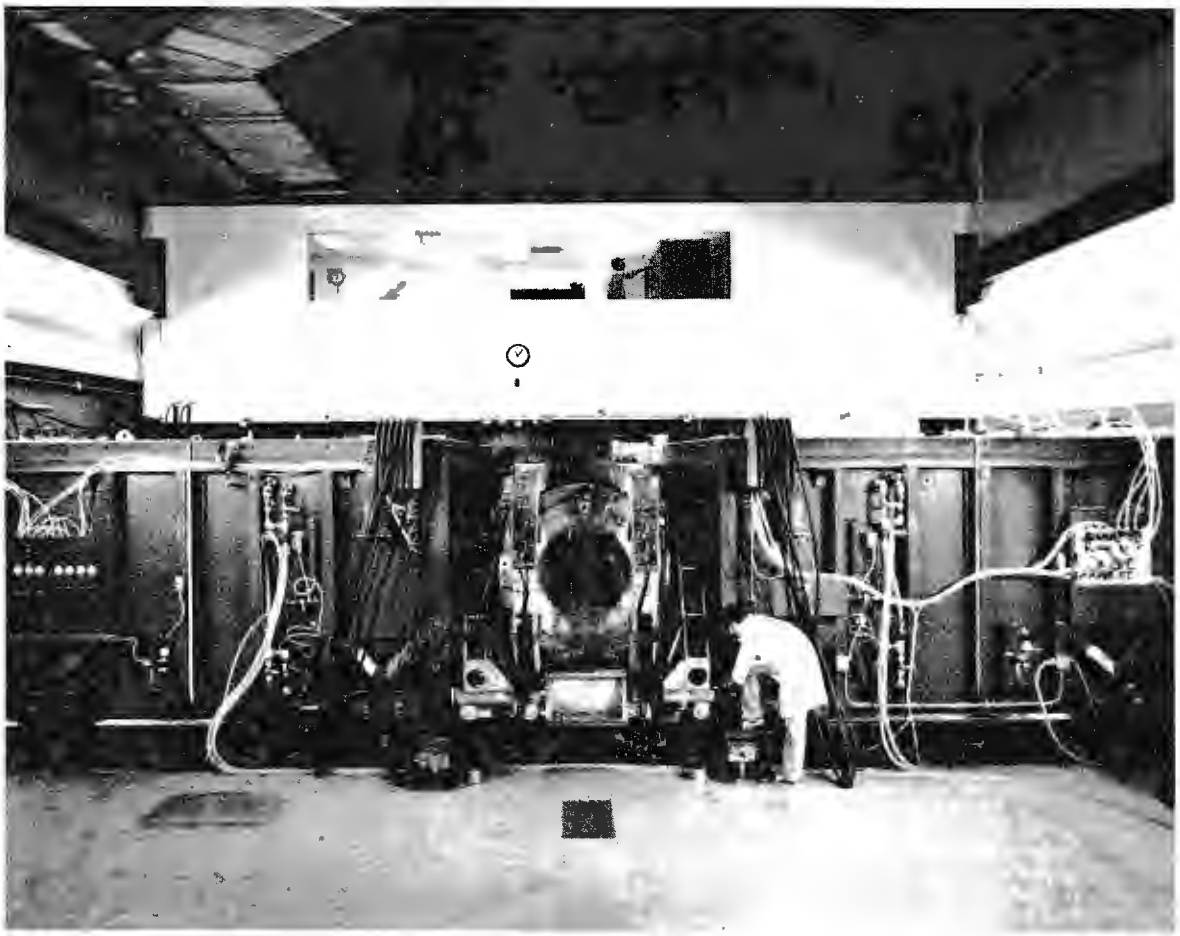
c. Space-based lasers offer a third possibility for effective strategic defenses capable of negating responsive threats. In the space-based laser program conducted in the laboratory, significant technical achievements have occurred in device technology; beam-control technology; large-optics technology; and acquisition, tracking, and pointing control technology. The coupling of six chemical laser resonators has demonstrated the potential for creating very high brightness weapons in a building block approach that could be applicable to ballistic-missile defense. Successful laboratory experiments have been performed with coupled laser beams using adaptive mirrors to produce a single high-brightness beam. Experimental apparatus for a large cylindrical chemical laser has been fabricated. Cylindrical lasers may be a compact way for providing a space-based infrared laser option. A model of this ALPHA laser and the experimental test chamber, to be located at the TRW San Juan Capistrano test site, is shown.

ALPHA CHEMICAL LASER MODEL



d. Conceptually, it may be possible to use lasers for strategic defense where the heavy laser is on the ground and relay mirrors in space are used to direct the beam to a target. In the ground-based laser program, significant progress has been made in demonstrating technologies that are associated with short-wavelength visible lasers having the potential for very high power. Short-wavelength lasers are desirable since smaller mirrors are needed to direct a lethal dose of energy on the target compared with mirrors used with longer wavelength lasers. Successful subscale laser experiments have demonstrated the potential for creating high-power xenon chloride and krypton fluoride gas lasers. An SDI program is under way to develop a laser called EMRLD, which can be used to perform high-average-power, repetitively pulsed, excimer laser experiments. Pulsed lasers may have some advantages over continuous wave lasers in terms of lethality. The EMRLD laser will be used to address this issue.

EXCIMER LASER EXPERIMENT AT AVCO RESEARCH LABORATORY

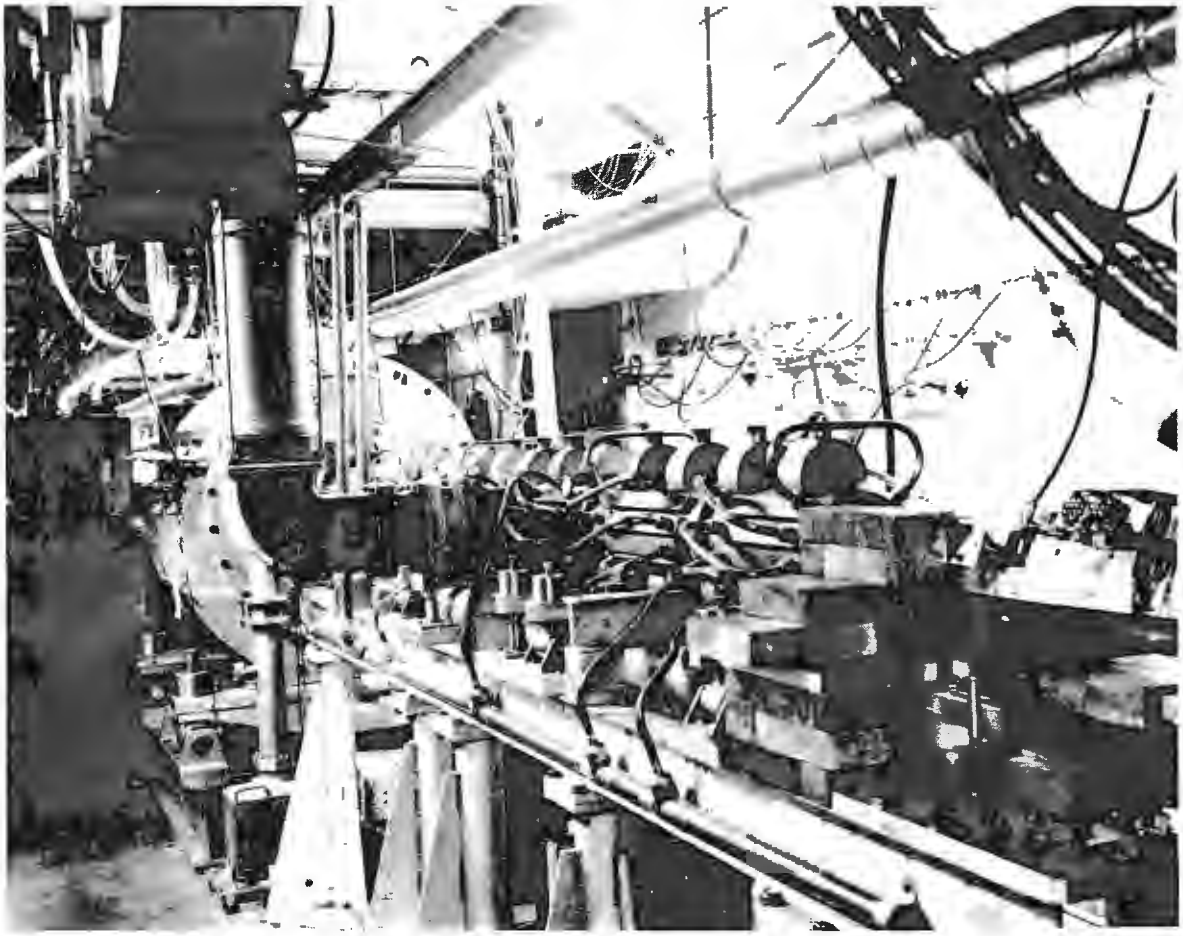


e. Several types of short-wavelength lasers may be feasible for the ground-based laser. In addition to the excimer laser described above, a free-electron laser provides an alternative approach. Free-electron laser operation has been successfully demonstrated at microwave frequencies. However, the technology needs to be extended to produce a visible wavelength laser.

A very high power microwave laser pulse was extracted from an electron beam accelerated at the LLNL. In addition, laser operation was achieved in the near infrared using an accelerator at LANL.

Recent physics experiments have established the basic feasibility of free-electron lasers and enabled us to begin to consider how we could scale this technology to visible wavelengths with high sustained power.

FREE-ELECTRON LASER EXPERIMENT AT LOS ALAMOS NATIONAL LABORATORY



f. In order to develop a ground-based laser that is a feasible strategic defense option, it is necessary to find ways of propagating the laser beam through the earth's atmosphere without losing the high quality inherent in laser beams compared with conventional light sources.

Compensating a visible high-power laser beam for aberrations caused by the atmosphere is a major issue in determining the feasibility of ground-based lasers (GBLs). Recent compensation experiments at the AMOS site in Maui have successfully demonstrated that at low average power a visible laser beam can be propagated through the atmosphere. Pointing accuracy in these experiments was within the tolerances required for a GBL system.

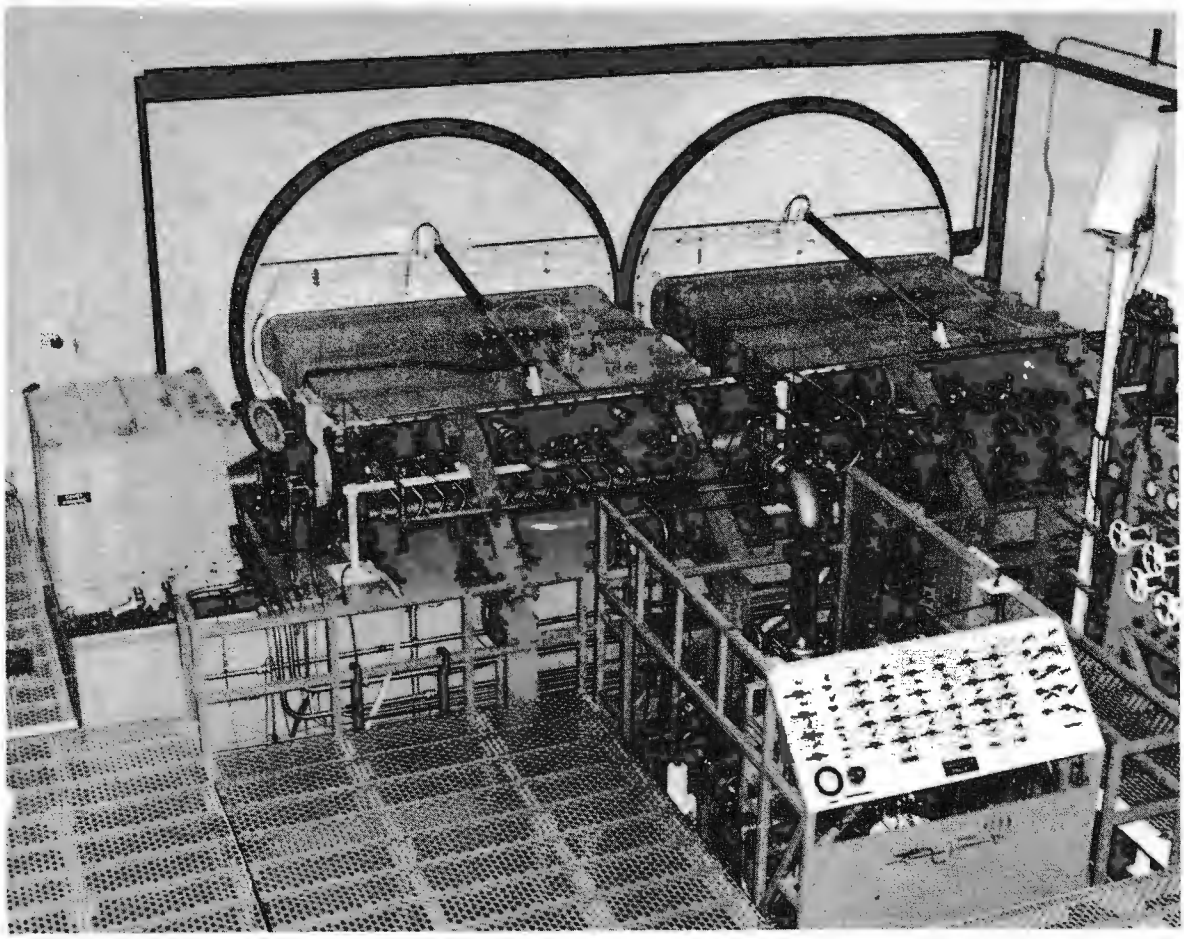
g. Large lightweight mirror technology is critical to the development of GBL space relays. Stabilization of these mirrors in space is also necessary. A flat mirror has recently been manufactured that is less than 10 percent of the density of the Space Telescope's primary mirror. This level of performance meets the requirements for space-relay mirrors.

ATMOSPHERIC COMPENSATION EXPERIMENT AT THE AMOS FACILITY SITE IN MAUI, HAWAII

h. The High-Energy Laser Systems Test Facility (HELSTF) at White Sands Missile Range supports high-energy laser technology and lethality experiments for both tactical and strategic applications.

A large chemical laser, MIRACL, has been tested in FY 1985 at HELSTF with beam quality near the theoretical limit. These results give us confidence in our ability to focus the laser beam onto a small spot at long range, which is a prerequisite for any laser-weapon application. This laser is now the free world's "brightest" continuous-wave laser.

MIRACL CHEMICAL LASER AT THE HELSTF SITE



4. A subset of the innovative technologies category addresses the need to consider novel ways to counter existing and future threats. Because of the level of support for such projects compared with that for the other technology programs, they have yet to produce results similar in magnitude to those in the other technology areas.

Examples of research being conducted are listed below.

- Advanced Accelerator Concepts
- Advanced Electrochemical Power Sources
- Advanced Materials and Structures
- Advanced Propellants
- Advanced Pulse Power
- Carbon-Carbon Composites
- High-Power Beam Combining Through Nonlinear Optics
- Integrated Detection, Estimation, and Communications Theory
- Laser Satellite Networking
- Optical Sensor Survivability
- Plasmoids and Ion Rings
- Reliable Advanced Electronic Systems
- Space Experimentation
- Strategic Defense Natural Environment
- Ultra-High-Speed Computing
- Ultra-Short-Wavelength Lasers

## III. SUMMARY

The SDI program is off to a fast start in exploring ways to apply existing and future technology bases to ballistic-missile defense concepts.

There is now a framework that provides an evolutionary approach to establishing the technologies that may support system architectures designed to negate existing and future ballistic-missile threats. Progress is currently being demonstrated in conventional and innovative technical research. In addition, system concept studies are now beginning to show directions the technology programs should take to determine whether or not viable defenses against ballistic missiles are possible.

The SDIO has found no lack of ideas or people and facilities willing to contribute to this effort. Perhaps the most encouraging progress is the awareness that this country and its allies have the capability and resources to address the technical challenges associated with SDI research.

SDI

STATEMENT ON

# THE STRATEGIC DEFENSE INITIATIVE

BY

LIEUTENANT GENERAL JAMES A. ABRAHAMSON
DIRECTOR, STRATEGIC DEFENSE INITIATIVE ORGANIZATION

BEFORE THE

SUBCOMMITTEE ON STRATEGIC AND THEATER NUCLEAR FORCES
COMMITTEE ON ARMED SERVICES
UNITED STATES SENATE

99TH CONGRESS, FIRST SESSION

DECEMBER 5, 1985

THANK YOU MR. CHAIRMAN FOR THE OPPORTUNITY TO APPEAR BEFORE YOUR COMMITTEE AND DISCUSS THE ISSUES SURROUNDING THE VERY IMPORTANT SUBJECT OF ALLIED PARTICIPATION IN THE STRATEGIC DEFENSE INITIATIVE. I APPRECIATE YOUR INTEREST IN THIS MATTER AND LOOK FORWARD TO ADDRESSING YOUR QUESTIONS.

I WOULD LIKE TO BRIEFLY REVIEW OUR PROGRAM OBJECTIVES AND DISCUSS A FEW OF THE SALIENT POINTS CONCERNING DETERRENCE AND THE PART THE SDI COULD BE EXPECTED TO PLAY. I WILL RELATE THIS PERSPECTIVE TO THE ALLIES AND THEIR ROLE, AS WELL AS OUTLINE SOME OF THE AREAS THAT MAY HOLD PROMISE FOR THEIR PARTICIPATION. I'LL CONCLUDE WITH A SUMMATION OF ACTIVITIES IN THE ALLIED ARENA AND PROGRESS THUS FAR.

A GOVERNMENT'S PRIME RESPONSIBILITY IS TO PROVIDE FOR THE SECURITY OF ITS PEOPLE. WE, ALONG WITH OUR ALLIES, HAVE OPTED FOR DETERRENCE OF AGGRESSION AS BEING THE MOST CERTAIN COURSE TO ASSURE THIS SECURITY AND OUR SURVIVAL AS FREE AND INDEPENDENT NATIONS. THE STRATEGIC DEFENSE INITIATIVE HAS SIGNIFICANT POTENTIAL TO LEND MEANINGFUL SUPPORT TO THIS COURSE. THE SDI HAS BEEN STRUCTURED AS A PROGRAM OF VIGOROUS RESEARCH FOCUSED ON ADVANCED TECHNOLOGIES FOR DEFENSE AGAINST BALLISTIC MISSILES WITH THE AIM OF FINDING WAYS TO PROVIDE A BETTER BASIS FOR DETERRING AGGRESSION, STRENGTHENING STABILITY, AND INCREASING THE SECURITY OF THE UNITED STATES AND OUR ALLIES.

THUS, THE PROMISE OF ENHANCED DETERRENCE IS AN ELEMENTAL FACTOR UNDERLYING THE SDI. THERE ARE CERTAINLY OTHER SIGNIFICANT WAYS IN WHICH A DEFENSE AGAINST BALLISTIC MISSILES WILL HELP TO ENSURE AGAINST NUCLEAR CONFLICT. IN THE ARMS CONTROL ARENA, THE SDI COMPLEMENTS AND SUPPORTS U.S. EFFORTS TO SEEK EQUITABLE, VERIFIABLE REDUCTIONS IN OFFENSIVE NUCLEAR FORCES. DEFENSES COULD ALSO PROVIDE PROTECTION AGAINST ACCIDENTAL MISSILE LAUNCHES OR LAUNCHES BY SOME FUTURE IRRATIONAL LEADER IN POSSESSION OF A NUCLEAR ARMED MISSILE. ADDITIONALLY, THE SDI PROGRAM IS A PRUDENT HEDGE IN THE FACE OF VERY AGGRESSIVE SOVIET RESEARCH AND DEVELOPMENT ACTIVITIES IN STRATEGIC DEFENSE.

THE PRESIDENT HAS SAID REPEATEDLY THAT THE SDI IS INTENDED TO EXAMINE THE POTENTIAL FOR BALLISTIC MISSILE DEFENSE FOR THE UNITED STATES AND FOR OUR ALLIES. TODAY I WOULD LIKE TO FOCUS ON THE ASPECT OF DETERRENCE AS IT RELATES TO OUR ALLIES.

DETERRENCE REQUIRES THAT NO DOUBT BE LEFT IN THE MIND OF A POTENTIAL AGGRESSOR THAT THE RISKS AND COSTS OF AGGRESSION FAR OUTWEIGH ANY GAINS THAT MIGHT BE SOUGHT. IN THE WORDS OF PRIME MINISTER MARGARET THATCHER IN HER ADDRESS TO THE CONGRESS LAST FEBRUARY, "OUR TASK IS TO SEE THAT POTENTIAL AGGRESSORS FROM WHATEVER QUARTER UNDERSTAND PLAINLY THAT THE CAPACITY AND RESOLVE OF THE WEST WOULD DENY THEM VICTORY IN WAR; AND THAT THE PRICE THEY WOULD PAY WOULD BE INTOLERABLE." WE, TOGETHER WITH OUR ALLIES, HAVE CONSISTENTLY PURSUED THIS COURSE. IN RECENT YEARS, HOWEVER, THE CONCEPT OF DETERRENCE AT THE STRATEGIC LEVEL HAS

FOCUSED ALMOST COMPLETELY ON ONE APPROACH, THAT IS, POSING TO AN AGGRESSOR UNACCEPTABLE COSTS THROUGH THE ULTIMATE THREAT OF NUCLEAR RETALIATION. THIS ALMOST EXCLUSIVE RELIANCE ON THE THREAT OF RETALIATION WITH OFFENSIVE FORCES - WITHOUT THE ABILITY TO DENY AN AGGRESSOR HIS OBJECTIVES THROUGH DEFENSIVE FORCES - HAS NOT ALWAYS BEEN THE CASE.

DEFENSIVE SYSTEMS ARE CONSISTENT WITH A POLICY OF DETERRENCE BOTH HISTORICALLY AND THEORETICALLY. IN THE 1950's AND 1960's, ENORMOUS EFFORT WAS DEVOTED TO STRATEGIC DEFENSE OF NORTH AMERICA. EVERY MAJOR CITY WAS RINGED WITH NIKE-AJAX AND NIKE-HERCULES GROUND-TO-AIR MISSILES AND MORE THAN 2,500 AIRCRAFT WERE DEDICATED TO AIR DEFENSE. THIS COMBINED WITH ALLIED AND AMERICAN RETALIATORY FORCES TO PROVIDE A POTENT DETERRENT CAPABILITY. WHEN THE SOVIET EMPHASIS SHIFTED FROM BOMBERS TO THE INTERCONTINENTAL BALLISTIC MISSILE, THIS DEFENSIVE CAPABILITY WAS ALLOWED TO DECLINE SINCE THERE WERE AT THAT TIME, NO EFFECTIVE MEASURES TO DEFEND AGAINST SUCH MISSILES.

AS WE MOVED TOWARD MORE DEPENDENCE ON OFFENSIVE DETERRENCE, WE DID SO IN FULL CONSULTATION WITH OUR ALLIES, TAKING INTO ACCOUNT THE OTHER CONTRIBUTORS OR REQUIREMENTS FOR DETERRENCE i.e. CONVENTIONAL FORCES AND THEATER NUCLEAR FORCES. THE ULTIMATE DETERRENT REMAINS U.S. STRATEGIC OFFENSIVE FORCES. WE AND OUR ALLIES DEVELOPED THE STRATEGY OF FLEXIBLE RESPONSE - THE CORNERSTONE OF U.S. AND ALLIED SECURITY FOR ALMOST 20 YEARS. WE IN NO WAY SEEK TO DISCARD THIS STRATEGY, BUT RATHER LOOK TOWARD

STRENGTHENING ITS VERY FLEXIBILITY. AS WE LOOK TOWARD THE FUTURE, THE CONTINUING GROWTH AND SOPHISTICATION OF SOVIET OFFENSIVE FORCES, AS WELL AS THEIR DEFENSIVE CAPABILITIES, WOULD, IF LEFT UNCHECKED AND UNANSWERED, RAPIDLY PLACE OUR DETERRENT CAPACITY - AS REPRESENTED BY U.S. AND ALLIED FORCES - IN QUESTION, REDUCING OR LIMITING THE OPTIONS SO IMPORTANT TO OUR FLEXIBLE RESPONSE STRATEGY. THE SDI OFFERS THE OPPORTUNITY TO SHIFT THE DETERRENT STANCE FROM THIS INCREASINGLY QUESTIONABLE FOUNDATION BASED PRIMARILY ON THE ULTIMATE THREAT OF DEVASTATING NUCLEAR RETALIATION TO ONE IN WHICH NON-NUCLEAR DEFENSES PLAY A GREATER AND GREATER ROLE.

AS SECRETARY WEINBERGER HAS POINTED OUT, "ULTIMATELY, WE ALL MUST REALIZE THAT IN A NUCLEAR WORLD WE SHARE A COMMON DESTINY AND ARE UNITED IN OUR VULNERABILITY TO NUCLEAR ATTACK. THAT IS WHY WE MUST WORK TOGETHER TO BRING OUR BEST MINDS TO THE FORMIDABLE TASK OF UNLOCKING SCIENTIFIC KNOWLEDGE THAT CAN UNITE US ALL IN A WORLD WHERE NO NATION NEED FEAR THE SUDDEN ADVENT OF NUCLEAR WAR..." THIS OPPORTUNITY IS MANIFESTED IN A NUMBER OF WAYS FOR BOTH OURSELVES AND OUR ALLIES.

SUCH AN APPROACH WOULD PROVIDE A FAR SOUNDER BASIS FOR A STABLE AND RELIABLE STRATEGIC RELATIONSHIP. AN AGGRESSOR'S UNCERTAINTIES REGARDING HIS OFFENSIVE WEAPONS' EFFECTIVENESS WOULD BE MARKEDLY INCREASED. THIS REDUCED CONFIDENCE - BECAUSE THE U.S. AND ITS ALLIES WOULD BE MORE CAPABLE OF DENYING AN AGGRESSOR'S MILITARY OBJECTIVES - WOULD MAKE THE AGGRESSOR MUCH

LESS LIKELY TO CONTEMPLATE INITIATING A NUCLEAR CONFLICT, EVEN IN CRISIS SITUATIONS. AT THE SAME TIME, THIS WOULD MEAN A REDUCTION IN THE UTILITY, OR PERCEIVED VALUE, OF BALLISTIC MISSILES, WHICH IS A GIANT STEP TOWARD RENDERING THEM IMPOTENT AND OBSOLETE. ON BALANCE, THE LIKELIHOOD OF NUCLEAR CONFLICT WOULD BE VASTLY REDUCED, AND THAT IS THE ESSENCE OF EFFECTIVE STRATEGIC DETERRENCE.

THE FOREGOING, AS WELL AS MOST CURRENT DISCOURSE, DOES CENTER ON NUCLEAR DETERRENCE. WHILE OUR ALLIES HAVE JOINED US IN THIS PRESENT POSTURE, THERE IS, HOWEVER, ANOTHER FACET OF DETERRENCE THAT MAY HOLD FOR THEM EQUAL OR EVEN GREATER RELEVANCE. TOO OFTEN, IN THE DEBATE SURROUNDING THE SDI, THE QUESTION OF CONVENTIONAL DETERRENCE IS NOT IN THE FOREFRONT.

OF ALLIED FORCES IN EUROPE, FOR EXAMPLE, 95 PERCENT OF THE DIVISIONS, 85 PERCENT OF THE TANKS, AND 80 PERCENT OF THE COMBAT AIRCRAFT ARE PROVIDED, MANNED, AND PAID FOR BY THE EUROPEAN ALLIES. SOVIET DOCTRINE SEEMS TO BE EVOLVING ALONG LINES THAT PLACE EVER GREATER VALUE ON TACTICAL BALLISTIC MISSILES AND THE HAVOC THEY COULD WREAK ON NATO FORCES. SOVIET SS-20s AND OTHER SHORTER-RANGE MISSILES PRESENTLY PROVIDE OVERLAPPING CAPABILITIES TO STRIKE ALL NATO EUROPE, AS WELL AS OUR ASIAN ALLIES. THEIR DOCTRINE STRESSES THE USE OF CONVENTIONALLY-ARMED (AND POSSIBLY CHEMICALLY-ARMED) BALLISTIC MISSILES TO INITIATE RAPID AND WIDE-RANGING ATTACKS ON CRUCIAL MILITARY TARGETS IN ORDER TO CRIPPLE THE ABILITY TO COUNTER THE INITIAL THRUST OF A SOVIET

ATTACK WITHIN, AND TO INHIBIT RESUPPLY AND REINFORCEMENT FROM WITHOUT.

SO FAR, SOVIET MILITARY PLANNERS HAVE HAD A FREE RIDE ON THE USE OF BALLISTIC MISSILES IN ANY DESIGNS FOR AGGRESSION IN A TACTICAL APPLICATION (JUST AS THEY HAVE IN THE STRATEGIC REALM). EVEN A MODEST DEFENSE AGAINST TACTICAL BALLISTIC MISSILES WOULD HAVE A MAJOR EFFECT ON THE SITUATION. NOT ONLY WOULD THERE BE SIGNIFICANTLY INCREASED COSTS FOR OFFENSIVE FORCES TO MAINTAIN THE SAME LEVEL OF ADVANTAGE ENJOYED TODAY, BUT OTHER TECHNOLOGIES AND THE CHANGING NATURE OF OPERATIONS AND TACTICS WOULD INTERACT WITH DEFENSES TO CREATE ALTOGETHER MORE COMPLEX PROBLEMS FOR THE PLANNER ENTERTAINING ANY THOUGHTS OF AGGRESSION.

BY REDUCING OR ELIMINATING THE MILITARY EFFECTIVENESS OF BALLISTIC MISSILES, BOTH TACTICAL AND STRATEGIC, DEFENSIVE SYSTEMS THUS HAVE THE VERY REAL POTENTIAL FOR ENHANCING DETERRENCE AGAINST NOT ONLY STRATEGIC NUCLEAR CONFLICT, BUT ALSO AGAINST NUCLEAR, CHEMICAL, AND CONVENTIONAL ATTACKS ON OUR ALLIES AS WELL. LIEUTENANT GENERAL WILLIAM ODOM, DIRECTOR OF THE NATIONAL SECURITY AGENCY, PRESENTED AN EXCELLENT, INSIGHTFUL ANALYSIS OF THIS ISSUE ENTITLED, "THE IMPLICATIONS OF ACTIVE DEFENSE OF NATO FOR SOVIET MILITARY STRATEGY," TO THE EUROPEAN AMERICAN INSTITUTE FOR SECURITY RESEARCH WORKSHOP IN NOVEMBER OF 1984. I WOULD LIKE TO OFFER A COPY OF THAT PAPER TO THE COMMITTEE FOR INCLUSION IN THE RECORD.

IN REFLECTING ON THIS VERY BRIEF DISCUSSION OF THE PROMISE OFFERED BY THE STRATEGIC DEFENSE INITIATIVE TO TRULY ENHANCE DETERRENCE AND THE ROLE PLAYED BOTH IN THE PAST AND NOW BY OUR ALLIES, I SUBMIT THAT THERE IS NO SUBSTANCE TO CHARGES THAT THE SDI THREATENS TO "DECOUPLE" THE UNITED STATES FROM THE SECURITY OF OUR ALLIES, OR CREATE A 21ST CENTURY "FORTRESS AMERICA." THE PRESIDENT ENVISIONS DEFENSE FOR BOTH AMERICANS AND OUR ALLIES. THE BASIS FOR BOTH U.S. AND ALLIED SECURITY WILL BE ONE AND THE SAME - AS IT HAS HISTORICALLY BEEN.

TURNING TO THE STEPS TAKEN BY SECRETARY WEINBERGER INVITING ALLIES TO PARTICIPATE IN THE PROGRAM, WE SAW CONSIDERABLE SCIENTIFIC AND TECHNICAL EXPERTISE AMONGST OUR ALLIES IN THEIR SCIENTIFIC AND INDUSTRIAL COMMUNITIES. CERTAIN ALLIED CONTRIBUTIONS COULD REDUCE BOTH THE SCHEDULE AND THE COST OF THE SDI RESEARCH PROGRAM. BEYOND THE IMPORTANT TECHNICAL CONTRIBUTIONS WHICH ALLIED PARTICIPATION MAY MAKE, WE BELIEVE THAT THEIR INVOLVEMENT WILL CERTAINLY LEAD TO A MORE IN-DEPTH UNDERSTANDING OF THE PROGRAM AND THE TECHNICAL BASIS FOR DEFENSE AS WELL AS ITS MILITARY BASIS. THIS UNDERSTANDING WILL BE A VITAL UNDERPINNING OF A FUTURE DECISION TO PROCEED INTO DEVELOPMENT. WE HAVE PLEDGED TO MAKE THAT FUTURE DECISION IN FULL CONSULTATION WITH OUR ALLIES AS WELL AS TO ATTEMPT NEGOTIATIONS WITH THE SOVIETS. MOREOVER, ALLIED PARTICIPATION WILL SPARK A LATENT SYNERGISM NOT ONLY IN DEFENSE AGAINST BALLISTIC MISSILES, BUT ALSO IN THE CONVENTIONAL ARMS ARENA.

THERE ARE MANY UNIQUE AND IMPORTANT TECHNICAL CAPABILITES THAT OUR ALLIES CAN BRING TO THE SDI RESEARCH EFFORTS - IN SOME CASES, IT MAY BE A MEANINGFUL TECHNOLOGY BASE IN CERTAIN AREAS, FOR EXAMPLE, THE SDI DIRECTED ENERGY RESEARCH PROGRAM. IN THIS AREA, SEVERAL OF OUR ALLIES HAVE ONGOING, ADVANCED PROGRAMS INVOLVING SMALL, BUT VERY SPECIFIC LASER AND PARTICLE BEAM RESEARCH WHICH COULD COMPLEMENT EFFORTS UNDERWAY IN THE U.S. IN THE FIELD OF OPTICS, SPECIALIZED HIGH QUALITY MATERIALS AND ADVANCED CONSTRUCTION TECHNIQUES ARE AREAS OF RESEARCH EXPERTISE FOUND IN SEVERAL ALLIED NATIONS. THERE ARE ALSO ALLIES WHO HAVE EXTENSIVE PROGRAMS INVOLVING GALLIUM ARSENIDE RESEARCH, COMPUTER RESEARCH, COMPOSITE MATERIALS, ELECTROMAGNETIC LAUNCHERS, AND INFRARED SENSORS AS WELL.

WHILE THE ATTRACTION OF A DIFFERENT ARRAY OF SCIENTIFIC TALENT IS A POWERFUL FACTOR FOR OUR INTEREST, THERE ARE ALSO OTHERS - SUCH AS ACCESS TO SPECIAL FACILITIES OR TEAMS OF RESEARCHERS WITH UNIQUE EXPERIENCE, OR THAT HAVE BROUGHT SPECIAL TECHNOLOGY PARTWAY AND TAKING IT FURTHER MAY BE USEFUL FOR THE SDI. IN THE CLIMATE OF LIMITED RESOURCES, EVERY EFFORT MUST BE MADE TO DERIVE MAXIMUM BENEFIT FROM OUR DEFENSE DOLLAR. IF CERTAIN JOBS CAN BE DONE MORE EFFECTIVELY, AT LESS COST, OR MORE QUICKLY, IN THE HANDS OF OUR ALLIES, THEN IT IS INCUMBENT ON US AS RESPONSIBLE MANAGERS TO SERIOUSLY CONSIDER SUCH EXECUTION.

TO DERIVE THE GREATEST BENEFIT FROM ALLIED EXPERTISE THROUGHOUT THE VARIOUS SDI RESEARCH AREAS AND SATISFY THE NEED TO

KEEP THEM AS FULLY INFORMED AS POSSIBLE OF THE DESIRABILITY OF DEFENSE-ORIENTED FORCES, THE U.S. SHOULD PROCEED TOWARD DEVELOPING A MEANINGFUL ALLIED ROLE IN SDI RESEARCH - ONE CONSISTENT WITH OUR TECHNICAL REQUIREMENTS, LAWS, REGULATIONS, AND INTERNATIONAL OBLIGATIONS.

AS THE SDI PROGRAM IS MOVING AHEAD AT A VERY RAPID PACE, OUR NEAR TERM GOAL IS TO GIVE OUR ALLIES EARLY OPPORTUNITIES TO PARTICIPATE IN SDI RESEARCH. WE INITIATED THIS PROCESS WITH THE SECRETARY'S INVITATION. IT WAS SENT TO 18 OF OUR ALLIES - AUSTRALIA, BELGIUM, CANADA, DENMARK, THE FEDERAL REPUBLIC OF GERMANY, FRANCE, GREECE, ISRAEL, ITALY, JAPAN, KOREA, LUXEMBOURG, NETHERLANDS, NORWAY, PORTUGAL, SPAIN, TURKEY, AND THE UNITED KINGDOM. THE RESULT HAS BEEN A SERIES OF CONTINUING BILATERAL DISCUSSIONS WITH MANY OF THE COUNTRIES; BRIEFINGS TO THEIR DELEGATIONS WHO COME TO WASHINGTON; ARRANGING VISITS FOR THESE GROUPS TO OUR LABORATORIES AND CONTRACTOR FACILITIES; AND, IN SOME CASES, A VISIT FROM AN SDIO TECHNICAL TEAM TO THEIR COUNTRY. THE OBJECT OF THESE DIALOGUES HAS BEEN TO ADDRESS THE VARIOUS PROCEDURAL CONCERNS AND TO IDENTIFY AREAS OF SDI RESEARCH FOR POSSIBLE PARTICIPATION, CONSISTENT WITH U.S. LAW, SECURITY INTERESTS IN PROTECTING SENSITIVE TECHNOLOGY, AND OUR OBLIGATIONS UNDER THE ABM TREATY.

IN THESE DISCUSSIONS, WE HAVE INDICATED OUR FLEXIBILITY WITH REGARD TO ENABLING MECHANISMS. IN OTHER WORDS, THERE ARE A NUMBER

OF WAYS THAT THE ALLIES COULD PARTICIPATE IN THE PROGRAM. SOME ALLIES ARE INTERESTED IN CONCLUDING NEW GOVERNMENT-TO-GOVERNMENT OVERARCHING OR FRAMEWORK AGREEMENTS WHICH WOULD PROVIDE A COMPREHENSIVE BASIS FOR THEIR COUNTRY'S INVOLVEMENT IN THE STRATEGIC DEFENSE INITIATIVE RESEARCH PROGRAM. PROCEEDING ALONG THESE LINES ALLOWS US TO SORT OUT THE ISSUES OF PRINCIPAL CONCERN TO THE ALLIES AND OURSELVES REGARDING THEIR PARTICIPATION. MATTERS SUCH AS ENSURING FAIR PROPERTY RIGHTS, PROVIDING PROPER ACCESS TO SDI INFORMATION, MAINTAINING STRICT INDUSTRIAL AND TECHNICAL SECURITY, AND ALLOWING FAIR COMPETITION WITH U.S. INDUSTRY ARE BUT A FEW OF THE CONCERNS FOREMOST IN ALL OUR MINDS. WHETHER OR NOT WE CONCLUDE SUCH OVERARCHING AGREEMENTS, SPECIFIC RESEARCH PROJECTS WILL REQUIRE SEPARATE IMPLEMENTING ARRANGEMENTS. THESE COULD TAKE A VARIETY OF FORMS. ONE COULD BE AN ARRANGEMENT WHEREBY WE WOULD ENTER INTO AN AGREEMENT FOR COOPERATIVE RESEARCH IN WHICH BOTH PARTIES WOULD SHARE IN COSTS. THE IMPLEMENTING VEHICLE IN THIS CASE WOULD BE GOVERNMENT-TO-GOVERNMENT MEMORANDUM OF AGREEMENT. SUCH COOPERATIVE ARRANGEMENTS CAN BE PARTICULARLY ATTRACTIVE AND HAVE POTENTIAL SINCE THERE ARE MANY CASES WHERE THE U.S. AND AN ALLY ARE BOTH WORKING IN COMPARABLE AREAS.

A MORE COMMON FORM WOULD BE A CONTRACT AWARDED FROM THE SDIO (OR ITS AGENT) TO AN ALLIED GOVERNMENT, OR GOVERNMENT AGENCY, SOMETIMES ON A SOLE SOURCE BASIS, BUT MORE NORMALLY ON A COMPETITIVE BASIS. THE ALLIED GOVERNMENT OR GOVERNMENT AGENCY MIGHT, IN TURN, SUB-CONTRACT TO ITS INDUSTRY OR LABORATORIES.

ALLIED GOVERNMENTS, IN THIS INSTANCE, WOULD PLAY A MANAGEMENT, OR INTEGRATION ROLE. WE COULD ALSO AWARD CONTRACTS DIRECTLY TO ALLIED INDUSTRY, AGAIN ON A SOLE SOURCE OR COMPETITIVE BASIS AS APPROPRIATE. FINALLY, WE BELIEVE THERE IS CONSIDERABLE LATITUDE FOR ALLIED LABORATORIES AND INDUSTRY TO WORK DIRECTLY WITH U.S. CONCERNS ON SDI CONTRACTS. WE HAVE ALREADY SEEN A GREAT DEAL OF INTEREST IN ALL THESE POSSIBILITES - FROM ALLIES AND FROM OUR OWN INDUSTRY.

IT IS IMPORTANT TO POINT OUT THAT THE FUNDAMENTAL BASIS FOR ALLIED PARTICIPATION MUST BE TECHNICAL MERIT. WE HAVE MADE CLEAR TO ALLIES THAT THERE CAN BE NO GUARANTEE OF A CERTAIN LEVEL OF EFFORT.

I SHOULD PERHAPS INDICATE ONE FINAL POSSIBILITY. ALLIES, PARTICULARLY THOSE WITH MORE LIMITED NATIONAL RESEARCH CAPABILITIES, COULD BE INVITED TO SEND SELECTED AND APPROPRIATELY CLEARED PERSONNEL WHO CAN MAKE REAL CONTRIBUTIONS, TO JOIN SPECIFIED U.S. RESEARCH TEAMS IN A SCIENTIFIC EXCHANGE PROGRAM. AS YOU KNOW, DOD ALREADY HAS A NUMBER OF SUCH EXCHANGE PROGRAMS IN PLACE. WHATEVER THE ARRANGEMENT, WE ARE TAKING VIGOROUS STEPS TO ASSURE THE SECURITY OF THE PROGRAM AND TO SAFEGUARD ALL SENSITIVE INFORMATION AND TECHNOLOGIES. THIS IS FUNDAMENTAL TO ANY AGREEMENTS THAT MAY BE REACHED.

BRIEFLY, I HAVE TRIED TO OUTLINE A FEW OF THE PERTINENT POINTS WITH RESPECT TO ALLIED PARTICIPATION IN THE STRATEGIC

DEFENSE INITIATIVE. I WOULD EMPHASIZE THAT U.S. AND ALLIED SECURITY REMAINS INDIVISIBLE. THE SDI PROGRAM IS DESIGNED TO ENHANCE ALLIED SECURITY AS WELL AS U.S. SECURITY. WE WILL CONTINUE TO WORK CLOSELY WITH OUR ALLIES TO ENSURE THAT, AS RESEARCH PROGRESSES, ALLIED VIEWS ARE CAREFULLY CONSIDERED AND THEY ARE GIVEN THE CHANCE TO TAKE PART. WE HAVE MADE A SERIOUS COMMITMENT TO CONSULT WITH OUR ALLIES, AND SUCH CONSULTATIONS WILL PRECEDE ANY STEPS TAKEN RELATIVE TO THE SDI RESEARCH PROGRAM WHICH MAY AFFECT OUR ALLIES.

I WOULD LIKE TO CLOSE WITH A STATEMENT MADE BY SIR WINSTON CHURCHILL MORE THAN THIRTY YEARS AGO WHEN IN ADDRESSING CONGRESS HE SAID, " BE CAREFUL ABOVE ALL THINGS NOT TO LET GO OF THE ATOMIC WEAPON UNTIL YOU ARE SURE, AND MORE THAN SURE, THAT OTHER MEANS OF PRESERVING PEACE ARE IN YOUR HANDS." UNFORTUNATELY, TODAY THE KNOWLEDGE OF NUCLEAR WEAPONS AND DELIVERY SYSTEMS IS ALREADY WIDESPREAD. MOREOVER, OUR POTENTIAL ADVERSARIES HAVE MORE POWERFUL NUCLEAR AND BALLISTIC MISSILE WEAPONS CAPABILITIES THAN ANYONE ELSE ON EARTH BUILT INTO THEIR FORCES, THEIR WARFIGHTING DOCTRINE, AND INTO THEIR WORLDWIDE METHODS OF INTIMIDATION AND PROPAGANDA. THUS TO APPLY CHURCHILL'S ADVICE AT ALL, WE MUST HURRY AND FIND THAT MORE EFFECTIVE MEANS OF KEEPING THE PEACE - WE BELIEVE THAT STRATEGIC DEFENSE OFFERS THE POTENTIAL FOR A MORE SECURE AND STABLE ENVIRONMENT WITH FAR LESS RELIANCE AND UTILITY PLACED ON NUCLEAR WEAPONS. WITH THE SDI, WE HOPE TO MAKE SURE, AND MORE THAN SURE, THAT THERE ARE OTHER AND BETTER MEANS OF PRESERVING THE PEACE. AGAIN, I THANK YOU FOR THE OPPORTUNITY TO APPEAR TODAY AND WELCOME YOUR QUESTIONS.