STRATEGIC DEFENSE INITIATIVE ORGANIZATION (SDIO)
SMALL BUSINESS INNOVATION RESEARCH PROGRAM

Submitting Proposals

Phase I proposals (5 copies) should be prepared for routine US Mail and addressed to:

Strategic Defense Initiative Organization
Attention: IST/SBIR
The Pentagon
Washington, DC 20301-7100

Since no provisions will be made to receive hand carried proposals, bidders should allow ample time for routine delivery of proposals by the US Post Office the above address can not be used for commercial delivery services or hand carry.

The SDIO SBIR Program supports science and engineering at the cutting edge of technologies that, if successful will have a significant impact on the mission of SDI. Topic areas of special interest to SDI are described in the following paragraphs. The efforts supported will be innovations ultimately leading to a product or process that potentially can be used in strategic defense. Many of the concepts being addressed by SDI involve major ground or space based systems may be beyond the capability of a high-technology small business, many of the subsystems, components, processes, etc. fall within the scope of this solicitation. Accordingly, the prospective bidders can interpret the SDI topics in terms of how they can contribute to the solution of the broader problems and challenges described in this solicitation. In many cases, the thrust of a topic includes establishing feasibility of concepts, enabling major advancements in capability, etc., rather than production. For example, the deliverable from a successful Phase II effort could be a prototype which becomes an element in a demonstration program; the follow-on Phase III could be further research to perfect the approach following testing or evaluation.

Phase I proposals must be confined to strategic defense innovative technologies, advanced concepts, or novel approaches, that in Phase II either may be carried out to laboratory prototype, or can lead to the next generation of products or processes. Phase II awards may not necessarily complete the total research and development that may be required to satisfy strategic defense needs; completion of the research and development of products or processes for use by SDI may occur during Phase III. Ultimately, Phase III must address the development of products or processes for use by SDI. Ideally, the research should make a significant contribution to the solution of an important SDI problem through a product or a process and provide the small business firm with the basis for a new product, process, or service.

Some activities will not be funded in Phase I or II: technical assistance, compilations of works of others, technology assessments, development of technically proven ideas, product development, demonstration projects, or pilot plants. Research and development on incremental or scaled-up versions of existing technology may be permitted if the additional R&D is necessary to meet significantly different conditions as rated in the topic descriptions.

FY1987 SBIR Topics
Strategic Defense Initiative Organization

SDIO87-001 TITLE: Directed Energy Concepts

DESCRIPTION: Innovative research in the generation and propagation of directed energy plays an important role in the determination of effective ballistic missile defense systems. Systems being considered include (but are not limited to) chemical lasers, excimer lasers, nuclear and non-nuclear driven x-ray lasers, gamma-ray lasers free electron lasers, neutral and charged particle beams, and plasmoids, Hybrid approaches also of interest. Interests in the concepts include full range of embodiments, i.e., light weight spaced-based, ground-based, and pop-up systems. Included in the directed energy problems are such diverse topics as weapon pointing, beam control, acquisition, tracking and pointing, mirror technology, beam propagation through natural and disturbed environments, and countermeasures. Approaches are needed that either extend or improve the present concepts. Approaches that facilitate or support the evaluation of concepts are also appropriate.

SDIO87-002 TITLE: Kinetic Energy Weapons

DESCRIPTION: Along similar lines to the topic SDIO 87-1, kinetic systems are candidates for ballistic missile defense. Systems being considered include (but are not limited to) electromagnetic rail guns, plasma guns, and other hypervelocity projectile concepts as well as chemically propelled interceptors. Included in the kinetic energy weapons area are smart projectiles development, homing devices, launchers designs, engagement tactics, hypervelocity aerocontrol/thermal protection, and countermeasures. Approaches are needed that either extend or improve the present concepts. Approaches that facilitate or support the evaluation of concepts are also appropriate.

SDIO87-003 TITLE: Sensors for Surveillance, Acquisition, and Discrimination

DESCRIPTION: Sensors and their associated systems will function as the “eyes and ears” of a space-based ballistic missile defense system, providing early warning of attack, target identification, target tracking, and kill determination. New and innovative approaches to these requirements using unconventional techniques are encouraged across a broad band of the electromagnetic spectrum, from radar to gamma-rays. Passive, active, and interactive techniques for discriminating targets from decoys and other penetration aids are solicited. In addition to novel sensing concepts, sensor-related device technology is also needed, with the intended goal of producing either a specific product or process. Examples of some of the specific areas to be addressed are: cryogenic coolers (open and closed systems), algorithms, low power optical beam steering, synthetic aperture lidar and radar, passive imaging (infrared to ultra-violet wave), interferometry, beam coherence and positioning, low-signal gamma-ray detection, and frequency-scanning laser techniques for active discrimination. Approaches are needed that can extend and improve the efficiency of present concepts.

SDIO87-004 TITLE: Nuclear Space Power Concepts

DESCRIPTION: Weapons, sensing and communications systems under consideration strategic defense have diversified power requirements. Methods and processes are being considered for a wide spectrum of power and power conditioning situations. Nuclear power concepts and the associated components are of interest for both manned and unmanned spacecraft. The power duty cycles to be considered include: hundreds of MW power for pulse applications, sustained hundreds of KW to MW power for electric propulsion, continuous tens to hundreds of KW power for house keeping, tracking, etc. This category includes auxiliary components and sub-systems vital to the operation of the power system. The energy conversion approaches include: thermoelectric, thermionic, and brayton cycle. New approaches leading to controlled wide excursions of power burst mode power are sought. Innovative high power thermal radiator concepts are needed for all types of power cycles. Also, concepts and systems that enhance safety, maintainability, and reliability of space nuclear power systems are sought.

SDIO87-005 TITLE: Non-nuclear Space Power and Power Conditioning

DESCRIPTION: Along the lines of topic SDIO 87-4, nonlinear approaches are sought. Applications in space demand high energy densities. The power duty cycles to be considered include: hundreds of MW power for burst applications, sustained hundreds of KW to MW power for electric propulsion, continuous tens hundreds of KW to MW power for electric propulsion, continuous tens hundreds of KW to MW power for house keeping, tracking, etc. Specific topics include novel battery concepts, chemically driven systems for burst power, advanced solar collectors and converters, inductive and capacitive stores, space-based MHD generators, heat dissipation systems, signature control, and plasma switches. Also, concepts and systems that enhance maintainability and ability of space power systems (e.g. insulation and cable) are sought.

SDIO87-006 TITLE: Propulsion and Logistics

DESCRIPTION: Strategic defense places unprecedented demands on all types of space transportation and propulsion systems; launch to low earth orbit, orbit transfer, orbit maneuvering, and station keeping. In particular, advancements needed to achieve major reductions in the costs of placing and maintaining loads in the desired orbit. Traditionally, the cost of space transportation and the operations of the spacecraft have been major factors in determining the life cycle costs of space-based assets. This burden on the deployment of strategic defense systems has been identified a major cost driver. Approaches leading defense systems has been identified a major cost driver. Approaches leading to techniques, methods, processes and products in support of these propulsion and logistics objectives are sought.

Propulsion approaches include liquid, solid, transatmospheric air breathing, and electric. Advancements are needed in propulsion-related areas, e.g., extending storage time of cryogenic fluids, reduction of contamination from effluents, and sensors and controls for autonomous operation. In space transportation and support primary emphasis is on reducing the cost of space operations. Areas of support primary emphasis is on reducing the cost of space operations. Areas of interest include the entire spectrum of space transportation and support: efficient launch systems, assembly, and control systems; expendable and recoverable components; improved structures and materials; increased propulsion efficiency; and significant reduction in the manpower intensive tasks of production, assembly, checkout, operations, and control.

SDIO87-007 TITLE: Thermal Management

DESCRIPTION: The high power levels for space stations will need effective heat dissipacion. Topics 87-4 and 87-5 state the power levels. Innovations are sought in thermal radiators and associated devices for all types of space-based power cycles, nuclear and non-nuclear.

SDIO87-008 TITLE: System Survivability

DESCRIPTION: The survivability of various components of a space-based missile defense system will be a key issue in the effectiveness of such a system. Products, processes, and techniques for active and passive hardening against directed and kinetic energy devices are sought. Components to be made survivable include sensors, battle management systems, power systems, and directed/kinetic energy weapon configurations. Survivable sub-components Include large and small optics, electronics, structures for support and fuel containment, and specific materials critical for shielding, maneuvering, propulsion, and targeting. In addition to shielding, other well designed and innovative countermeasures are encouraged. Specific examples of areas to be addressed include thermo-mechanical shock hardening, heat dissipation techniques, protective coatings, baffling techniques, materials conditioning, orientation or deployment strategies and insulation methods. Of particular interest is hardening survivability against x-ray lasers and bright short wavelength ground based lasers.

SDIO87-009 TITLE: Target Lethality

DESCRIPTION: A major factor in determining the effectiveness of a ballistic missile defense is the lethality of the directed and kinetic energy devices against responsively hardened targets. The key questions that need to be addressed under this topic deal with the quantitative assessment of target lethality. Hence, techniques are needed to acquire, access, and query an extensive database to basic materials, electronics, and optics due to various mechanisms. Techniques are needed to quantify laser radiation damage due to ionization, thermal deposition, and impulse shock as a function of wavelength, intensity, and pulse characteristics. This is required in order to direct future research in novel directed energy concepts. Similar techniques are needed to investigate and quantify damage mechanisms due to particle beam interaction with targets. In the area of kinetic energy, the effects of hypervelocity projectile impact on structural and hardened materials are of extreme interest. Finally, innovative ideas or concepts for measurement of radiation or particle penetration, structural damage due to thermo-mechanical stress, opacities of plasma blow-off, and equation-of-state data are relevant.

SDIO87-010 TITLE: Computer Architecture and Very High-Level Language Design for Battle Management

DESCRIPTION: Strategic defense systems for battle management demands order-of-magnitude advances. The system must acquire and track thousands of objects wth hundreds of networked sensors and data processors, direct weaponry to intercept targets, and determine the degree of kill. Three areas of interest are:

New computer architecture which are lightweight, compact, fault-tolerant, and hardened to radiation, but allow for the extremely rapid processing of data that will be required. This issue can be addressed via either new designs for computer components (e.g., optical signal processors) or innovative architecture using existing technology.

Very high-level language (VHLL) design for both the development and testing of extremely large software systems.

Novel numerical algorithms for enhancing the speed of data processing for sensing, discrimination and systems control. These may be specifically tailored to a particular architecture, since the computer will likely be a single-purpose design suited to the strategic defense data processing task.

Supporting concepts are also sought. Examples of these include secure laser satellite networking of battle managers and sensors, and deployment strategies of components in a battle environment.

SDIO87-011 TITLE: Optical Computing and Optical Signal Processing

DESCRIPTION: Dense computing capability is sought in all architectural variations, from all optic to hybrid computers. Specific examples of areas to be addressed include, but are not limited to, high speed multiplexing, monolithic optielectronic transmitters, holographic methods, reconfigurable interconnects, optoelectronic circuits, and any other technology contributing to advances in intra-computer communications, optical logic gates, bistable memories, optical transistors, and power limiters.

SDIO87-012 TITLE: Space Structures

DESCRIPTION: The strategic defense mission places great demands upon the design of space structures to be used for their fabrication. The requirements include structures for prime power systems, antennas, tracking and pointing systems, solar collectors, and pressure vessels. All of these present individual challenges in terms of stiffness, impact resistance, high temperature capability, deployment, etc. Most of the anticipated situations depend on major improvements in material properties, cost effectiveness, and protection methodology. Space structures supporting weapons and antenna must accommodate retargeting maneuvering without detrimental jitter from vibrations and thermo-mechanical flutter. Techniques for both passive and active control of the structural dynamic responses to environmental and operational excitations are needed. Methods are needed to predict the dynamic performance and stability characteristics of structures acting in concert with on-board disturbed controllers for maneuvering, pointing, and vibration/noise suppression.

SDIO87-013 TITLE: Structural Materials

DESCRIPTION: Many of the anticipated structural advances sought in Topic 87-12 will depend on major improvements in material properties, cost effectiveness, and prediction methodology. Space structures supporting weapons and antenna must accommodate retargeting maneuvering without detrimental jitter from vibrations and thermo-mechanical flutter. Techniques are needed to obtain greatly improved understanding of structure-property relationships for advance carbon/carbon, ceramic-matrix, and metal-matrix composite materials, Specific goals requiring advanced techniques and processes include imparting oxidation resistance and damage tolerance to carbon/carbon composites, enhancing the static and dynamic toughness of ceramic composites and creating fatigue-resistant metal composites with order of magnitude improvements in passive vibrational damping. Methods are needed to establish the thermodynamics and kinetics basis for minimizing fiber-matrix reactions in composites exposed to high operating temperatures. Method are needed to address the basic mechanics of failure characteristics and fatigue behavior under complex mechanical and thermal loadings. Tribology innovative techniques and ideas are sought in areas such as solid and liquid lubricants, moving mechanical assemblies, lightweight alloys, and antiwear adhesives. Advances are sought in materials for optical systems, components, and radiation hardening. Proposals involving these well as other space structure and material-related research and innovative technology topics are encouraged.

SDIO87-014 TITLE: Electronic Materials

DESCRIPTION: The necessary advances in electronics for the many strategic defense applications will require advances in electronics materials. Primary emphasis lies in advancing the capability of integrated circuits, detectors, sensors, large scale integration, radiation hardness, and all electronic components