THE STRATEGIC DEFENSE INITIATIVE

TECHNOLOGY APPLICATIONS PROGRAM

THE SDI TECHNOLOGY APPLICATIONS PROGRAM

HISTORICAL PERSPECTIVE

Historically, both the Department of Defense (DOD) and the National Aeronautics and Space Administration (NASA) have significantly advanced the state-of-the art in science and technology and spurred the American economy by means of technology transfer from military and space programs. Through the various military service research and development agencies, NASA centers, and federal laboratories, significant advances in technology and new inventions were transferred to the private sector that are standard consumer items of today and new products of tomorrow.

THE SDIO OFFICE OF TECHNOLOGY APPLICATIONS

In view of the unprecedented advances in technology being derived from Strategic Defense Initiative research, the SDIO Office of Technology Applications was established to develop and implement a domestic technology transfer program designed to make SDI technology available to other DOD and federal agencies as well as to business and research interests in the American private sector. Unclassified information regarding new technologies will be made available to qualified American corporations and small businesses, universities, and entrepreneurs as well as assistance in identifying the sources of new SDI technology in order to negotiate proprietary rights and patent matters. The Office of Technology Applications is developing a technology applications information system, and is using voluntary scientific and technical advisors from across the country to assist in the identification of SDI technology with spinoff potential. The program is also integrated with the activities and technical resources of the Federal Laboratory Consortium.

SDIO TECHNOLOGY APPLICATIONS PROGRAM ACTIVITIES

The SDIO Technology Applications program activities reach across the spectrum of American governmental, industrial, and academic scientific and technical communities to assist in the identification and promotion of domestic technology applications. These activities and programs are being conducted in conjunction and cooperation with other federal and state and local government agencies, federal laboratories, universities and the private sector and include:

- **SDI TECHNOLOGY APPLICATIONS INFORMATION SYSTEM (TAIS)**

- **Classified Applications:** A classified data base of synoptic data regarding new and unique SDI-generated technologies. This data base will serve as a source for the review of all SDI technology by a Classified Technology Committee and by a Federal Applications Panel consisting of appropriately cleared representatives from both the military services and other federal agencies which have a need for SDI-related technology.

- **Technology Applications Information System:** An unclassified data base, developed as a physically separate extension of the classified data base containing synoptic data regarding new and unique SDI-generated technologies. This data base will be resident in a desktop microcomputer and will be accessible via computer modem to qualified American business and academic clients who execute a Militarily Critical Technology Agreement in accordance with DOD

Directive 5230.25. The data base will also be open to all federal and state agencies.

- **SDIO VOLUNTARY ADVISORY COMMITTEES AND PANELS**

The SDIO Technology Applications program includes the following advisory committees and panels whose members serve without remuneration except for reimbursement of travel and per diem under invitational travel orders when travel is necessary.

- **Federal Applications Committee.** A Federal Applications Committee has been established as a subcommittee of the SDIO Advisory Committee to (1) assist in a top level review of classified, as well as unclassified technologies for potential applications to other military and federal applications and (2) provide guidance on the overall approach and progress of the program. This senior advisory committee, which consists primarily of retired flag officers, will meet on a semi-annual basis and be assisted by representatives from the Military Departments and other Federal Agencies.

- **Civil Applications Committee.** A Civil Applications Committee has been established as a subcommittee of the SDIO Advisory Committee . The committee consists of senior government, civil and industry leaders supported by recognized experts in specific technical fields. The committee will assist in a top level review of unclassified SDI technologies for potential applications to other the public and private sector and (2) provide guidance on the overall approach and progress of the program. This senior advisory committee, will meet on a semi-annual basis and be assisted by four Technology Applications Panels as described below.

- **Technology Applications Panels.** Technology Applications Panels have been established to (1) assist in reformatting technology information into synopses that are meaningful to scientific and technical personnel outside the Department of Defense, (2) identifying potential applications of the technology, and (3) reviewing technology client inquiries. Panels have been established in the following generic technology areas:

  - Bio-Medical Applications
  - Electronics, Communications and Computer Applications
  - Power Generation, Storage and Transmission Applications
  - Materials and Industrial Process Applications

Volunteer members of the Technology Applications Panels include representatives from universities, private research institutes, Federal Laboratories, industry, government agencies, and professional and industrial organizations. A number of the members hold patents and are nationally known leaders and inventors in their respective fields. The Technology Applications Panels meet on a regular basis to review technology efforts. Panel members will also use the modem accessible data base on a continuing basis to review technology information and communicate with other panel members and advisors in the process of screening SDIO technology for spinoffs.

PROMISING SDIO SPINOFFS

- The Office of Technology Applications will identify and promote promising marriages of technology and domestic applications deemed to have a high pay-off potential in the near term. Although such projects are not funded from the SDIO budget, the Office of Technology Applications will seek to promote promising programs through encouragement of successful partnerships among entrepreneurs, inventors, and venture capitalists. Some of the current activities in this area follow:

  - **Sol-Gel Derived Bioglass**: A bio-active material that has the capability of replacing or repairing human bone and soft tissue. SDI - research at the University of Florida in materials processing technology for rapid fabrication of optical devices resulted in a method to extend this bio-technology into a host of new applications that should result in many new types of bio-compatable prostheses. In the first meeting of the SDIO Bio-Medical Applications panel, it was determined that this new material promises a dramatic improvement with another new bio-medical innovation - the Programmable, Implantable Medication System (PIMS) which itself uses satellite telemetry technology and NASA Mars Viking Lander technology to automatically dispense insulin for diabetics. The inventor of the PIMS, Mr. Fischell of Johns Hopkins University Applied Physics Laboratory is a member of the SDIO Bio-Medical Technology Applications Panel.

  - **Diamond Crystal Coating Technology**: Developed under the SDI Diamond Technology Initiative Program for the coating and protection of mirrors, electronics and other devices in space, this new process for depositing thin layers of diamond crystal on surfaces has numerous potential applications:
    - Protection of eyeglasses, windows, mirrored surfaces
    - Surface hardening of cutting, grinding, manufacturing tools and machinery
    - Acoustical speaker applications - a technology spinoff that is currently being marketed by the Sony Corporation.
    - Manufacture of microminiature surgical instruments from micro circuit technology, coated with diamond crystal to produce super sharp microsurgical instruments for eye surgery

  - **Earth Atmospheric Data:** Data derived from studies of the earth's atmospheric characteristics associated with the performance of directed energy defense systems is being shared with NASA and NOAA to enhance overall geophysical, atmospheric, and meteorological research.

  - **High Speed, Fault-Tolerant Computer Applications in Medicine:**

    - High speed computer processors and programs of the SDI Gallium Arsenide MIPS program are being made available to the medical community through the Mayo Clinic to enhance the study of model molecular structures essential to the derivation of new designer drugs.

    - Computers used in operating rooms currently can fail with life-threatening and potentially fatal consequences. Applications of the SDI Gallium Arsenide Advanced On-board Signal Processor provides computing technology designed to degrade gracefully without total shutdown. Applications are being explored by the Mayo Clinic.

- **Optical Tracking Applications to Eye Surgery:** SDI technology for Optical tracking of ballistic missiles and warheads has potential application to tracking the rapid random movements of the eye to enhance eye surgery with lasers.

- **Other Spinoffs:** Examples of other devices and processes that have been identified in an initial research effort by the bio-medical and power generation panels include:

  - **Microminiature, gas-powered refrigerator devices** with applications to food preservation, industrial processing and materials manufacture, and super conductors.
  - **Photolithographic Processes for Micro fluidic Devices** with applications in industry, medicine, and aerodynamics.
  - **High Power Density Alkaline Fuel Cells** which can use ambient air in lieu of exotic fuels and are adaptable to long term power needs at remote sites or for back-up systems.
  - **Monolithic Solid Oxide Fuel Cells** with no moving parts that can use gasoline, jet fuel, and methane gas with efficiencies twice that of conventional automobile engines.
  - **Multi-Layer Ceramic Processing techniques** that can combine the characteristics of electrical, thermal and mechanically-active properties in one material.
  - **Super Capacitors** with over 20 times the capacitance or energy storage capability of current technology.
  - **Attentive Associative Memory Software** which permits a high degree of artificial intelligence self-programming capability for computers.
  - **Cryogenic alternators** which have a 40% increase in power output per unit weight and are more simple, reliable, and inexpensive than current devices.
  - **High power super batteries** which may be spun off to lightweight more powerful uses in the auto industry, powered wheelchairs for handicapped, etc.
  - **Superconductor Materials** with applications to superfast computers, low power electronics & appliances, and transportation systems.
  - **Hypercube Parallel Processing Techniques** for high speed large scale computing problems such as FAA air traffic control applications.
  - **Advanced Thermoelectric Cell** for conversion of heat to electrical power

MEDICAL FREE ELECTRON LASER PROGRAM

SDI Free Electron Laser technology has a significant potential for applications in medical research. At the direction of the Congress, the Medical Free Electron Laser (MFEL) program was initiated within SDIO to establish FEL research facilities and conduct bio-medical and materials research.

In accordance with the intent of Congress, five regional MFEL centers are being established at: (1) Stanford University, California, (2) University of California at Santa Barbara, (3) Brookhaven National Laboratory, New York, (4)

National Bureau of Standards (NBS), Maryland, and (5) Vanderbilt University, Tennessee.

The MFEL program draws upon the resources and expertise of 14 universities, two national laboratories, two commercial laboratories, and one teaching hospital to explore the following areas:

- Pre-clinical Medical Research: Surgical applications, therapy and the diagnosis of disease are being pursued at the Massachusetts General Hospital, the University of Utah, Northwestern University, Baylor Medical School the University of California at Irvine and the Uniformed Services University of the Health Sciences.

- Biophysics Research into medical laser applications at the cellular level are being conducted at the University of Michigan, Purdue, Princeton, the University of Texas, Jackson Laboratories (Maine) and Physical Science, Inc. (Massachusetts) and the Uniformed Services University of the Health Sciences.

- Materials Science is being investigated at Brown University, State University of New York at Buffalo, University of Utah, and at Stanford, Vanderbilt, Princeton, and Southern Methodist Universities.

The MFEL program is projected at a funding level of $15 million per year with all associated hardware to be in place by FY 1989.

OTHER POTENTIAL SDI SPIN-OFFS

The economic implication for the SDIO program to provide a substantial return on investment is obvious. Some key examples of SDI technology that have potential for Technology Applications are:

- Computer data processing speed and efficiency enhancements through improved components, circuitry and software.

- Electronic components which are lighter, smaller, more capable and energy efficient.

- Software with artificial intelligence that would allow computer systems to learn from experience and be able to make realistic deductions.

- Optical computing using laser light instead of electrical circuits for data transmission and other optical applications.

- Electrical power systems which are more efficient and less expensive.

- Sensors which are lighter, smaller, more sensitive, and less expensive for medical, manufacturing, research, control systems, and a host of other applications.

- Cryogenic cooling systems which are lighter, smaller, more efficient.

- Light-weight mirrors with computer-controlled adaptive alignment for laser applications to manufacturing processes.

- Electrical systems hardening techniques applicable to reduction or elimination of noise and other interference in communications systems and to allow continued use of electronic devices in hospitals for monitoring patients when strong magnetic fields associated with magnetic resonance imaging diagnostic equipment is in use.

- Tracking and pointing technology developed for surveillance may be valuable in applications to commercial aircraft guidance and control and ground traffic monitoring.

- Tomography associated technology which may enhance medical techniques for location and discrimination of soft tissue abnormalities.

- Free electron laser applications to non-invasive cancer surgery, early diagnosis and treatment of heart disease and stroke, and other medical diagnostic and treatment applications.

- Integration of laser technology, robotics and computerized precision control techniques into applications associated with a host of manufacturing processes, and bio-medical applications.

The reapplication of the technology generated by SDI thus promises a broad range of spinoffs that can add up to significant benefits in terms of human welfare, industrial efficiency and economic value through tomorrow's practical application. The benefits of SDI spinoffs promise a significant enhancement in America's productivity and competitive position in the international market place.

Questions regarding the program may be addressed to the SDIO Office of Technology Applications at (202) 693-1556.