AIR FORCE

PROPOSAL PREPARATION INSTRUCTIONS

The responsibility for the implementation and management of the Air Force STTR Program is with the Air Force Materiel Command, Wright-Patterson Air Force Base, Ohio. The Air Force STTR Program Executive is R. Jill Dickman, (800) 222-0336. Do NOT submit STTR proposals to the AF STTR Program Executive under any circumstances. Addresses for proposal submission and numbers for administrative and contracting questions are listed on the following page.

Technical questions may be requested using the DTIC SBIR Interactive Technical Information System (SITIS). For a full description of this system and other technical information assistance available from DTIC, please refer to section 7.2 of this solicitation.

Pre-Solicitation Announcements (PSA), listing the full descriptions of the topics and the author of each were issued by the individual AF laboratories in electronic and hard copies, after being announced in the Commerce Business Daily. Contact the laboratories directly for information on their PSAs (see activity/mailing addresses and phone numbers on the next page). Open discussions were held with the topic authors concerning technical aspects of the topics until this solicitation was released. Small businesses that did not know about the PSAs or did not participate in the exchange may find relevant questions or comments from these talks listed in SITIS.

For each Phase I proposal, send one original and three (3) copies to the office designated on the following page. Be advised that any overnight delivery may not reach the appropriate desk within one day.

Unless otherwise stated in the topic, Phase I will show the concept feasibility and the merit and Phase II will produce a prototype or at least show a proof-of-principle.

AIR FORCE PROPOSAL SUBMISSION INSTRUCTIONS

TOPIC NUMBER	ACTIVITY/MAILING ADDRESS (Name and number for mailing proposals and for administrative questions)	CONTRACTING AUTHORITY (For contract questions only)
AF 96T001	Air Force Office of Scientific Research AFOSR/XPP (Dr. Jerome Franck) 110 Duncan Avenue, Suite B115 Bolling AFB DC 20332-0001 (Dr. Jerome Franck, (202) 767-4970)	Ernest Zinser (202) 767-4992
AF 96T002 - AF 96T003	Armstrong Laboratory AL/XPTT 2509 Kennedy Circle Brooks AFB, TX 78235-5118 (Belva Williams, (210) 536-2103)	Sharon Shen (210) 536-6393
AF 96T004	Rome Laboratory RL/XPX 26 Electronic Parkway Griffiss AFB, NY 13441-4514 (Margot Ashcroft, (315) 330-3046)	Joetta Bernhard (315) 330-2308
AF 96T005 - AF96T006	Phillips Laboratory/XPI SBIR Program (R. Hancock) 3650 Aberdeen Ave SE Kirtland AFB, NM 87117-5776 (Robert Hancock, (505) 846-4418)	Mr. Francisco Tapia (505) 846-5021
AF 96T007	Armament Directorate WL/MNPX 101 West Eglin Blvd, Suite 143 Eglin AFB, FL 32542-6810 (Jerry Jones, (904) 882-8591)	Lyle Crews, Jr (904) 882-4284
AF 96T008	WL/AAOP, BLDG 624 2nd Floor ATTN: Sharon Gibbons 2011 8th Street, Room N2G21 Wright-Patterson AFB, OH 45433-7623 (Sharon Gibbons, (513) 255-5285)	Terry Rogers (513) 255-5830 Bruce Miller (513) 255-7143
AF 96T009	WL/MLIP, BLDG 653 2977 P St, Ste 13 Wright-Patterson AFB, OH 45433-6523 (Sharon Starr, (513) 255-7175)	Terry Rogers (513) 255-5830 Bruce Miller (513) 255-7143

AIR FORCE TOPIC DESCRIPTIONS

AF 96T001 Title:Fabrication and Characterization of Oxide-Fiber based Ceramic Matrix Composites

DESCRIPTION: Oxide fiber-based ceramic matrix composites exhibit a number of attractive features for applications as high-temperature engine materials. Because these materials are composed of oxides, they are inherently stable at very high temperatures and in oxidizing environments. However, two problems are currently hindering the introduction of oxide CMCs in Air Force and industrial applications: (1) lack of understanding of the relationship between microstructure and high-temperature properties of fibers, and (2) high cost of oxide fibers. This announcement seeks to alleviate both of these problems. It concentrates on novel, economical technologies for fabricating high quality oxide fibers and coatings compatible with the fibers at very high temperatures. Phase I should demonstrate a reliable, economical approach to fabricating large quantities of high quality oxide ceramic fibers (YAG, alumina, mullite) capable of operating at temperatures near or above 1500 C for extended periods of time. Phase II will concentrate on fabricating and testing composites from the oxide fibers. This will entail development and application of fiber coatings capable of protecting these fibers at temperatures up to 1500 C, developing economical and compatible oxide matrixes, and mechanical testing at room and elevated temperatures of the produced composites. The advances in these technologies should lead to fabrication of CMCs capable of operating at very high temperatures with vital Air Force and dual-use applications.

AF 96T002 TITLE: Development of Analytical Methods for the Detection of AFFF

DESCRIPTION: Develop new and innovative methods to detect and measure Aqueous Film Forming Foam (AFFF) contamination in soils, groundwater, and wastewater. The high Biological Oxygen Demand (BOD) and foaming tendencies of military grade AFFF-contaminated wastewater cause problems with treatment in wastewater treatment facilities. New technologies are being developed to circumvent this problem by physical or chemical remediation. However, as no method exists to determine the level of the compounds, the efficacy and efficiency of these systems cannot be thoroughly tested. As of now, only indirect American Society for Testing and Materials (ASTM) analytical methods exist for the analysis of contaminants and co-contaminants of AFFF-laden water: BOD, Total Organic Carbon (TOC), Benzene Toluene Ethyl Xylene (BTEX), Chemical Oxygen Demand (COD) and simple foaming tests. However, these methods do not accurately represent the concentration of the waste components. In addition to AFFF-laden wastewater, AFFF and its associated compounds present problems when introduced to the subsurface (e.g. contamination of soil and groundwater). Since there is no federally (EPA) authorized analytical protocol for AFFF waste analysis, or for determination of the fate and transport of those components in the atmosphere, or to measure the effects of AFFF components on other associated contaminants, a method to identify, quantify, and measure the fate and transport of those compounds in a given medium must be developed. The formulation of military grade AFFF is a complex proprietary mixture whose perfluorinated surfactant portions may be composed of any combination of various fluorocarbon surfactants. This complex mixture and the foaming tendency of AFFF makes chemical analysis of AFFF and its co-contaminants extremely tedious, if not nearly impossible, by current standard methods. The Air Force requires information on how to detect and measure AFFF components (specifically the fluorocarbon surfactants) and co-contaminants in soils, groundwater, and wastewater. The solvent (which is used as a foam stabilizer) in AFFF, 2(2-butoxyethoxyethanol), is easily measured. However, its presence complicates other analyses. The goals of the Phase I and Phase II proposed research are to: (1) characterize all surfactant and additive components of AFFF including corrosion inhibitors, foam stabilizers, detergents, and fluorocarbon surfactants; (2) identify and quantify the possible biological and chemical breakdown products of these compounds (including the solvent) following oxidative degradation; and (3) develop methods of extraction from soils and groundwater to provide samples to be accurately and precisely tested by the method developed in Goal one. The research must establish the presence of the AFFF components in the presence of other environmental contaminants such as petroleum hydrocarbons, chlorinated solvents and dense nonaqueous phase liquids (DNAPLs) (e.g. chlorinated solvents). The research must also address the foaming problem presented by AFFF. The ultimate goal is to be able to use the technique(s) established under this program to measure the components that are of importance to AFFF remediation processes and to make the technique field applicable. Research in Phase I would answer the questions listed above. This knowledge is necessary to develop methods used to identify and quantify AFFF and its components and co-contaminants to: (1) resolve the levels

of the compounds in wastewaters, (2) determine their fate and transport in the environment, and (3) understand their persistence in the subsurface. In the Phase II, knowledge gained through this research can be incorporated into a treatment process plan, or verification of such a plan, for fluorocarbon surfactant-contaminated sites and wastewater. Proper interaction with federal, state, and local legal authorities for final approval of the test protocol would also take place in Phase II. Operation should also extend to other applications such as a marketable mobile field kit used to determine the levels of the compounds in a given media. This research would allow a more direct method of the detection of AFFF and its associated compounds both in wastewater and the subsurface. The development of an innovative cost-effective methodology for the detection of these compounds could be used by both government agencies and the commercial sector. The development of a sensory device or an analytical field kit would aid any organization or agency with the detection of AFFF contamination levels in a given medium. Application will extend to treatment of wastewater, reclamation of AFFF, and the prevention of AFFF interference with soil remediation technologies.

Additional technical information packets may be obtained by calling Belva Williams (210)536-2103.

AF 96T003 TITLE: Site Assessment Software For Total Petroleum Hydrocarbons

DESCRIPTION: The Armstrong Laboratory (AL) is soliciting ideas for the development of a user-friendly software package to assist in making decisions regarding remediation of dump/spill sites contaminated with weathered petroleum hydrocarbons from fuels and lubricants. Petroleum hydrocarbons are one of the most common contaminants found on military bases and commercial/industrial sites. AL is conducting mammalian toxicity tests to provide information on bioavailability and toxicity of selected components of weathered jet fuels. The awardee is expected to collaborate with the AL by conducting research to strengthen the toxicology database, and develop software which incorporates the following site assessment capabilities for weathered total petroleum hydrocarbons (TPH): 1. cost/benefit analysis for cleanup alternatives; 2. tiered approach for risk assessment and establishing clean-up goals (generic to site-specific); and 3. Federal and selected state regulations. The TPH software is intended for use by environmental professionals such as regulators, consultants, and engineers to support health-risk based decision making (risk management) in determination of site remediation goals for TPH analytes in the environment, and for tutorial and educational purposes. The need is self evident; there is a vast number of government and commercial sites that have environmental problems from historic (and current) use of petroleum based fuels, and there are currently no generally accepted risk-based cleanup standards for weathered TPH. The commercial potential for this product is high because no product with the described features is currently available from any source, and demand will be high because of the government's increasing emphasis on risk based management of environmental concerns. Phase I of this project will consist of developing a prototype software package, identifying data gaps, and proposing experimental methodologies to fill the gaps. Phase II will consist of filling data gaps by experimentation and complete development of the TPH software package.

Additional technical information packets may be obtained by calling Belva Williams (210)536-2103.

AF 96T004 TITLE:Innovative C3I Technologies

DESCRIPTION: C3I Technology pursued within Rome Laboratory addresses four mission thrusts: Command, Control, and Communications; Electromagnetics and Reliability; Intelligence and Reconnaissance; and Surveillance and Photonics. Proposals may address any aspect of C3I technology. Proposed titles must reflect the specific technology problem being addressed. Areas of interest may include, but are not limited to, the following:

a) C3 concepts for fixed, mobile, or distributed command centers; mission-support system-planning tools; innovative methods for employing commercial off-the-shelf communications technology; innovative concepts and technologies in computer science (including software engineering, software quality, distributed-computer-systems technology, artificial intelligence, and distributed data bases); innovative concepts in information portrayal; and survivable protocols.

b) Electromagnetic technology, including the following: 1) adaptive pattern control for high-performance phased-array antennas; 2) innovative target and clutter scattering models for improved radar detection; 3) improved modeling of high frequency propagation for enhanced communications and small target detection; 4) monolithic millimeter wave components; 5) mate-rials for thin, lightweight, conformal, phased arrays; 6) superconducting electronics for improved phased arrays, signal detection, and signal processing; and 7) computational electromagnetics for assessing susceptibility in RF environments.

c) Science and engineering research that encompasses all aspects of the system life cycle from "cradle to grave," including development and use of tools and techniques such as the following: 1) modeling and simulation; 2) materials and process characterization; 3) operational assessments; 4) assessments and correction of failure modes and effects; 5) development of diagnostic techniques for implementation of cost-effective, logistic support capability.

d) Intelligence technology, including the following: target identification, signal exploitation, data handling, sensor exploitation, speech processing, mass storage, and information war-fare; to provide real-time information that will dramatically enhance air superiority, survivability and global awareness.

e) A wide variety of surveillance technologies; including signal processing; airborne radars (bistatic radars and multispectral surveillance radars); advanced algorithm development and testing for airborne surveillance systems; and the application of digital and analog photonics to existing and planned Air Force systems.

AF 96T005 TITLEInnovative Applications of Advanced Photonics

DESCRIPTION: The Phillips Laboratory (PL) has corporate responsibility in the Air Force for the development of advanced weapons technologies. This activity includes the development of semiconductor diode lasers, diode-pumped solid-state lasers, mid-infrared lasers, chemical oxygen/iodine lasers, and photolytic iodine lasers. These high power lasers, as well as related advancements in the development of nonlinear optics, nonlinear coupling of lasers, spatial light modulators, and imaging (active, passive and compensated), offer a wide range of opportunities for innovative, dual-use applications. It should be noted that while the PL is not specifically interested in developing fiber-optic network technology, offerors should not be discouraged from submitting proposals which involve the use of fiber-optics or fiber optic couplings. New and innovative concepts for the development of technologies and/or applications in the following fields are sought.

Industrial Applications: PL is seeking novel proposals for innovative applications of high power lasers at wavelengths suitable for materials processing. Such applications may include precision measurement, cutting, boring, drilling, and welding as well as computer aided fabrication and assembly. Proposals to develop similar novel applications using emerging imaging technologies may also be appropriate.

AF 96T006 TITLE:Innovative Applications of Advanced Spacecraft and Launch Vehicle Technologies

DESCRIPTION: The Phillips Laboratory (PL) has corporate responsibility in the Air Force for the development of advanced spacecraft and launch vehicle technologies. This activity includes the development of advanced space structures concepts; design, analysis and test methodologies for spacecraft and launch vehicle structures; vibration isolation; vibration damping; active and passive structural control; stabilization and precision pointing; smart mechanism and device concepts; sensors and actuators; and health monitoring systems. New and innovative concepts for the development of technologies and/or dual-use applications in the following fields are sought.

a. Lightweight Momentum Energy Storage Devices for Space Applications: The Air Force has identified an interest in investigating and developing potential applications of lightweight momentum energy storage devices as an alternative to conventional batteries for energy storage for advanced space applications. The design goals are to develop a system capable of energy storage/retrieval through a motor/generator system that would provide a 25% decrease in system weight as compared to conventional battery systems and increase overall component life to >20 years. The proposed

momentum energy storage system must demonstrate the capability to provide equivalent or better long-term energy storage and retrieval to that of conventional battery systems based upon the same available power from a solar array. The PL is seeking innovative concepts for the design, analysis, fabrication and test of a lightweight momentum energy storage device for advanced space applications. The system must also take into account satellite stabilization requirements. The system must be capable of providing attitude control actuation while performing its primary function of energy storage/retrieval. This technology has application to all three axis stabilized military and commercial satellites and may have a profound impact on programs such as IRIDIUM and TELEDESIC.

b. Industrial Applications: PL is seeking novel proposals for innovative applications of vibration isolation, vibration damping, stabilization, precision control, and smart mechanisms/devices applicable to launch vehicle and spacecraft precision pointing missions. In addition, innovative proposals addressing health monitoring of dynamic systems using expert systems or neural network architectures are sought. Proposals to develop industrial applications of these technologies in the areas of precision machining and manufacturing, precision measurement equipment, semi-conductor fabrication, and health monitoring may also be appropriate.

AF 96T007 TITLE: Polymer/Nanocrystal Blends for Flexible Microelectronic Circuits and Devices

OBJECTIVE: Develop techniques for using semiconducting ceramic nanoscale particles in conducting polymers for flexible transistors and entire microelectronic circuits.

DESCRIPTION: Hard target fuzing involves operation of target sensing and detonation microcircuitry that can survive repeated high-G shock resulting from the penetration reinforced concrete barriers which surround the heart of the target. Indeed, hard target fuzing could benefit from increased shock survivability, producibility, and affordability conceivable through all-polymer circuit design. Having no metal attachments or rigid connections, circuit fabrication would simply require use of print rollers to perform a series of printing operations. The conducting polymer materials may be more readily tailored with regard to electronic properties using nanocrystalline ceramic additives, and appropriate interfacial modifiers to achieve either n-type or p-type semiconducting behavior. Optimal "polyramics" developed will be highly processible polymer/ceramic nanocomposite blends exhibiting stable semiconductivity, conductivity, or superconductivity useful for making a wide variety of electronics junction devices and interconnects.

PHASE I: Phase I will attempt to model and verify bulk polyramics nanocomposite electronic behavior and will include experimental validation of at least one type of p-n junction device.

PHASE II: Phase II will be a detailed evaluation of microcircuitry and device applications using the most favorable polyramics materials with regard to processibility.

POTENTIAL COMMERCIAL MARKET: The materials and processes to be developed under this effort offer broad prospects for low-cost, all-polymer flexible circuits suitable for a variety of commercial products ranging from electronics toys to sea-worthy portable radios having no metal parts.

Technical information packets for the topic may be obtained by calling Jerry Jones, (904) 882-8591, ext 1250.

AF 96T008 TITLE: Advanced Optical Beam Steering Technology

DESCRIPTION: The Wright Laboratory Avionics Directorate is soliciting ideas for the development of beam steering technologies that relate to the transmission and reception of laser radiation that go beyond the current state of the art. Current systems rely on optical pointing systems that are very complex, costly, and too large for most aircraft applications. The Avionics Directorate is interested in laser beam steering concepts, techniques, and devices for a broad range of potential future Air Force applications including laser radar, communications, displays, optical mass storage and electronic warfare. The goal is to eventually replace the current large and complex mirrored gimbal systems in use today with small, low cost systems that can be internally or conformally mounted in an aircraft. The technologies may include, but are not limited to, electro-optical devices, acousto-optical devices, micro mirrors, micro lenses, fiber-optics, and liquid crystal devices. Since most of the applications are airborne, the beam steering

technologies should be capable of future compact packaging. Future systems must also be light weight and robust to operate in a dynamic flight environment where vibration and temperature factors are critical. Other critical parameters for the above applications include: broad wavelength operation, wide field-of-regard coverage, optical transmit and receive capability, high optical pointing stability, small instantaneous field-of-view, low optical distortion, fast slew rates, and ability to handle high average laser powers.

PHASE I: Determine the technical merit and feasibility of the ideas submitted. Specific experiments should be conducted to verify critical aspects of the defined concepts.

PHASE II: Fabricate a prototype demonstration of the concept defined in Phase I and experimentally demonstrate the concept.

POTENTIAL COMMERCIAL MARKET: Commercial applications exist in the areas of mass optical data storage for computers and fiber optic switching networks.

Technical information packets for the topic may be obtained by calling Sharon Gibbons, (513) 255-5285.

AF 96T009 Title:Metals, Nonmetals, Computational Science, Electronic and Optical Materials and Processes For Aerospace Applications

DESCRIPTION: The Materials Directorate, Wright Laboratory (WL/ML), is soliciting ideas for the development of high payoff aerospace materials and processes in the areas of metals, nonmetals, computational science, electronics and optics, and high energy laser applications.

In the areas of metals, nonmetals, computational science, and high energy laser applications: structural and nonstructural materials and processes are solicited with emphasis on control of structure and properties whether to achieve high temperature, low weight, or specialized properties. New approaches are needed to process these materials in an efficient, affordable, timely, and environmentally safe manner. Example areas are: closed-loop feedback-based process control; computational science and modeling and simulation of processes; low-cost curing of composites; advanced deposition techniques for thin films and bulk materials; in situ real-time in-process monitoring and inspection; high temperature reaction processes, and fatigue processes. In addition, materials and processes for long-life (5-7 years), environmentally compliant survivable aircraft coatings are being sought in addition to novel application techniques that allow little or no volatile organic compounds or hazardous air pollutants. In addition to the metals, and computational science areas, new and innovative ideas are also being sought for laser removal of paint and other coatings from aircraft and related systems (composite and metal surfaces) and ideas and techniques for laser treatment of aircraft metal surfaces to inhibit or reduce fatigue crack growth. Ideas for laser removal of paint and coatings should emphasize clean and efficient stripping, little or no cosmetic damage or structural degradation of undersurfaces, and elimination of hazardous chemical use or production of hazardous byproducts. For laser surface treatment ideas, there is special interest in extending the life/performance of aircraft and engine components that are subject to high cycle fatigue.

In the areas of electronic and optical materials: ideas are solicited for the development of high payoff materials and processes for microelectronics; microwave and millimeter wave applications; infrared (IR) detectors; electro-optics; IR transparencies; and magnetic materials. This includes nonlinear optical materials, semiconductor materials for electronics, and thin film high temperature superconductors. The goal is to develop innovative and creative solutions to problems in the area of electronic and optical material growth that result in practical growth techniques suitable for commercial production. Devices may be examined only for the purpose of evaluating and demonstrating the techniques and materials which have been developed to enable successful device fabrication.

PHASE I: Determine the technical approach and feasibility of the ideas submitted. Specific experiments should be conducted to verify critical aspects of the defined concepts.

PHASE II: Fabricate a prototype demonstration of the material concept defined in Phase I and experimentally demonstrate materials properties and/or processing technique and parameters.

POTENTIAL COMMERCIAL MARKET: In the areas of metals, nonmetals, computational science, and high energy laser applications: Commercial applications exist in the aerospace industry as well as in the automotive industry for affordable, lightweight structures, high temperature engine components, and low-cost materials processing. Applications also exist for environmentally compliant materials and processes. A third application area is maintainable, long-life infrastructure materials technologies. In the ares of electronic and optical materials: Commercial applications exist in millimeter wave and microwave communications, high speed electronics and photonics for data transmittal and computing, and magnetics for high efficient electric motors.

Technical information packets for the topic may be obtained by calling Sharon Starr, (513) 255-7175.

ARMY

Submission of Proposals

The responsibility for the implementation, administration, and management of the U.S. Army STTR Program rests with the Army STTR Program Management Office at the U.S. Army Research Office (ARO). You are invited to send your STTR proposals to ARO at the following address. Proposal must be received no later than the Solicitation Closing Date indicated on the front cover of this solicitation.

U.S. Army Research Office
ATTN: STTR-96
P.O. Box 12211
Research Triangle Park, NC 27709-2211

The Army has identified eleven technical topics, numbered ARMY 96T001 through ARMY 96T011, to which small businesses and their partner research institutes may respond. Please note that these are the only topics for which proposals will be accepted at this time. Unless otherwise stated in the topic Phase I will show the concept feasibility and the merit and Phase II will produce a prototype or at least show a proof-of-principle.

The eleven Army STTR topics presented on the following pages were generated by the U.S. Army Research Office. Selection of Phase I proposals for funding is based upon technical merit and the evaluation criteria contained in this solicitation document. Due to limited funding, the Army will only fund those proposals which are of superior technical quality and which present excellent opportunities for dual use and commercialization beyond STTR-funded projects.

Please note that the Army will be limiting Phase I awards to $100,000. Any Phase II contracts resulting from these Phase I efforts will be limited to $500,000.

Department of the Army
FY1996 STTR Topic Descriptions

ARMY 96T001 TITLE: Sensor Protection from Lasers

DESCRIPTION: Protection devices are sought that can prevent damage to human eyes, IR sensors, etc. from laser irradiation, while permitting normal eye and sensor functions. Protection devices must let through much of the visible and/or infrared radiation when no laser irradiation is present, but when irradiated would ideally block all radiation at the laser frequency. Response threshold and response time must be adequate to ensure protection. Typically, sensor protection devices are composed of a protection element embedded in an optical train. For the protection element, possible approaches might use optical and nonlinear optical solutions to the problem, including the nonlinear responses of a variety of newly structured materials that include photonic bandgap structures, photorefractives, and enhanced $X^{(3)}$ nonlinearities of the combined system. The materials may be solid state, gaseous, liquid crystal, or other as appropriate.

PHASE I: Demonstrate proof-of-principle.

PHASE II: Implement a prototype sufficient to identify and resolve any key problems that could otherwise prevent successful commercialization.

COMMERCIALIZATION POTENTIAL: Commercial applications could include coatings on car windows to attenuate incoming headlights, and coatings on windows of buildings to reduce heating from the sun.

ARMY 96T002 TITLE: Energy Absorbing Structures

DESCRIPTION: Innovative methods are needed for energy absorption, via novel structures and/or materials.. Fail safe and/or fail soft approaches might be considered. A primary metric in typical applications would be the rate of energy absorption per unit volume.

PHASE I: Demonstrate proof-of-principle.

PHASE II: Develop a prototype sufficient to identify and resolve any key problems that might otherwise impede successful commercialization.

COMMERCIALIZATION POTENTIAL: Although military applications are obviously to armor, gun recoil, crashworthiness, and ammunition safety, there are also numerous civilian applications including but not limited to transportation safety, fixed assets survival in natural calamities, and manufacturing processes

ARMY 96T003 TITLE: Virtual Training Technologies

DESCRIPTION: Interactive distance learning technologies have matured steadily for use in training diverse skills at dispersed or remote locations, and they have tremendous potential for use in refreshing a previously learned skill or knowledge. New distance learning technologies, most notably internet-based training or interactive satellite, wireless, or cable television, can be used to create “virtual classrooms” to prepare soldiers or civilians across a broad spectrum of knowledge and skills. Intelligent agents could be devised to access the wealth of information available on the internet, and process it into compact instructional materials and intelligent tutoring systems distributed across networks. A further contribution would be to demonstrate the feasibility and value of virtual testing, where "hands-on" testing can occur over the virtual environment, or soldiers could actually be certified in certain tasks, such as installing a mine. The virtual classrooms can also be designed to offer realistic and powerful training simulations in the context of the theater of operation (desert, rugged terrain, cultural climate, etc.) or civilian applications like mountain climbing and driver education. Commercially viable implementations of novel, research-driven training systems for civilian applications of distance learning technologies are the goal of this topic.

PHASE I: Identify requirements for a generic, off-the-shelf hardware system which could combine distributed technologies with intelligent agents for search and retrieval and intelligent technologies for training. Develop system functional specifications for a prototype system.

PHASE II: Develop the prototype sufficiently as to identify and successfully address any key problems that would otherwise impede successful commercialization.

COMMERCIALIZATION POTENTIAL: Commercial applications would include the teaching of skills to large numbers of people. Examples might be factory workers or truck drivers.

ARMY 96T004 TITLE: Computer Aided Diagnosis and Treatment Display

DESCRIPTION: Innovations are sought in computer aided medical diagnosis and display, suitable for field use. It is envisioned that the device would make intelligent diagnoses and treatment recommendations using real-time inputs about the patient's condition, and a suitable data base of medical information. Recommendations would account for the possibility of multiple life-threatening conditions. Ideally, some of the patient inputs would be generated by non-invasive sensors that continuously monitor the patient's condition.

PHASE I: Proof-of-principle will be demonstrated. Inputs for the demonstration effort may be either standard physiological sensor output or computer-generated inputs.

PHASE II: Hardware and software will be produced as needed to serve as a prototype for commercialization.

COMMERCIALIZATION POTENTIAL: Civilian applications might be to ambulance rescue squads, for use by paramedics.

ARMY 96T005 TITLE: Instrumentation for Coastal Engineering Measurements

DESCRIPTION: Scientists and engineers involved in coastal engineering have requirements to measure waves, water levels, and currents, both in the natural environment and laboratory settings. Advances in electronics, global positioning systems, acoustics, and micro computing open a realm of innovative opportunities to produce useful instrumentation. Examples of potential instruments include, but are not limited to:

(1) GPS Wave Buoy — a wave measuring device for field applications based on a carrier-phase GPS approach without a shore-reference station.

(2) Compact, Portable Hyper Spectral Images and Processing System — for stand alone use or use with a co-located remote sensor such as a lidar bathymetric system. Should include small size, increased horizontal positioning accuracy and increased spatial and spectra resolution compared to existing systems. Processes should offer significant improvements in processor time.

(3) Laboratory systems for measuring: (a) 3 dimensional wave field; (b) current profiles; (c) motions of moored ships. Water depths in laboratory typically less than 1.5 feet and scales 1:10 and 1:50.

(4) High resolution remote monitoring equipment for defining armor unit quality and breakage on coastal structures in the field.

(5) Remote sensing methods for wave and current measurements in areas with heavy traffic.

PHASE I: Proof-of-principle will be demonstrated.

PHASE II: A prototype will be developed to identify and resolve any key problems that might otherwise impede successful commercialization.

COMMERCIALIZATION POTENTIAL: Commercialization potential will obviously depend upon the type of instrumentation developed. It is intended that the instrumentation be developed primarily for the civilian market, even though military applications would exist related to coastal engineering.

ARMY 96T006 TITLE: Information Fusion

DESCRIPTION: Techniques are sought for integrating information from multiple electronic, optic, or similar sources that may have similar or dissimilar characteristics, in order to extract the maximum of available information that may be present in these combined sources. Typical functional applications would be to improve decision making processes

under uncertainty, to resolve ambiguities in the recognition and identification of patterns, and to plan for logistics and maintenance. Sound algorithmic designs and robust, efficient computational tools are essential for acquisition, compression, transmission, interpretation of data for near real-time information processing and decision making. Multi-resolution techniques (such as wavelets, quadtrees, etc.) and novel computing paradigms (such as parallel and distributed processing) offer new avenues toward promising advancement in this area.

PHASE I: Develop a detailed design for a proof-of-concept.

PHASE II: Implement the design developed in Phase I and produce a working prototype. Demonstrate the prototype on an appropriate dataset which has the potential for dual-use or commercial exploitation.

COMMERCIALIZATION POTENTIAL: Autonomous image processing and dynamic sensory information fusion is not only necessary for Army's missions in target acquisition and situation awareness, but also important to many civilian applications from manufacturing assembly lines, security verification, medical imaging, and collision avoidance systems for vehicles.

ARMY 96T007 TITLE: Low Energy/Low Noise Electronic Components for Mobile Platform Applications

DESCRIPTION: Techniques are sought for designing and implementing low energy/low noise electronic components suitable for such applications as mobile communications, surveillance, detection, diagnostic, direction and location finding, and imaging. Novel technologies might address signal processing, modulation techniques, amplifier and oscillator circuits, quasi-optical power combining, electro-optic RF control, micromachining techniques, frequency standards, night vision, and ultra-low noise device design.

PHASE I: Develop a proof-of-principle.

PHASE II: Develop a prototype sufficient to identify and resolve any key problems that might otherwise impede successful commercialization.

COMMERCIALIZATION POTENTIAL: Commercial applications are numerous, and include major improvements to portable telephone systems, surveillance, and navigation, to take only the most obvious examples.

ARMY 96T008 TITLE: Antennas for Communications-on-the-Move Networks

DESCRIPTION: Improved ("smart") antennas are needed for portable and mobile communications networks that will reduce needed power, increase throughput, improve reliability, and provide for improved security. It is anticipated that such antennas will operate in currently unused higher frequencies where mobile communications can have wider bandwidths.

PHASE I: Develop proof-of-concept.

PHASE II: Develop a prototype sufficient to identify and resolve any key problems that might otherwise impede successful commercialization.

ARMY 96T009 TITLE: Molecular Recognition

DESCRIPTION: Molecular recognition is a fundamental process that regulates key biological events including enzymatic catalysis, gene expression, macromolecular interactions, and signal transduction. It is also central to the response and adaptation of organisms to the environment and to external stimuli such as stress. Molecular recognition is characterized both by remarkable specificity and sensitivity, as well as fast reaction rates. To take advantage of the physical principles and properties of molecular recognition, technological advancements are needed to improve enzymatic function, establish the structural basis for receptor-ligand interactions, develop chemical and biological detection devices, and clarify the relationship between structure and function of macromolecules. Areas of interest include, but are not limited to: (1) detection of chemical and biological agents; (2) biomimetic engineering; (3) optimization of enzymatic processes, and: (4) connection of protein structure to function, as these relate to molecular recognition.

PHASE I: Identify and characterize 1) an enzyme or biochemical pathway suitable for use in bioremediation, 2) receptors or receptor-ligand pairs with the potential to act as sensors for chemical or biological agents, or 3) highly ordered biological materials or matrices, especially those capable of sensing changes in environmental or external stimuli.

PHASE II: Optimize molecules or processes identified in Phase I for use in 1) bioremediation, 2) biological detection, or 3) development of new (possibly functional or "smart") materials. It is assumed that this optimization will represent technological and/or economic improvements over current strategies, altogether novel approaches, or previously uncharacterized biological architectures.

COMMERCIALIZATION POTENTIAL: Possible commercial applications include: testing water, soil, plants, and/or animals for chemical or biological contamination; economically and environmentally sound alternatives to removal of toxic contaminants from civilian and military sites; development of new crystalline or other ordered materials; development of new strategies for crystal or material formation; identification of materials with useful properties; development of new strategies for material assembly.

ARMY 96T010 TITLE: Improved Power Sources

DESCRIPTION: The DoD needs quiet, efficient, lightweight power sources that have greater energy/power densities than are currently available. This solicitation invites creative ideas for improving power sources in the power range of a few watts to a few kilowatts.

PHASE I: Develop proof-of-concept.

PHASE II: Develop a prototype sufficient to identify and resolve any key problems that might otherwise impede successful commercialization.

COMMERCIALIZATION POTENTIAL: Commercial applications are dependent on the power range, but could include power sources for communications devices and for computers, at the low end, to power sources to drive motors at the upper end.

ARMY 96T011 TITLE: Electrochemical Synthesis

DESCRIPTION: DoD uses many materials, ranging from metals such as aluminum and titanium to liquid gun propellants, which rely on electrochemical processing for at least some steps in their production. This solicitation calls for creative ideas to improve electrochemical processing of materials.

PHASE I: Develop proof-of-concept.

PHASE II: Develop a prototype sufficient to identify and resolve any key problems that might otherwise impede successful commercialization.

COMMERCIALIZATION POTENTIAL: Commercial applications are to a variety of manufacturing processes that include electrochemical processing as an intrinsic step.

ADVANCED RESEARCH PROJECTS AGENCY
Submission of Proposals

ARPA's charter is to help maintain U.S. technological superiority over, and prevent technological surprise by, its potential adversaries. Thus, the ARPA goal is to pursue as many highly imaginative and innovative research ideas and concepts with potential dual-use applicability as the budget and other factors will allow.

The responsibility for implementing ARPA's Small Business Technology Transfer (STTR) Program rests with the Office of Administration and Small Business (OASB). The ARPA SBIR/STTR Program Manager is Connie Jacobs. ARPA invites small businesses, in cooperation with a researcher from a university, an eligible contractor-operated federally-funded research and development center (FFRDC), or a non-profit research institution, to send proposals directly to ARPA at the following address:

ARPA/OASB/STTR
Attention: Ms. Connie Jacobs
3701 North Fairfax Drive
Arlington, VA 22203-1714
(703) 696-2448

The topics published in this solicitation are broad in scope. They were developed to bring the small business community and research partners together to meet the technological needs of today. ARPA has identified 3 technical topics, numbered **ARPA ST961-001** through **ARPA ST961-003**, to which small businesses may respond in the FY 96 solicitation. For the following topics, Phase I will show the concept of feasibility and the merit, and Phase II will produce a prototype or at least show a proof-of-principle.

ARPA Phase I awards are limited to **$99,000**, and are for approximately one (1) year efforts. Phase II awards will be limited to $500,000. ARPA does not provide bridge funding between Phase I and Phase II awards, except in connection with the fast-track provisions outlined in Section 4.4.

ARPA selects proposals for funding based upon technical merit, its potential for commercialization, and other evaluation criteria contained in this solicitation document. ARPA reserves the right to select and fund only those proposals considered to be superior in overall technical quality and highly relevant to the ARPA mission. As a result, ARPA may fund more than one proposal in a specific topic area if the technical quality of the proposal(s) in question is deemed superior, or it may fund no proposals in a topic area. Each proposal submitted to ARPA must have a topic number and must be responsive to only one topic.

For each Phase I proposal, submit one original (with red appendices A and B) and four (4) copies to the address above. One additional photocopy of Appendices A and B is also requested. ARPA has prepared a checklist to assist small businesses in responding to ARPA topics. Please use this checklist prior to mailing or handcarrying your proposal(s) to ARPA. Do not include the checklist with your proposal.

ARPA 1996 Phase I STTR
Checklist

1) Proposal Format
   a. Cover Sheet - Appendix A (identify topic number) _____

   b. Project Summary - Appendix B _____

   c. Identification and Significance of Problem or Opportunity _____

   d. Phase I Technical Objectives _____

   e. Phase I Work Plan _____

   f. Related Work _____

   g. Relationship with Future Research and/or Development _____

   h. Potential Post Applications _____

   i. Key Personnel _____

   j. Facilities/Equipment _____

   k. Consultant _____

   l. Prior, Current, or Pending Support _____

   m. Cost Proposal (see Appendix C of this Solicitation) _____

   n. Prior SBIR Awards _____

   o. Agreement between the Small Business and Research Institution _____

2) Bindings
   a. Staple proposals in upper left-hand corner. _____

   b. **Do not** use a cover. _____

   c. **Do not** use special bindings. _____

3) Page Limitation
   a. Total for each proposal is 25 pages inclusive of cost proposal and resumes. _____

   b. Beyond the 25 page limit do not send appendices, attachments and/or additional references. _____

4) Submission Requirement for Each Proposal
   a. Original proposal, including signed **RED** Appendices A and B. _____

   b. Four photocopies of original proposal, including signed Appendices A and B. _____

   c. One additional photocopy of Appendices A and B only. _____

ARPA ST961-001TITLE:Technologies to Detect and Localize Snipers and Associated Small Arms Gunfire Events

DESCRIPTION: Distributed and single array sensor and associated processing system concepts to detect and localize a sniper's position to an accuracy of less than 3m radians in both azimuth and elevation at ranges in excess of 1000 meters, in adverse and urban environments, are requested. Sensor systems of interest include, but are not limited to, acoustic systems to exploit shock and muzzle blast signatures, electro-optical sensor systems to exploit signatures associated with the sniper's human figure, the hot gun barrel, the muzzle blast event, and RF and electro-optical sensor systems to track the bullet's trajectory.

Technical challenges for this topic include, but are not limited to, acoustic shock and muzzle blast multi-path and clutter rejection in urban environments; vehicle motion compensation and noise cancellation; signal attenuation and selected signature denial, if snipers use advanced tactics and special devices (muzzle blast suppressors or silencers) in high-ambient noise environments.

Small, cost-effective systems that are vehicle mounted, stationary, but man-transportable or man-wearable, are required. Cost, size, weight, power consumption, ergonomics and human computer interface, response time, spatial resolution accuracy, range accuracy, and robustness with regards to countermeasures and advanced sniper tactics, are the primary parameters that will be considered in the evaluation of proposed system concepts.

REFERENCES:

1) Acoustic Projectile Trajectory Evaluation Device, United States Patent Number 5,258,962 (November 2, 1992).
2) Position Measuring Apparatus and Method, United States Patent Number 4,885,725 (dated December 5, 1989).
3) Optical Frequency Encoding for Normal Shock and Position Sensing Having a Broadband Light Source and a Color Gradient Filter, United States Patent Number 5,283,430 (dated February 1, 1994).
4) Projectile Position Detection Apparatus, United States Patent Number 4,350,881 (dated September 21, 1982).

ARPA ST961-002 TITLE:High-Power Vertical Cavity Surface Emitting Lasers (VCSEL) for Commercial and Military Systems

DESCRIPTION: There are a wide range of military systems which require high-power, reliable, and efficient lasers. These include laser radar, laser line of sight communications, optical fuzing, large displays, lightweight countermeasures, and high density storage. However, a suitable electronically steerable cost effective source has not been available for laser communication or laser radar. Recent developments in optoelectronics technology have led to the emergence of a new type of laser called Vertical Cavity Surface Emitting Lasers (VCSELs). VCSELs have been fabricated with efficiencies above 50%, low-lasing thresholds of under 100 micro amps, as well as having high wafer yields of above 90%. These lasers readily lend themselves to the fabrication of large 1-D and 2-D arrays. Coherent arrays would enable a large number of applications to become cost-effective such as laser communication, laser radar, laser scanning, large displays, as well as optical fuzing applications. Military laser communication, especially satellite-to-satellite, air-air, and satellite-air, and secure terrestrial mobile communication would be significantly enhanced by the lightweight, low-power, and very high-data rates enabled by this technology. This program would focus on the development of an electronically steerable (10 degrees) high-power (>1 watt) laser source based on VCSELs for commercial and military applications.

REFERENCES:

1) R.A. Morgan, K. Kojima, L.E. Rogers, G.D. Guth, R.E. Leibenguth, M.W. Focht, M.T. Asom, T. Mullally, and W.A. Gault, "Progress and Properties of High-Power Vertical-Cavity Surface-Emitting Laser Arrays," Laser Diode Technology V, OE/ LASE '93, pp. 100-108, SPIE, Bellingham, WA, 1993.
2) F. H. Peters, et al, "High-Power VCSELs", Electronic Letters, Vol. 29, 200 , January, 1993.

ARPA ST961-003 TITLE: High Dynamic-Range Diode Laser Sources

DESCRIPTION: Photonic links have many applications in current and anticipated radar systems. Compact diode laser sources are desired which can replace linearized external modulation fiber optic links, with the resulting reduction in cost and complexity. A highly linear diode laser source needs to be developed which operates over a wide temperature range without a thermoelectric cooler. The laser should have low relative intensity noise and high linearity to provide a directly modulated UHF optical link with a spurious-free dynamic range of 122dB*Hz2/3 for transmission distances up to 250m. The laser should maintain this performance over a temperature range of -60 deg C to +40 deg C with a predetermined bias condition (e.g. constant drive current or constant output optical power). Link performance should be demonstrated over a minimum bandwidth of 10% in the UHF band.

REFERENCES:

1) LeBihan, J. and G. Yabre, "FM and IM Intermodulation Distortions in Directly Modulated Single-Mode Semiconductor Lasers," IEEE J. Quant. Elect., Vol. 40, No. 4, April 1994.

2) Darcie, E. Thomas, and George E. Bodeep, "Lightwave Subcarrier CATV Transmission Systems," IEEE Trans. Microwave Th. & Tech., Vol. 38, No. 5, May 1990.

3) Ackerman, E., et al, "A Low-Loss Ku-Band Directly Modulated Fiber-Optic Link," IEEE Photonics Tech. Lett., Vol. 3, No. 2, Feb 1991.

4) Lu, H., et al, "Strained-Layer MQW Gain-Coupled DFB Lasers: An Approach for High-Power and High Temperature Operation," OFC '95 Technical Digest, Vol. 8. Opt. Soc. America, 1995.

5) Morthier, G., "Influence of the Carrier Density Dependence of the Absorption on the Harmonic Distortion in Semiconductor Lasers," Journal of Lightwave Technology, Vol. 11, January 1993, p. 16.

6) Camacho, Fernando, et al, "Fundamental Limits for Linearity of CATV Lasers," Paper CThJ1, CLEO '94 Proceedings, Opt. Soc. America, 1994.

BALLISTIC MISSILE DEFENSE ORGANIZATION (BMDO)
SMALL BUSINESS TECHNOLOGY TRANSFER PROGRAM
Submitting Proposals

Send **five** copies of Phase I proposals to (Appendix A and B need not be red):

Ballistic Missile Defense Organization
ATTN: TRI/STTR
7100 Defense, Pentagon
Washington, DC 20301-7100

For administrative help **ONLY**: call **800-937-3150**

Electronic access: **800-WIN-BMDO** (bulletin board system) or
http://www.futron.com/bmdo/sbir.html (A Home Page/World-Wide-Web)

Proposals delivered by means other than US Mail must be delivered to Room 1D110, The Pentagon, Washington, DC. **WARNING: Only persons with access to the interior of the Pentagon building can reach Room 1D110. Delivery to a Pentagon entrance is not sufficient**. (NOTE: Only a few courier services have access to the Pentagon.) BMDO will acknowledge receipt if the proposal includes a self-addressed stamped envelope.

BMDO seeks the most innovative technology to find and disable a missile in flight - lighter, faster, smarter, more reliable components. Proposers need not know details of possible BMDO systems.

BMDO seeks to invest seed-capital, to supplement private capital, in a product with a future market potential (preferably private sector) and a measurable BMDO benefit. BMDO will not compete with private or government markets in that it will not further develop concepts already mature enough to compete for private capital or government development funds. BMDO prefers projects which move technology from the non-profit institution into the private sector market through a market-oriented small firm. BMDO expects to fund about 20 projects.

Phase I should be only an examination of the feasibility and competitive merit of the concept with an average cost about $60,000. Although proposed cost will not affect selection for negotiation, contracting may be delayed if BMDO reduces the cost ceiling. Phase I competition will give approximately equal weight to degree of innovation and market potential. Phase II competition will give more weight to future market potential. BMDO expects keen competition for both Phases.

Because BMDO seeks the best nation-wide experts in innovative technology, proposers may suggest both technical reviewers and contract technical monitors by enclosing a cover letter with the name, organization, address and phone number (if known), and a rationale for each suggestion. Each must be a government employee. BMDO promises only to consider the suggestion.

BMDO FY96 STTR Topic Descriptions

BMDO 96T001 TITLE: Sensors

DESCRIPTION: Sensors provide warning of attack, target identification, target discrimination from non-target objects, and determination of kill. New and innovative approaches are sought for sensors in the infrared, visible, and ultraviolet wavelengths for passive, active, and interactive sensors. Examples are: cryogenic cooling, superconducting focal plane elements, low power optical beam steering, passive focal plane imaging, interferometry for imaging, optics, diode pumped lasers, and optical materials.

BMDO 96T002 TITLE: Electronics and Photonics

DESCRIPTION: BMDO needs advances in processing capacity made possible by advances in electronics and opto-electronics. BMDO wants to advance integrated circuits, detectors, sensors, large scale integration, and radiation hardness. Advances are sought in band gap engineering, single crystal diamond, solid state lasers, optical detectors, electronics packaging, and any other related breakthrough technology.

BMDO 96T003 TITLE: Surprises and Opportunities

DESCRIPTION: BMDO recognizes that, at the leading edge of technology, surprises and opportunities may arise from creative minds and entrepreneurs. BMDO will consider proposals in other technologies that present an extraordinary opportunity for BMDO. But proposals will receive a preliminary screening that may reject them without full technical review as not offering enough of an extraordinary opportunity. This open call is for breakthrough technology with great market potential beyond the standards for the topics listed above.

NAVY

Proposal Submission

The responsibility for the implementation, administration and management of the Navy STTR program is with the Office of Naval Research. The Navy STTR Program Manager is Mr. Vincent D. Schaper. Inquiries of a general nature may be brought to the Navy STTR Program Manager's attention and should be addressed to:

Office of Naval Research
ATTN: Mr. Vincent D. Schaper
ONR 362 SBIR
800 North Quincy Street
Arlington, VA 22217-5660
(703) 696-4286

All STTR proposals submitted in response to a Navy STTR topic should be sent to the above address.

This solicitation contains eight technical topics that meet the mission requirements of the Navy and PL 102-564 to which small R&D businesses together with a research institution may respond. The Navy will provide potential awardees the opportunity to reduce the gap between phases I & II by providing a $70,000 Phase I proposal award and a $30,000 Phase I Option award. Only an awardee whose Phase II proposal has been recommended and selected for award will have the Phase I Option funded. Therefore, those who have finished or almost finished their Phase I should submit their Phase II proposal. The Phase II proposal should contain three elements: 1)a plan of how the proposer will commercialize the technology to the government and the private sector; 2) a Phase II work plan; and 3) a Phase II Option. At the end of the Phase II portion, a determination will be made by the Navy as to whether the proposer has satisfied the commercialization plan sufficiently for the government to fund the "Phase II Option" portion of the proposal. The Phase II Option should address the further R&D or test and evaluation aspects of the proposal. The total Phase II funding should not exceed $500,000 with 80% going to the Phase II and 20% for the "option Phase II". Just as the Navy has set aside funding for "fast track" efforts in the SBIR Program, we will consider faster contract award for companies that identify third party funding and can obtain the cash in hand prior to award.

Selection of Phase I proposals is based upon technical merit and evaluation criteria contained in this solicitation document. Due to limited funding, the Navy reserves the right to limit awards under any topic and only those proposals considered to be of superior quality will be funded.

NAVY FY 1996 STTR TOPICS

N96T001 Adaptive Sensor-Driven Control for Dexterous Manipulators

N96T002 Novel Robotic Actuators

N96T003 Haptic Sensing and Display for Telerobotic Manipulation and Virtual Environment Applications

N96T004 Biomimetic Locomotion

N96T005 Non-Toxic Biofouling Control Technologies

DEPARTMENT OF THE NAVY
FY 1996 STTR TOPIC DESCRIPTION

The Navy is seeking innovative, biologically inspired robotic technologies and is planning multiple Phase I awards in each of the following four areas. Topics N96T001 - N96T004 have the same objective, Phase I, Phase II, Phase III, and commercial potential descriptions.

OBJECTIVE: Exploit and implement recent developments in biologically inspired robotic science and technology to advance the Navy's capability for replacing humans with robots in hostile and dangerous environments.

N96T001TITLE: Adaptive Sensor-Driven Control for Dexterous Manipulators

The focus of this topic is the development and implementation of biologically inspired control algorithms for semi-autonomous robotic grasping and manipulation in unstructured or partially structured environments where reliance on sensory information, adaptation, and learning are essential. The use of haptic (tactile and kinesthetic) information in object recognition and manipulation are of particular interest, but projects on visually guided control will also be considered.

N96T002TITLE: Novel Robotic Actuators

This topic area concerns the development and implementation of robotic actuators that are muscle-like in their compactness, flexibility, large strength-to-weight ratio, and low level intelligence enabled by distributed, embedded sensors and biologically inspired control schemes.

N96T003TITLE: Haptic Sensing and Display for Telerobotic Manipulation and Virtual Environment Applications

Topics of interest include haptic sensors, including MEMS (Micro-Electro-Mechanical Systems) based technologies, haptic interfaces, algorithms for encoding the feel and movement of objects, and advances in our understanding of the nature of feedback needed to create a realistic haptic experience.

N96T004TITLE: Biomimetic Locomotion

Biomechanics, hydrodynamics, and control of locomotion in non-legged aquatic animals such as fish and marine mammals are of interest. Of most interest are mechanisms underlying highly maneuverable forms of locomotion, and technology for implementing biologically inspired design concepts for highly maneuverable underwater vehicles. Mechanisms underlying stealth and efficient locomotion are also of interest.

PHASE I: Demonstrate feasibility of concept or technology; identify critical issues for implementation and transition into Navy-relevant technology; identify performance goals and the work necessary in a Phase II effort.
PHASE II: Implement technology in prototype hardware and/or software products. Demonstrate the prototype for application to a Navy relevant problem.
PHASE III: Develop for commercialization the prototypes resulting from Phase II effort. The ability for commercial transition in the Phase III effort to will be critical for both Phase I and Phase II selection.

COMMERCIAL POTENTIAL: Robotic control algorithms, sensors, actuators, and haptic interfaces have commercial potential in a wide variety of domains, including hazardous waste removal, nuclear plant maintenance, tele-surgery, oceanographic exploration, and underwater pipeline maintenance. Haptic interfaces have commercial potential for virtual reality applications in the entertainment industry, medical training, aerospace industry training, and computer interfaces. Techniques for increasing the efficiency and maneuverability of underwater vehicles have commercial potential for remote underwater exploration and pipeline maintenance.

N96T005TITLE: Non-Toxic Biofouling Control Technologies

OBJECTIVE: The objective of this topic is to provide non-toxic antifouling (AF) agents and delivery/control release systems for the AF agents suitable for hull coatings and other applications

DESCRIPTION: Current technologies for biofouling control on ship hulls, underwater structures, storage tanks, water treatment facilities and in the power industries involve toxic metals (copper, tin and zinc) incorporated into coating materials or used as water additives. More recently, toxic organic compounds have been introduced to control fouling in closed systems and in coatings. These materials or systems do not provide sufficiently long-term AF capabilities, they have come under increasing environmental restrictions, have serious and costly disposal problems, and, in many cases, pose significant human health hazards in their application, maintenance or removal. This program seeks (1) non-toxic and/or environmentally benign AF agents derived from biological or biomimetic sources that can be incorporated in coatings or used as water additives and (2) delivery systems and/or controlled release technologies that can maintain biofouling control on coatings and environmental efficacy. About 5 awards will be made in this topic area which address one or more of the areas below:

1. Demonstration of novel, non toxic AF agents and their environmentally efficacy.
2. Demonstrate controlled release technologies for small organic AF agents suitable for a range of coating materials.
3. Demonstration of delivery technologies for small organic AF agents based on coating polymer chemistry (pendant arm hydrolysis, ablation, etc.)

PHASE I: Develop and establish proof-of-concept of non-toxic AF agents which are effective against some or all classes of biofouling organisms at millimolar or less levels with demonstrated environmental efficacy. Develop and establish proof-of-concept of controlled release technologies that are capable of delivering small organic AF agents at rates less than 10 ug cm-2 day and achieve biofouling control, and which can be incorporated into current and newly emerging coating materials. Develop a Phase II plan which can demonstrate technical feasibility and transition to commercialization as an affordable technology.

PHASE II: Demonstrate technology in Phase I as to biofouling control efficiency, environmental efficacy and potential for commercialization.

PHASE III: Implement technologies into existing or new coatings materials and demonstrate AF and environmental efficacy under field or operational conditions.

COMMERCIAL POTENTIAL: There are several large commercial applications for these technologies. They include antifouling marine coatings for hulls, non-fouling coatings for off shore structures in the power and oil industries, coatings for storage systems, water treatment facilities, electric power generating plants and cooling towers, and for submerged platforms. In addition these materials and systems will have commercial markets in the hard surface cleaning industries, water treatment industries, other paint and coating systems, public health related industries (air/water handling systems for buildings, aircraft and ships), and in the biomedical industries (protheses, dental instrumentation, etc.).

REFERENCES:

1. Alberte, R.S., et al., (eds.) 1992. Aspects of Current Research in the US Navy Biofouling Program. Biofouling 6:(2): 91-218.
2. Wicks, Z.W., Jones, F.N. and Pappas, S.P. 1992. Organic Coatings: Science and Technology, Vols. I and 2. John-Wiley & Sons, Inc.
3. Alberte, R.S. and Snyder, S. (eds). 1995. Biofouling Control. Naval Research Reviews (in press).