DEFENSE ADVANCED RESEARCH PROJECTS AGENCY

Submission of Proposals

The responsibility for carrying out DARPA's SBIR Program rests with the Office of Administration and Small Business. The DARPA Coordinator for SBIR is Dr. Bud Durand. DARPA invites the small business community to send proposals directly to DARPA at the following address:

DARPA/OASB/SBIR
Attention: Dr. Bud Durand
3701 North Fairfax Drive
Arlington, VA 22203-1714
(703) 696-2448

The proposals will be processed in the Office of Administration and Small Business and distributed to the appropriate technical office for evaluation and action.

DARPA has identified 32 technical topics, numbered DARPA 93-001 through DARPA 93-032, to which small businesses may respond in the first fiscal year (FY) 1993 solicitation (93.1). Please note that these are the only topics for which proposals will be accepted at this time. Proposals can no longer be accepted on those previously advertised 97 technical topics which were numbered DARPA 92-130 through DARPA 92-226. A list of the topics currently eligible for proposal submission is included below, followed by full topic descriptions. The topics originated from DARPA technical offices.

DARPA's charter is to help maintain U.S. technological superiority over, and to prevent technological surprise by, its potential adversaries. Thus, the DARPA goal is to pursue as many highly imaginative and innovative research ideas and concepts with potential military applicability as the budget and other factors will allow. In the early years of the SBIR program most of the promising Phase I proposals could be funded, but as the program's popularity increased, this became more and more expensive. DARPA therefore instituted program changes to fund more Phase Is. These included increasing the number of SBIR topics, and setting more funds aside for Phase I proposals. In order to do this and still have a reasonable amount of funds available for the further development of promising Phase Is, the Phase II limit was lowered to $250,000.

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

DARPA has prepared a checklist to assist small business activities in responding to DARPA topics. Please use this checklist prior to mailing or handcarrying your proposal(s) to DARPA. Do not include the checklist with your proposal.

DARPA 1992 Phase I SBIR

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. Post Potential Applications ____

i. Key Personnel ____

j. Facilities/Equipment ____

k. Consultants ____

l. Prior, Current, or Pending Support ____

m. Cost Proposal - Appendix C ____

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 (Appendix C) 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. ____

SUBJECT/WORD INDEX TO THE DARPA SBIR SOLICITATION

INDEX OF DARPA FY 93 TOPICS

DARPA 93-023 In-Situ Non-Destructive Inspection of Ultra Large Scale Integrated (ULSI) Wafers

DARPA 93-024 Point-of-Use Generation and Disposal of Wafer Process Chemicals

DARPA 93-025Hybrid Image Understanding (IU)/Neural Net (NN) Techniques for Target Recognition and .... Multisensor Fusion

DARPA 93-026 Semantic Search of Information Database

DARPA 93-027 Voice Authentication Monitoring System

DARPA 93-028 Computational Sensors

DARPA 93-029 Sensor and Algorithm Planning & Allocation for Use in Image Understanding

DARPA 93-030 Bubble-Based False Undersea Targets

DARPA 93-031 Intelligent, Modular, Scalable Controllers and Actuators for Use in Automated Systems

DARPA 93-032 Synthetic Dolphin Blubber Compliant Coatings

DARPA 93-001TITLE: Use of Meteor Scatter for Long-Range Position Location of High Frequency (HF)/Very High Frequency (VHF) TransmittersDARPA 93-001TITLE: Use of Meteor Scatter for Long-Range Position Location of High Frequency (HF)/Very High Frequency (VHF) Transmitters

CATEGORY: 6.2 Exploratory Development

OBJECTIVE: Develop, analyze, and assess the performance of a system for locating the position of high frequency (HF) and very high frequency (VHF) transmitters using energy from these transmitters that incidentally scatters from meteor trails. Build and demonstrate the system in a real-time field test capitalizing, if possible, on the DARPA meteor scatter test link.

DESCRIPTION: Energy from HF and VHF emitters will inadvertently be scattered from meteor trails. The major assumption in this task is that knowledge of the meteor scatter phenomenon and measurements of the arriving signal can be coupled to derive the information necessary to geolocate these emitters. The basic questions to be answered by this SBIR are: How accurately can a remote emitter be located using the meteor scatter channel and a realistic baseline system? What are the system requirements to achieve geolocation within a given error bound? What is the algorithm for solving the meteor scatter geolocation problem? What is the performance of the proposed meteor scatter geolocation system under realistic meteor scatter propagation channel conditions? How sensitive is the performance of the proposed system to variations in the channel, errors in the signal measurement system, variations in the Effective Radiated Power (ERP) of the emitter, and the waveform of the emitter? How well does the proposed system perform in non-real time but with real channel data? And finally, how does the proposed system perform in real time on a real meteor scatter link at various ranges? The contractor will perform analytic and design studies in Phase I. In Phase II, the contractor will instantiate algorithms in a real machine for simulation and for non-real time performance evaluation. Phase II ends with a demonstration of the geolocation system on a real meteor scatter test range.

Phase I: The following issues will be addressed:

1. What measurements and accuracies are required to bound with 90% confidence the position of the remote emitter within a circle of diameter: a. 10 miles, b. 1 mile, c. 0.1 mile?
2. The sensitivity of these error circles to emitter ERP and propagation and range variances associated with real meteor scatter channels.
3. The basic architecture and essential requirements of the major components of the meteor scatter position location (MSPL) system. From this, establish a baseline of overall performance and critical component performance requirements for the MSPL system.
4. The time required to achieve a given circular error as function of emitter ERP assuming the baseline MSPL system.
5. The algorithms for solving the MSPL problem.

Phase II: Develop a non-real time simulation of the MSPL problem and demonstrate the performance of the proposed MSPL architecture and algorithm. Demonstrate the performance of the MSPL algorithms in non-real time with data taken from a real meteor burst link. Develop a real-time instantiation of the MSPL algorithms on an economical host machine and interface the host machine to the radio frequency portion of the MSPL system. Develop a test plan for proving the accuracy of the MSPL system. Perform a field test in real time and prepare a final report on the test results.

DARPA 93-002TITLE: Aerospace System Applications of Micromachine TechnologiesDARPA 93-002TITLE: Aerospace System Applications of Micromachine Technologies

CATEGORY: 6.2 Exploratory Development

OBJECTIVE: Identify and develop systems, subsystems, and/or integrated componentry which exploit advanced micromachine technology and are tailored to aerospace applications.

DESCRIPTION: Advanced electronic chip manufacturing technology has recently spawned a revolutionary new capability to fabricate micromechanical elements and simple systems. These devices, which have been demonstrated to operate at physical scales of 1-200 microns, currently range from simple gears and linkages to more complex micromotor systems. The practical utilization of this technology is dependent on a number of factors, including the development of more complex interactive micromachine elements, or alternatively, the integration of large numbers of simpler elements into macroscale devices; the resolution of inherent mechanical interface problems; and, identification of suitable candidate applications, involving extensions of the technology into both current and potential new areas. Innovative ideas are sought which exploit micromachine technology in aerospace vehicle and related system applications to improve performance, efficiency or reliability, or which afford innovative alternative approaches to current aerospace technologies. Proposals should display understanding of micro-electro-mechanical systems (MEMS) technology, including fabrication techniques, constraints, and operating limitations, as well as a thorough knowledge of intended aerospace application(s).

Phase I: Establish feasibility and potential for proposed candidate systems, subsystems or integrated componentry which exploit micromachine technology and are tailored to specific aerospace applications. Quantify performance characteristics and establish constraints and limitations associated with the developed approach through analyses, computations, and/or physical experiments. Provide preliminary design, where feasible.

Phase II: Design, develop, fabricate, and test selected micromachine-based systems, subsystems, or integrated components resulting from Phase I efforts. Provide necessary data and information for integration with other system components. Identify manufacturing and production issues and limitations, along with solutions/strategies for resolution.

DARPA 93-003TITLE: Concepts and Technologies for an Advanced, Tailless, Thrust-Vectored Air VehicleDARPA 93-003TITLE: Concepts and Technologies for an Advanced, Tailless, Thrust-Vectored Air Vehicle

CATEGORY: 6.2 Exploratory Development

OBJECTIVE: Develop critical enabling technologies for application in feasible candidate concepts of an advanced, remotely-operated, reconfigurable, high-performance, maneuvering air vehicle which employs vectored thrust as its primary means of stability and control at subsonic and supersonic speeds.

DESCRIPTION: Aircraft, such as the X-31 Enhanced Fighter Maneuverability (EFM) demonstrator, are expected to pioneer dynamic maneuvering flight in the post stall regime. This aircraft is equipped with enhanced thrust vectoring capability to provide necessary control authority at high angles of attack and relatively low airspeeds. Future atmospheric flight vehicles can be expected to exploit these unique control capabilities more fully, greatly improving overall vehicle agility, as well as reducing or eliminating the requirement for more traditional aerodynamic control surfaces. The further development of lower amplitude, higher bandwidth, thrust-vectoring methodologies may also provide a means of achieving stability at higher (supersonic) speeds for these vehicles. Innovative ideas which contribute to the development and/or implementation of the critical enabling technologies are sought, along with novel system concepts achievable within the state of the art. The system focus for this effort is on a low cost family of reconfigurable, demonstrator vehicles which embody modern high performance air vehicle characteristics and which are collectively capable of addressing multiple development objectives applicable to manned and/or unmanned flight at all corners of the flight envelope. These objectives could involve a number of design or performance issues, including configuration variations, high speed performance and stabilization, combat agility, complementary alternative aerodynamic control schemes, and propulsion-based control and integration methods, to name a few. Proposals should focus on specific technology elements or issues, but must demonstrate an understanding of their impact to vehicle design and performance parameters. An overall understanding of vectored thrust vehicle issues as applied to airbreathing systems should be incorporated in the proposal.

Phase I: Investigate feasibility of developing, adapting, or implementing candidate technologies or technology suites advocated in the offeror's proposal. Develop solutions to potential design issues or technology constraints, and show potential for integration into candidate system concepts through analysis, computation, and/or experiment.

Phase II: Develop preliminary design(s) for the promising candidate system, subsystem, or critical component investigated in Phase I. Develop and conduct a demonstration which illustrates operational feasibility and assesses performance of the device.

DARPA 93-004TITLE: Low-Cost, Ultra-Low Power, High Efficiency Power Conditioning/Regulation for Unattended Ground Sensors DARPA 93-004TITLE: Low-Cost, Ultra-Low Power, High Efficiency Power Conditioning/Regulation for Unattended Ground Sensors

CATEGORY: 6.2 Exploratory Development

OBJECTIVE: Develop low-cost, low-voltage, ultra low-power, high-efficiency power conditioning/regulation technique for unattended sensors.

DESCRIPTION: DARPA is interested in developing advanced internetted unattended ground sensors (IUGS) for enhanced wide-area surveillance applications. These sensors will use sophisticated signal processing and communications electronics in their design to facilitate several month, extended range operations under an internetted system architecture. This requires advanced power conditioning and regulation techniques designed for low-voltage, ultra-low power, high-efficiency operation. If the IUGS is to be affordable, these techniques must also be low-cost and easily manufacturable.

Phase I: Conduct a system architecture study which will pursue the requirements addressed above with sufficient data to demonstrate feasibility.

Phase II: Use the approach outlined in Phase I to develop an engineering model, and deliver it to the government for testing.

DARPA 93-005TITLE: Prototype Implementation of Scalable High Speed Network ServicesDARPA 93-005TITLE: Prototype Implementation of Scalable High Speed Network Services

CATEGORY: 6.2 Exploratory Development

OBJECTIVE: Develop prototype implementations of scalable high speed network services compatible with existing internet protocols and with significant new capability in defense-specific functions such as reliability, fault-tolerance, and security.

DESCRIPTION: Prototype implementations of existing or new network services are sought. Implementations of existing services must include a significant new capability in one or more of the following: reliability, fault-tolerance, security, or ability to scale to new levels of network size or performance. Approaches must be compatible with existing internet protocols and must demonstrate innovation. New services must not duplicate existing functions and must address a significant unmet need in the internet.

Phase I: Deliver a detailed design and cost information as well as a complete plan for implementation. Prototypes demonstrating feasibility are desired.

Phase II: Deliver a full implementation and demonstration of the service. Complete user documentation, source code, and system designs must be supplied.

DARPA 93-006TITLE: Scalable Accelerators and Interfaces for High Performance Computing SystemsDARPA 93-006TITLE: Scalable Accelerators and Interfaces for High Performance Computing Systems

CATEGORY: 6.2 Exploratory Development

OBJECTIVE: Develop and prototype scalable implementations of accelerators and interfaces for High Performance Computing Systems (HPCS).

DESCRIPTION: Hardware/software accelerators are sought, capable of running in collaboration with general purpose scalable parallel HPCS, which can solve classes of defense problems by 2-3 orders of magnitude faster or demonstrate new interfaces on these systems. The accelerator must either exploit existing standards and open interfaces, define a unique interface and justify its potential benefits, or a combination of the two. Limitations, domains, and applicability for these approaches must be quantified. Demonstrations should be consistent with the goals of the Federal High Performance Computing and Communications Program.

Phase I: Define in detail the candidate accelerator, technical approaches, interfaces, tradeoffs, and risks along with supporting evidence of success, such as early prototyping experiments. Expected performance must be estimated, along with comparative trends in general purpose computing. Define experiments and strategy to test the concepts.

Phase II: Develop, prototype, demonstrate, and deliver the accelerator, along with associated documentation and testing strategy to compare to predictions. Extrapolate costs for replication and use on HPCS.

DARPA 93-007TITLE: Prototype Implementations of Scalable High Performance Computing (HPC) SoftwareDARPA 93-007TITLE: Prototype Implementations of Scalable High Performance Computing (HPC) Software

CATEGORY: 6.2 Exploratory Development

OBJECTIVE: Develop novel ideas for advancing HPC Software including compiler technology for scalable HPC computing systems, particularly in the area of code optimization and parallelization; scalable software library modules that can be developed into functioning code for scalable computing systems; novel concepts for supporting scalability in libraries; new operating system functions; and innovative software algorithms.

DESCRIPTION: Concepts are sought for innovative and novel ideas for advancing HPC software for scalable HPC computing systems. Concepts must be described with enough detail to demonstrate system independency and have clearly defined and open interfaces. The focus should be on the development and refinement of scalability features in HPC software and library modules.

Phase I: Provide a detailed specification of the proposed concept, principle, or algorithm. Describe new or novel ideas for concepts. Describe scalability and parallelism. Demonstrate how the new concept, principle, or algorithm would be used in HPC. Finally, describe the path or process for implementation on HPC computing systems.

Phase II: Develop the software prototype, subsystem, or module which implements the new HPC software technology. Demonstrate the effectiveness of the new technology. Provide documentation that clearly describes the result, any external interfaces, or requirements; how to use the software module; and the system interface. A hard copy and magnetic media copy of any code are required.

DARPA 93-008TITLE: CVD Non-Contact Temperature Sensor for Feedback Process ControlDARPA 93-008TITLE: CVD Non-Contact Temperature Sensor for Feedback Process Control

CATEGORY: 6.2 Exploratory Development

OBJECTIVE: Develop non-contact, in-situ sensing techniques for measuring temperature in chemical vapor deposition (CVD) manufacturing processes for feedback control.

DESCRIPTION: Inability to directly measure absolute as well as relative temperature of product in CVD reactors limits the application of intelligent processing of materials (IPM) methods, including feedback control, to these processes. Chemical vapor deposition methods for creating thin as well as thick films of metals or ceramics on substrates are already widely practiced, and significantly improved process control will greatly expand these commercial manufacturing processes. Process yield and product quality can both be substantially improved by application of IPM with feedback temperature control.

Phase I: Identify and experimentally demonstrate feasibility of non-contact in-situ temperature measurements in a CVD reactor.

Phase II: Incorporate successful sensing technology into a CVD manufacturing process or a CVD reactor product line to achieve feedback process control.

DARPA 93-009TITLE: Flexible Manufacturing of Metal Matrix Composites for Electronic PackagingDARPA 93-009TITLE: Flexible Manufacturing of Metal Matrix Composites for Electronic Packaging

CATEGORY: 6.2 Exploratory Development

OBJECTIVE: Demonstrate the rapid prototyping capability for the manufacture of metal matrix composite components for use in packaging for multichip modules. Flexible manufacturing methods for near-net-shape components are required for small production runs (100 units/run) of high performance/power density electronic packages.

DESCRIPTION: Metal matrix composites (MMCs) are finding increased attention as packaging materials for multichip modules (MCMs) due to: high thermal conductivity required for heat dissipation; ability to tailor the thermal expansion coefficient to match silicon and/or gallium arsenide (GaAs) chips; and electrical conductivity useful in shielding circuits from electronic noise. Affordable and timely manufacturing methods are desired for small lots of application specific metal matrix multichip modules.

Computer integrated manufacturing (CIM), in which a computer model of the metal matrix package is used for both simulation of performance and the rapid prototyping of the components using Solid Freeform Fabrication (SFF), has the potential to greatly reduce the development time cycle and development costs of high quality metal matrix composite MCMs. SFF is also envisioned as a flexible manufacturing method for small volume production runs. A turnaround time from print to finished MMC MCM prototype of less than seven days is desired. Solid freeform manufacturing can be for either the tooling to produce the package, or the powder preform for the metal matrix composite.

Phase I: Determine material property requirements for MCMs and demonstrate the fabrication of materials in test specimen form with the required properties. The required properties include thermal conductivity and thermal expansion coefficient. The feasibility of using SFF for rapid prototyping will also be demonstrated in this phase.

Phase II: Produce metal matrix MCMs for test and evaluation by an electronic system integrator. Demonstrate the ability to produce parts to print, including meeting all dimensional tolerances, surface finish, and thermal expansion and thermal conductivity requirements, with a seven day turnaround time. The manufacturing demonstration must be relevant to defense needs, and may be accomplished with collaboration of military service or commercial laboratories for purposes of assessing "customer" acceptance. A minimum of two designs with production runs of 25 or more parts will be demonstrated. Manufacturing reproducibility and quality will be assessed for the rapid prototyping process developed in Phase I.

DARPA 93-010TITLE: Battery on a Chip (BOC) Feasibility/ApplicationsDARPA 93-010TITLE: Battery on a Chip (BOC) Feasibility/Applications

CATEGORY: 6.2 Exploratory Development

OBJECTIVE: Demonstrate the feasibility of a battery on a microelectronic chip concept with improved performance for a DoD-relevant application.

DESCRIPTION: Several types of thin-film solid state batteries have recently been developed. This technology offers the possibility of providing on-chip power for devices such as microsensors, receivers/transmitters, RAM backup, etc., as well as distributed multichip module (MCM) power. Proposals are sought which couple this novel battery technology with microelectronic devices which would provide improved performance over the more conventional approaches involving a separate power source. A DoD-relevant application using this battery on a chip combination should be defined, and the quantitative advantages of this approach should be discussed in the proposal, along with the manufacturing processes to be utilized in the BOC fabrication.

Phase I: Produce and test promising thin-film solid state batteries for identified battery on chip application.

Phase II: Incorporate candidate battery and chip (or MCM) and evaluate performance.

DARPA 93-011TITLE: Mechanical Issues in the Application of High Temperature Superconducting MaterialsDARPA 93-011TITLE: Mechanical Issues in the Application of High Temperature Superconducting Materials

CATEGORY: 6.2 Exploratory Development

OBJECTIVE: Analyze the mechanical issues involved in the fabrication and use of high temperature superconducting thin films in such structures as interconnects in semiconductor packaging schemes, or integrated Radio Frequency (RF) circuitry.

DESCRIPTION: The development of residual stresses in thin-film materials, resulting from thermal and chemical strains, is a continuing problem in the synthesis of high quality thin-film superconducting material. Problems arising from residual stresses appear not only in the films, or layers of superconducting material, but also in the layers of dielectric materials and interlayers used to enhance epitaxy, texture, or chemical stability. In an attempt to alleviate this situation, it is necessary to develop a set of analysis tools (primarily computational) to analyze thin-film synthesis procedures vis-a-vis residual stress and epitaxial development.

Phase I: The objectives of this phase are to develop the models and special purpose computational tools necessary to predict (1) residual stresses from thermal and chemical strains, and (2) damage in the form of fracture through the layers (including the substrate) and delamination between the layers.

Phase II: The objective of this phase is to develop, based on the results of the Phase I models, a computational design tool that can be used to explore the effects of structural and design variables. In this way, potentially flawed designs can be avoided and ones with optimal properties can be recognized much faster than would be possible following a purely empirical approach. The design tool should be flexible enough to allow for (1) the addition and subtraction of layers, (2) changes in layer thickness, and (3) changes in the layer's physical properties. Structural features such as vias should be treated also, since it can be expected that stress concentrations due to vias will create additional potential for fracture.

DARPA 93-012TITLE: Indium Phosphide (InP) Material Growth for Microwave and Millimeter Wave Monolithic Integrated CircuitsDARPA 93-012TITLE: Indium Phosphide (InP) Material Growth for Microwave and Millimeter Wave Monolithic Integrated Circuits

CATEGORY: 6.3 Advanced Development

OBJECTIVE: Advance the development and fabrication of InP substrates and epitaxial material for microwave and millimeter wave monolithic format devices and circuits that will provide performance characteristics not presently available and, thus, satisfy system requirements that are not presently being adequately met.

DESCRIPTION: Gallium arsenide (GaAs) is the most common material suitable for use in developing microwave and millimeter wave devices and monolithic format integrated circuits. However, further performance improvements have been achieved using InP as a substrate material, particularly at millimeter wave frequencies. Nevertheless, InP material growth is at an embryonic stage of development and established sources of large diameter (3 inch diameter or greater) InP wafers are not yet available. This project is directed toward the improvement of the microwave and millimeter wave performance characteristics of InP substrate material and substrate/epitaxial combinations. It is expected that this project will also lead to the establishment of sources of supply for large diameter (3 inch or greater) InP wafers with characteristics suitable for high performance and low-cost microwave device and circuit development.

Phase I: Develop a plan for cost-effective techniques for producing InP substrate material and/or InP substrate/epitaxial material combinations that will result in a supply of material with performance characteristics suitable for producing microwave and millimeter wave devices and circuits.

Phase II: Perform appropriate work to begin or extend the development of sources of InP substrate material or substrate/epitaxial combinations with the characteristics described above.

DARPA 93-013TITLE: Conformal Electronic PackagingDARPA 93-013TITLE: Conformal Electronic Packaging

CATEGORY: 6.1 Basic Research

OBJECTIVE: Develop materials and processes for interconnection and packaging of electronic components in arbitrary configurations.

DESCRIPTION: New materials and processes are sought which could enable high density interconnection and packaging of electronic components, digital or digital/analog, in arbitrary spaces. Although there has been much progress in development of high performance printed circuit board and multichip module technology, interconnects are generally processed on rigid flat surfaces. This may result in a poor volumetric match between electronic modules and the space that is naturally available in certain applications (e.g., hand-held). Areas of interest include the deposition of conductors and insulators as well as bonding and attachment of components.

Phase I: Perform preliminary analysis and experimentation on materials and processes.

Phase II: Investigate promising materials and processes and develop interconnect process technology. Demonstrate feasibility of interconnect on curved surfaces through design, fabrication, and evaluation (e.g., electrical, mechanical, thermal, repair/rework) of test structures.

DARPA 93-014TITLE: Multi-Chip IntegrationDARPA 93-014TITLE: Multi-Chip Integration

CATEGORY: 6.3 Advanced Development

OBJECTIVE: Develop tools and technologies which will facilitate the availability of cost-effective multi-chip modules (MCMs) to a wide variety of users.

DESCRIPTION: MCMs are electronic components which consist of a number of unpackaged integrated circuits (ICs) interconnected by some sort of high density interconnect (>1000 (cm of wire)/(sq. cm of area)) and enclosed in a package which is compatible with the next level of systems interconnect. Compared to conventional single chip packaging, MCMs offer significant improvements in system performance, functional density, and reliability. Although MCM technology has been in production at large vertically integrated companies for over 10 years, availability to the broader community has been limited by structural and technological issues. Among them are the ability to procure "known-good" bare die (unpackaged ICs), the ability to achieve first pass success on designs involving existing ICs from multiple suppliers, high non-recurring engineering (NRE) costs associated with introducing new designs, and long design cycle times.

DARPA is soliciting proposals from small businesses which would like to develop and market new technologies or tools which mitigate one or more of the above-mentioned barriers to MCM use. In doing so, we hope to stimulate a vigorous merchant market for MCMs and a robust supplier infrastructure to support that industry. Because of the significant commercial demand which is projected for this technology, we would like to ensure that a common industrial base can serve both the military and commercial markets and thus achieve economies of scale. Specific areas of interest include, but are not limited to, computer-aided design tools, bare die test equipment and methodologies, new approaches to module level test, simulation and analysis tools, flexible manufacturing and assembly equipment, and component information libraries.

Phase I: Define a detailed specification for the new tool or technology to be developed. Describe new and innovative ideas which will provide new capabilities for MCM test. Demonstrate the feasibility of key elements of the approach as necessary. Develop a plan to demonstrate the utility of this capability in collaboration with an end user. Prepare a business plan to ensure commercial availability.

Phase II: Develop and demonstrate the prototype defined in Phase I.

DARPA 93-015TITLE: Support Structures for Field Emission Display DevicesDARPA 93-015TITLE: Support Structures for Field Emission Display Devices

CATEGORY: 6.2 Exploratory Development

OBJECTIVE: Identify new materials or processes that can be used to fabricate spacers for field emission displays.

DESCRIPTION: Field emission displays require some form of structures to support the face plate of the displays device. These support structures must be compatible with the high electric field and high vacuum operating conditions of the display. Furthermore, their manufacturing process must be affordable and compatible with other display components.

Phase I: Identify support structure materials and develop fabrication process steps.

Phase II: Prepare sample structures and test under simulated operating conditions.

DARPA 93-016TITLE: Method for Stimulating Hardware-in-the-Loop in a Distributed Simulation EnvironmentDARPA 93-016TITLE: Method for Stimulating Hardware-in-the-Loop in a Distributed Simulation Environment

CATEGORY: 6.2 Exploratory Development

OBJECTIVE: Insert hardware components into man-in-the-loop distributed simulation, and thereby eliminate the assumptions inherent in any software models of those components.

DESCRIPTION: Distributed Interactive Simulation (DIS) and SIMulation NETworking (SIMNET) are gaining widespread acceptance for use in military training. These simulation tools are equally attractive for use in research and development and in the acquisition process. Distributed simulation for acquisition is desirable because of the ability of the user to participate throughout the design process and to directly influence the final form of the system being developed. However, the fidelity required for R&D applications is generally of a much higher quality than that required for training applications. That is, for R&D purposes, it is usually necessary to model all features and performance characteristics of the product being developed if any meaningful sensitivity analyses or trade-off analyses are to be performed. However, for training purposes, it is merely sufficient if realistic cues are presented to the man-in-the-loop to elicit some desired behavior. In most cases, the fundamental physics of the underlying processes are modeled only very crudely - if at all - and then only to the degree required to produce the desired human response. As a result, the validity of these simulations for R&D purposes is often questioned.

One solution to the problem of validity of DIS for R&D is to incorporate validated models into the underlying software. A more attractive approach, and the subject of this solicitation, is to incorporate actual hardware into the simulation thereby eliminating the need for any software model of the component's performance. The hardware must be stimulated by the simulation environment, respond, and interact appropriately with the simulation environment. As additional hardware components are designed and fabricated, they too could replace their respective software models. As the percentage of hardware components in the simulator increases, the overall system performance can be more confidently assessed because it more closely approximates the final product.

Phase I: Prepare a concept for incorporating hardware components into SIMNET-like simulators so that their built-in performance algorithms may be utilized instead of using software models to approximate performance. Implementation concepts should be compatible with the evolving DIS Standards and Communications Protocols. For the purposes of this solicitation, hardware components of the following types should be considered: sensors, seekers, and guidance and control devices.

Phase II: Demonstrate the concept by embedding a Government-Furnished Equipment (GFE) hardware component(s) into the SIMNET simulator and validate its (their) performance in comparison with that of the software model(s) the component(s) replace(s).

DARPA 93-017TITLE: Method for Incorporating High-Fidelity Engineering Models into Distributed SimulationsDARPA 93-017TITLE: Method for Incorporating High-Fidelity Engineering Models into Distributed Simulations

CATEGORY: 6.2 Exploratory Development

OBJECTIVE: Insert high-fidelity engineering and physics models into man-in-the-loop distributed simulations, and thereby improve the overall validity of weapon system performance modeling.

DESCRIPTION: Distributed Interactive Simulation (DIS) and SIMulation NETworking (SIMNET) are gaining widespread acceptance for use in military training. These simulation tools are equally attractive for use in research and development and in the acquisition process. Distributed simulation for acquisition is desirable because of the opportunity afforded to the user to participate throughout the design process and to directly influence the final form of the system being developed. However, the fidelity required for R&D applications is generally of a much higher quality than that required for training applications. That is, for R&D purposes, it is usually necessary to model all features and performance characteristics of the product being developed, if any meaningful sensitivity analyses or trade-off analyses are to be performed. However, for training purposes, it is sufficient if realistic cues are presented to the man-in-the-loop to elicit some desired behavior. In most cases, the fundamental physics of the underlying processes are modeled only very crudely - if at all - and then only to the degree required to produce the desired human response. As a result, the validity of these simulations for R&D purposes is often questioned. One solution to the problem of validity of DIS for R&D is to incorporate validated models into the underlying software. Engineering and physical models of system performance are expressed in a variety of forms but are usually reducible to a set of state equations which characterize system performance in terms of the interrelationships of the state variables of interest. Because the procedure for validating such models is clearly defined, using them is a straightforward solution to the problem of validating distributed simulation for R&D.

Phase I: Prepare a concept for incorporating high-fidelity system performance models into SIMNET-like simulators. Implementation concepts should be compatible with the evolving DIS Standards and Communications Protocols and should be generic so as to allow for the widest variety of commonly used approaches to system performance modeling. For the purposes of this solicitation, performance of components of the following types should be considered: sensors, seekers, guidance and control devices, engine and drivetrain.

Phase II: Demonstrate the concept by embedding a validated, high-fidelity software model of a hardware component into SIMNET software, and assess the resulting performance.

DARPA 93-018TITLE: Develop a Generic Graphic Modeling Tool for Generating Detailed Missile Fly-Out Trajectory Analysis DARPA 93-018TITLE: Develop a Generic Graphic Modeling Tool for Generating Detailed Missile Fly-Out Trajectory Analysis

CATEGORY: 6.1 Basic Research

OBJECTIVE: Develop a graphical tool for animating missile simulation and/or flight test data.

DESCRIPTION: The advances in the graphical hardware have made it possible to develop low cost graphical analysis tools for animating events of interest in missile simulations and flight tests. Typically, static 2-D line and 3-D surface plots are used to analyze simulation and flight test data. By adding the 4th dimension of time, and being able to visualize "real world" images, the analyst's perception of these events is enhanced.

Phase I: Define the graphical model and trajectory input file formats, and develop a tool to perform the following tasks: playback of simulation and/or telemetry data; reconstruction of sensor field of view; and, playback of multistage/multibody separation events.

Phase II: Develop a graphical user interface and incorporate peripheral hardware devices to control playback sequences. Expand software to include: multiple missiles/targets; sensor imagery such as detector scenes, display of track gates, and field of regard; and development of a multiple window environment for viewing several scenes simultaneously.

DARPA 93-019TITLE: Development of Non-Liquid Host Dye Laser Concepts DARPA 93-019TITLE: Development of Non-Liquid Host Dye Laser Concepts

CATEGORY: 6.1 Basic Research

OBJECTIVE: Provide improved dye lasers. By impregnating the laser dyes in a suitable solid host material, issues such as solvent flammability, toxicity, and dye carcinogens may be minimized. This will also cut the total system weight and complexity by as much as 50% - 70%.

DESCRIPTION: The focus of this topic is to identify prospective host materials and manufacture solid state dye laser rods and slabs. The candidate host materials should allow homogenous dye impregnation, minimize lensing and distortion effects, be transmissive in the laser dye absorption and fluorescence bands, and be inclusion/bubble free down to <0.1 microns. The processes involved in manufacturing the laser rods or slabs will be chosen in a manner which would not damage the dye molecule. The identification of host material other than plastics (e.g. Poly Methol Methacrylate (PMMA), Poly Carborate (CR-39)) is encouraged.

Phase I: The initial phase of this effort is to include investigation of the host materials. Different casting techniques, absorption and fluorescence curves of the undoped host, dye solubility, and possible limitations on rod diameter and length, as well as slab thickness and length will be investigated. Feasibility of casting host material against parallel (<1 minute of arc) optical flats which would relieve the need for optical polishing will be addressed. Also, the possibility of applying anti-reflective or laser resonator coatings directly on the host material will be examined in this phase.

Phase II: Phase II includes manufacture of solid state dye laser rods and slabs. The information gained from Phase I will be applied in Phase II in an effort to achieve optimum quality dye laser rods and slabs. The dye laser rods and slabs shall be doped with, but not limited to, the following laser dyes: 1.) Sulforhodamine 640, (2) Rhodamine 590 chloride, and (3) Rhodamine 590 Tetrafluoroborate. At least one of the Pyrromethene - BF_2 - complexes (Exiton Laser Dye: pyrromethene 546, 556 or 567), (4) Coumarin 540, (5) Coumarin 314, (6) Coumarin 102 and, (7) undoped. If feasible, the following sizes of dye laser rods will be cast: (1) 10.0 mm x 380.0 mm, (2) 10.0 mm x 500.0 mm, and (3) 25mm x 660 mm. The slabs will be 150.0 mm x 5.0 mm x 20.0 mm if possible. The concentrations may require adjustments in order to achieve uniform pumping.

DARPA 93-020TITLE: Increased Field of Regard (FOR) Techniques for Staring Infrared Focal Plane ArraysDARPA 93-020TITLE: Increased Field of Regard (FOR) Techniques for Staring Infrared Focal Plane Arrays (IR FPA)

CATEGORY: 6.2 Exploratory Development

OBJECTIVE: Investigate and develop innovative optical scan mechanisms and techniques for large search FOR, for IR FPA.

DESCRIPTION: Large area staring IR FPAs in both Medium Wavelength Infrared (MWIR) and Long Wavelength Infrared (LWIR) are a developing technology and are under consideration for several future applications in missile guidance. The 2-D focal plane array "stares" at the target without a scanning mechanism and generates a high quality, rectilinear data sample of the target and background scene. The current disadvantage to the utilization of the staring sensor is, that unless very large and expensive FPAs are utilized, the search or acquisition Field of View (FOV) is very small, and limited by the staring FPA (i.e., looking through a soda straw). To improve the performance of the FPA for these applications, a mechanism for scanning the staring FOV in a larger search volume is needed so that this 2-D FPA technology can be useful to the developing concepts involving wide area search. Two approaches are immediately known that can address this problem. A conventional optical wedge scanner operating with a gimbal scan can be configured to search the FPA FOV over a large area with periods of low or zero spatial velocity so that the FPA can be "framed." (Data must be collected at low velocity to avoid image smear.) Another more innovative and progressive approach is to utilize two lenslet plates of binary optics with a micro shifting mechanism. Small motion of these plates may cause large shifts in the FOV of an IR FPA located behind the plates. Since only small relative motion of the plates is necessary, a programmable or controlled search regime may be possible. Other techniques for increasing the FOV of IR FPAs will be investigated in Phase I.

Phase I: Provide detailed analysis of at least two different conceptional designs, through a preliminary design and performance prediction effort.

Phase II: Develop hardware and perform laboratory demonstrations to verify the most promising technical approach.

DARPA 93-021TITLE: Processing Technology Development for the Manufacturing of Optoelectronic Integrated Circuit ModulesDARPA 93-021TITLE: Processing Technology Development for the Manufacturing of Optoelectronic Integrated Circuit Modules

CATEGORY: 6.2 Exploratory Development

OBJECTIVE: Packaging Methods and Approaches for Optoelectric Integrated Modules are being solicited. The module should be clearly identified in intended functions and capabilities.

DESCRIPTION: Optical/Optoelectronic modules are being developed to perform critical functions in information processing systems. These modules generally consisted of optical, optoelectronic components. The preferred embodiment of the modules is a self-contained, compact unit with mechanical and thermal stability. The packaged product must provide compatible optical and electrical inputs/outputs. The extra capabilities of the modules are often achieved by temporal, spatial, or wavelength multiplexing, coherent detection, optical routing, and switching, etc. The exacting requirements of optical alignment, in addition to high speed electronics, represents a considerable degree of complexity. This solicitation seeks ideas and methodology in packaging of integrated optoelectronic modules. While each functional module will probably require individualized solution, suitable extension of the particular solution to general methods should be considered. Generic approaches are also being solicited.

Phase I: Outline concept. Identify major technical barriers. Demonstrate feasibility in overcoming the barriers.

Phase II: Demonstrate and deliver the assembled hardware.

DARPA 93-022TITLE: All-Dry Photoresist and Wafer Cleaning TechniquesDARPA 93-022TITLE: All-Dry Photoresist and Wafer Cleaning Techniques

CATEGORY: 6.1 Basic Research

OBJECTIVE: Develop and demonstrate dry alternatives to conventional wet photoresist and wafer cleaning processes which can be implemented in a semiconductor manufacturing environment.

DESCRIPTION: The fabrication of ultra large scale integrated circuits (ULSI) has grown to include hundreds of process steps with a significant number of wet etch steps for metal and organic contamination removal and many wet photoresist steps for pattern definition. The replacement of these conventional steps with all-dry processing could offer significant reductions in the total number of process steps as well as improvements in defect reduction, process control, and waste disposal. This implementation would eventually result in improvements in yield and manufacturing cost, and is the goal of this program. This program will consist of a task for dry processing for pattern definition and a task for wafer cleaning. The photolithography task will consider material systems for use with 193-nm and x-ray exposure tools for geometries below 250 nm. In particular, top surface imaging (TSI) material systems are of interest. These include positive and negative tone silylation resists and bilayer schemes which can be dry deposited and developed. In addition, deposited inorganic resist systems will be considered for extended application to x-ray exposure. The wafer cleaning task will explore the removal of metal and organic surface contaminants by dry process techniques. In particular, laser assisted particle removal (LAPR), CO_2 and hypersonic gas jet cleaning all have shown initial capability to remove surface contaminants, and will be considered. The selected approach should demonstrate initial feasibility with a low risk approach to commercial implementation in a semiconductor manufacturing environment.

Phase I: Study and demonstrate the initial feasibility of all dry patterning and wafer cleaning techniques for ULSI semiconductor manufacturing. In particular, provide initial process performance, yield, and manufacturing cost estimates. Develop a commercialization plan for the selected approach.

Phase II: Demonstrate a prototype process (or sub-process) using all dry patterning and wafer cleaning techniques for ULSI semiconductor manufacturing.

DARPA 93-023TITLE: <u>In-Situ Non-Destructive Inspection of Ultra Large Scale Integrated (ULSI) Wafers</u>DARPA 93-023TITLE: <u>In-Situ Non-Destructive Inspection of Ultra Large Scale Integrated (ULSI) Wafers</u>

CATEGORY: 6.1 Basic Research

OBJECTIVE: Develop and demonstrate approaches for the in-situ inspection of wafer level physical and electrical performance parameters.

DESCRIPTION: The fabrication of ultra large scale integrated (ULSI) circuits has grown to include hundreds of process steps with a significant number of ex-situ inspection steps. This inspection approach is quite costly, results in probe/handling related yield loss, and does not offer a mechanism for real-time process control. This program will develop a new class of non-destructive inspection tools which will extract wafer level physical and electrical performance parameters through in-situ measurements. The two candidate tools of near term interest are a non-contact test station for single wafer measurements of linewidth, overlay, and device electrical parameters, and a high resolution imaging system for pattern inspection. The proposed approaches should demonstrate initial feasibility with a low risk approach to commercial implementation in a semiconductor manufacturing environment.

Phase I: Develop an approach for a prototype in-situ inspection system and predict its performance and Cost of Ownership (COO) using the SEMATECH COO (or similar model). Develop a commercialization plan for the tool.

Phase II: Develop and demonstrate a prototype in-situ inspection system which has performance and COO benefits over existing systems and which provides an interface for real-time process control.

DARPA 93-024TITLE: <u>Point-of-Use Generation and Disposal of Wafer Process Chemicals</u>DARPA 93-024TITLE: <u>Point-of-Use Generation and Disposal of Wafer Process Chemicals</u>

CATEGORY: 6.1 Basic Research

OBJECTIVE: Develop a new class of semiconductor process chemistry and supporting equipment for point-of-use generation, reaction, and disposal of reactants.

DESCRIPTION: The fabrication of ultra large scale integrated (ULSI) circuits relies upon multiple process steps involving numerous chemical reactions. Many of the process chemicals which are used in significant volume, such as AsH3, PH3, B2H6, HCL, and HF, are highly toxic, require costly containment, distribution, and disposal support, and have significant particle contamination. This program will develop new process chemistries, advanced filters, and gas distribution and disposal hardware for integration into a point-of-use system. The process chemistry task will develop a new class of designer precursor molecules which will enable process gases to be locally synthesized from liquid sources with higher purity than conventional means. Initial demonstrations to date have identified organo-silicone precursors for AsH3, PH3, and B2H6. Improvements upon these and extensions to other process chemistries used in the semiconductor industry will be considered. The remaining two tasks will address components for point-of-use filtration of corrosive gases using absolute and absorption media, improved components for toxic gas disposal, and low-cost mass flow controllers for integration into point-of-use process systems.

Phase I: Identify and demonstrate initial chemistries or components which can be integrated into a point-of-use process. Develop a commercialization plan for the technology developed in Phase I.

Phase II: Demonstrate the chemistries or components developed in Phase I in a point-of-use process.

DARPA 93-025TITLE: Hybrid Image Understanding (IU)/Neural Net (NN) Techniques for Target Recognition and Multisensor FusionDARPA 93-025TITLE: Hybrid Image Understanding (IU)/Neural Net (NN) Techniques for Target Recognition and Multisensor Fusion

CATEGORY: 6.1 Basic Research

OBJECTIVE: Combine the best capabilities of IU and NN techniques, in a complementary way, to obtain performance results in target recognition and multisensor fusion beyond that obtainable using these fields individually.

DESCRIPTION: Image understanding techniques make effective use of "world knowledge" such as map or collateral information, but are slow in performing specific image classifications. Neural network techniques are fast in classification, but are awkward for encoding symbolic information. Innovative research efforts are sought for developing hybrid IU/NN systems that demonstrate the power of combining the two technologies. The systems developed must incorporate sophisticated, well-developed techniques in both image understanding and neural networks, and must demonstrate a nontrivial synergistic usage of the two technologies. The systems developed must address specific target recognition and/or multisensor fusion tasks. Preference will be given to proposals with potential for near-term transition to DoD systems, and for which training and testing data are readily available.

Phase I: Develop concepts for hybrid IU/NN target recognition and multisensor fusion, and carry out computer simulations to verify their efficacy.

Phase II: Develop a demonstration system applied to a specific problem in target recognition and/or multisensor fusion.

DARPA 93-026TITLE: DARPA 93-026TITLE: Semantic Search of Information Database

CATEGORY: 6.2 Exploratory Development

OBJECTIVE: Determine how to use a large semantic network to improve database searches.

DESCRIPTION: Many information retrieval systems rely on keyword searches; some rely on statistical techniques. The former is susceptible to human limitations in selecting appropriate sets of keywords, and Boolean formulas; the latter, to characteristics of the corpora from which statistical weights are derived. It may be possible to improve the performance (i.e., recall and precision) of either or both approaches by taking advantage of the information encoded in large semantic networks. One likely candidate is Princeton's WordNet, a lexical resource which represents the major semantic relations in human memory (e.g., synonymy, hyponymy, meronymy, antonymy). DoD has supported the development of WordNet. Information about obtaining WordNet and associated reports by File Transfer Protocol (FTP) can be obtained by communicating with wordnet@clarity.princeton.edu.

Phase I: Determine how database searches could be improved, automatically or interactively, using WordNet. Perform a limited proof-of-concept.

Phase II: Extend and enhance the techniques explored in Phase I. Develop an interface to a significant database (e.g., Defense Technical Information Center) and conduct an extensive test measuring performance differences with and without those techniques.

DARPA 93-027TITLE: Voice Authentication Monitoring SystemDARPA 93-027TITLE: Voice Authentication Monitoring System

CATEGORY: 6.2 Exploratory Development

OBJECTIVE: Explore novel techniques for monitoring and making decisions about a speech signal to ascertain that the speaker is the person he or she claims to be, and has not, during the course of the conversation, been replaced by an impostor.

DESCRIPTION: Concepts are sought for novel signal-processing and decision-making techniques for parameterizing a speaker's voice, computing the change in those parameters both during a conversation and from a baseline set of parameters for the claimed speaker, and making a decision as to whether to terminate the conversation or allow it to continue. The techniques must accommodate normal voice changes over time and during a conversation, while being able to recognize that an impostor has either initiated or "hijacked" the conversation. The decision procedure must be sensitive to speaker change, yet not prematurely terminate valid conversations, as a consequence of repeated testing. It is anticipated that both the selection of an appropriate technique from competing ones, and the determination of operating parameters for a technique, will require empirical evaluation. Therefore, this exploratory development will include the design and implementation of a suitable system for the comparative evaluation of different signal-processing and decision-making techniques, and the design of a paradigm for making such an evaluation.

Phase I: Provide a conceptual, mathematical and algorithmic description of the proposed techniques and a discussion of their novelty and advantages over current ones. Identify and explain the operational parameters for each technique. Provide a detailed specification of a system for demonstrating and evaluating the techniques.

Phase II: Implement the system and the techniques and perform tests for setting parameters and evaluating performance. Report on details of implementation not covered in the Phase I descriptions, and analyze the performance, particularly the source of errors. Include a copy of the code in the report. The magnetic-media copy of the code must be delivered in ASCII form, in the UNIX tar (tape archiver command) format.

DARPA 93-028TITLE: Computational SensorsDARPA 93-028TITLE: Computational Sensors

CATEGORY: 6.1 Basic Research

OBJECTIVE: Develop computational sensors that incorporate computation at the level of sensing to increase their performance and achieve new capabilities that are not otherwise possible. Also required are algorithms that can utilize the output of such sensors.

DESCRIPTION: Computational sensors use nonstandard geometry and/or built-in computational capability to achieve new capabilities. An example of nonstandard geometry is a circular sensor having spatially varying resolution from a high resolution center (fovea) to a low resolution periphery, as in the human eye. An example of built-in computational capability is the "silicon retina," the California Institute of Technology chip based on the neural architecture of the eye. The research would involve development of computational sensors. Such algorithms are required because conventional image understanding algorithms are defined for sensors having rectangular arrays of picture elements.

Phase I: Construct or simulate a laboratory model of a computational sensor and/or several important image understanding algorithms for an existing computational sensor.

Phase II: Apply the computational sensor and/or the algorithms to an applied problem of interest including, but not limited to, object tracking. The domain of interest is unmanned vehicles or robotics.

DARPA 93-029TITLE: Sensor and Algorithm Planning and Allocation for Use in Image UnderstandingDARPA 93-029TITLE: Sensor and Algorithm Planning and Allocation for Use in Image Understanding

CATEGORY: 6.1 Basic Research

OBJECTIVE: Develop "task-oriented vision" (i.e., combined image understanding and planning techniques that allow sensors and algorithms to be treated as resources allocated to solve a vision problem).

DESCRIPTION: Task-oriented vision will endow a system with a flexible control structure for allocating and using only the resources necessary to answer the visual question of the moment to the desired level of detail or certainty.

Under this control, vision modules or sensors of known characterisitics are sequentially brought to bear on selective areas of the scene. Their choice should depend on the results of previously executed modules or sensors. Each module produces a partial representation of the (minimal) information needed to answer the question, and this evidence is combined to produce a partial answer. The process continues until the partial answers are enough. Thus, a task-oriented vision capability can act as the cognitive executive for active vision.

Phase I: Develop the basic framework for a task-oriented computer vision system.

Phase II: Mechanize and deliver the task-oriented concepts as applied to an interesting machine vision problem related to unmanned vehicles or robotics.

DARPA 93-030TITLE: Bubble-Based False Undersea TargetsDARPA 93-030TITLE: Bubble-Based False Undersea Targets

CATEGORY: 6.2 Exploratory Development

OBJECTIVE: Mechanically provide/develop a volume for use in sea water which has a small void fraction of air within a contained sea water mass to be used as an undersea target.

DESCRIPTION: The object is to mechanically provide/develop a volume for use in sea water which has a small void fraction of air within a contained sea water mass to be used as an undersea target. The properties of this air volume are such that an acoustic echo will be reflected when the volume is ensonified by an underwater acoustic signal. The void reaction might be realized by air in small tubes, a pump circulating water with minute amounts of air entrained within a bladder, a gelatin-like mix of sea water and air, or other ideas. The objective is low cost, easy handling, flexibility, and simplicity of maintenance and deployment operations. A detailed study of acoustic behavior is not desired, as this is mostly understood and can be modeled. A simple low cost means to create and maintain the bubble target is desired.

Phase I: Provide/Develop proof-of-principle design and small scale experiment

Phase II: Design, fabricate, and test acoustic bubble-based target

DARPA 93-031TITLE: Intelligent, Modular, Scalable Controllers and Actuators for Use in Automated SystemsDARPA 93-031TITLE: Intelligent, Modular, Scalable Controllers and Actuators for Use in Automated Systems

CATEGORY: 6.2 Exploratory Development

OBJECTIVE: Develop and demonstrate intelligent, modular, scalable electro-mechanical and fluid-mechanical controllers and actuators for automation system applications.

DESCRIPTION: There is a need to develop intelligent controllers and actuators for automated mechanical systems. Both new applications and upgrade applications will require automation with distributed intelligent controllers and actuators. Systems are required that are both modular and extendable in both software and hardware and that can utilize alternative control and actuation strategies. In the future, distributed automated machinery will require local intelligent modes where sensing, signal processing, data fusion, state reasoning, controllers, and end effect actuators will be collocated and scalable to facilitate use on classes of machine automation. This is a new field that requires interdisciplinary expertise.

Phase I: Develop a conceptual design for intelligent controllers and actuators. Demonstrate subscale concept feasibility of the selected design. A trade-off analysis with appropriate metrics is required.

Phase II: Design and demonstrate a full-scale prototype of a representative class of intelligent, scalable, modular controllers and actuators. Conduct performance and cost sensitivity analysis to demonstrate viability of concept.

DARPA 93-032TITLE: Synthetic Dolphin Blubber Compliant CoatingsDARPA 93-032TITLE: Synthetic Dolphin

Blubber Compliant Coatings

CATEGORY: 6.2 Exploratory Development

OBJECTIVE: Develop synthetic materials based on the viscoelastic properties of live dolphin blubber to act as a compliant coating for underwater vehicles to reduce drag as well as noise. No experimentation with live dolphins will be conducted as part of this effort.

DESCRIPTION: The dolphin has a remarkable skin and blubber which minimizes both drag and flow noise. Recent studies of fast swimming dolphins in sea water show little phosphorescent activity due to the reduced turbulent boundary layer. Recent materials investigations have shown the unusual properties of the blubber. The purpose of this task is to synthesize the material so it will exhibit properties similar to those of live dolphin blubber.

Phase I: Develop, fabricate, and test synthetic blubber materials. Examine candidate coatings and measure viscoelastic properties. Three coatings will be selected for full-scale tests.

Phase II: Fabricate, install, and test the coatings developed in Phase I on undersea vehicles approximately 36 feet in length and 44 inches in diameter.