NAVY

Proposal Submission

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

Office of the Chief of Naval Research
ATTN: Mr. Vincent D. Schaper
800 North Quincy Street, BCT #1, Room 922
Arlington, VA 22217-5000
(703) 696-4286

SBIR proposals shall not be submitted to the above address and must be received by the cognizant activities listed on the following pages in order to be considered during the selection process.

The Navy's mission is to maintain the freedom of the open seas. To that end the Navy employs and maintains air, land and ocean going vehicles and personnel necessary to accomplish this mission. The topics on the following pages represent a portion of the problems encountered by the Navy in order to fulfill its mission.

The Navy has identified 132 technical topics in this, the first of two SBIR solicitations to be released during FY 1993 by DOD to which small R&D businesses may respond. The Navy has experienced a reduction in its SBIR funding and this is reflected in the amount of topics in this solicitation. While the reduction in funds will not impact the Phase I awards that result from the topics listed in this solicitation, it makes it extremely important that Phase I award recipients influence the end uses of the technology since Phase II SBIR funds will be limited and thus highly competitive.

This solicitation also contains several new formatting ideas: 1) we have provided Phase III information for many topics, 2) for about 25% of the topics we have identified possible areas where a commercial potential may exist and, 3) in at least three topics, the topic descriptions are extremely broad. I would appreciate your comments and suggestions on these format changes.

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

NAVY SMALL BUSINESS INNOVATION RESEARCH PROGRAM

Submitting Proposals on Navy Topics

Phase I proposal (5 copies) should be addressed to:

Topic Nos. N93-001 and N93-002

Administrative SBIR Contact

Mail/Handcarry Address:

Office of Naval Technology
Attn: Code ONT 20P22, Room 502
SBIR Program, Topic No. N93-_____
800 N. Quincy Street, BCT #1
Arlington, VA 22217-5000

Mr. Doug Harry
(703) 696-4453

Topic No. N93-003 through N93-005

Mail/Handcarry Address:

Office of Advanced Technology
Attn: Code OAT 31, Room 922
SBIR Program, Topic No. N93-_____
800 N. Quincy Street, BCT #1
Arlington, VA 22217-5000

Mr. William Slowik
(703) 696-1299

Topic Nos. N93-006 through N93-017

Mail Address:

Commander
Marine Corps Systems Command
Attn: Code AW, SBIR Program, Topic No. N93-_____
Quantico, VA 22134-5080

Mr. Robert Stith
(703) 640-4801/2761

Handcarry Address:

Commander
Marine Corps Systems Command
Attn: Code AW, SBIR Program, Topic No. N93-_____
Building #3097, 2nd Deck, Room 13
Quantico, VA 22134-5080

Topic Nos. N93-018 through N93-043

Mail Address:

Commander
Space and Naval Warfare Systems Command
Attn: Code SPAWAR OOK, SBIR Program, Topic No. N93-_____
Washington, DC 20363-5100

Ms. Betty Geesey
(703) 602-6092

Handcarry Address:

Administrative
SBIR Conract

Commander
Space and Naval Warfare Systems Command
Attn: Code SPAWAR OOK, SBIR Program, Topic No. N93-_____
Crystal Park #5, Room 110
2451 Crystal Drive
Arlington, VA 22202

Topic Nos. N93-044 and N93-045

Mail Address:

Commander
Naval Supply Systems Command
Attn: Code SUP 4233D, SBIR Program, Topic No. N93-_____
Washington, DC 20376-5000

Ms. Linda Whittington
(703) 607-1648

Handcarry Address:

Commander
Naval Supply Systems Command
Attn: Code SUP 4233D, SBIR Program, Topic No. N93-_____
Crystal Mall #3, Room 710
1931 Jefferson Davis Highway
Arlington, VA 22202

Topic Nos. N93-046 through N93-048

Mail Address:

Commander
Naval Air Systems Command
Attn: Code AIR-05TE2, SBIR Program, Topic No. N93-_____
Washington, DC 20361

Ms. Cathy Nodgaard
(703) 692-7393

Handcarry Address:

Commander
Naval Air Systems Command
Attn: Code AIR-05TE2, SBIR Program, Topic No. N93-_____
1411 Jefferson Davis Highway
Jefferson Plaza #1, Room 444
Arlington, VA 22202

Topic No. N93-049

Mail Address:

Commanding Officer
Naval Medical Research and Development Command

CDR Jim Beddard
(301) 295-0885

Attn: Code NMRDC-42, SBIR Program, Topic No. N93-_____
Bethesda, MD 20889-5044

Handcarry Address:

Commanding Officer
Naval Medical Research and Development Command
Attn: Code NMRDC-42, SBIR Program, Topic No. N93-_____
6700 Wisconsin Avenue
Building #1, 12th Floor
Bethesda, MD 20889-5044

Topic Nos. N93-050 through N93-080

Mail Address:

Commander
Naval Sea Systems Command
Department of the Navy/NAVSEA
Attn: Code 06HE, SBIR Program, Topic No. N93-_____
Washington, DC 22202

Mr. William Degentesh
(703) 602-3005

Handcarry Address:

Commander
Naval Sea Systems Command
Attn: Code 06HE, SBIR Program, Topic No. N93-_____
Crystal Plaza #5, Room 924
2211 Jefferson Davis Highway
Arlington, VA 22202

Topic Nos. N93-081 through N93-105

Mail Address:

Commander
Naval Surface Warfare Center
Dahlgren Division
Attn: Code R05, SBIR Program, Topic No. N93-_____
Silver Spring, MD 20903-5000

Mr. Donald Wilson
(301) 394-1279

Handcarry Address:

Commander
Naval Surface Warfare Center
White Oak Detachment
Attn: Code R05, SBIR Program, Topic No. N93-_____
Building #1, Reception Room
Silver Spring, MD 20903-5000

Topic Nos. N93-106 through N93-114

Mail Address:

Commander
Naval Undersea Warfare Center
Detachment New London
Attn: Code 0911, SBIR Program, Topic No. N93-_____
New London, CT 06320-5594

Mr. Jack Griffin
(203) 440-4116

Handcarry Address:

Commander
Naval Undersea Warfare Center
Detachment New London/Shaw's Cove
Attn: Code 0911, SBIR Program, Topic No. N93-_____
Office Park, Building #4
New London, CT 06320-5594

Topic No. N93-115

Mail Address:

Commanding Officer
Naval Air Warfare Center
Aircraft Division Warminster
Attn: Code 01B, SBIR Program, Topic No. N93-_____
P.O. Box 5152
Warminster, PA 18974-0591

Ms. Carol Van Wyk
(215) 441-2375

Handcarry Address:

Commanding Officer
Naval Air Warfare Center
Aircraft Division Warminster
Attn: Code 01B, SBIR Program, Topic No. N93-_____
Street Road/Jacksonville Road
Warminster, PA 18974-0591

Topic No. N93-116 and N93-117

Mail Address:

Commanding Officer
Naval Air Warfare Center
Aircraft Division Trenton
Attn: Code PE31, SBIR Program, Topic No. N93-_____

Mr. Robert Dobrowolski
(609) 538-6754

6250 Phillips Boulevard
Trenton, NJ 08628-0176

Handcarry Address:

Commanding Officer
Naval Air Warfare Center
Aircraft Division Trenton
6250 Phillips Boulevard
Trenton, NJ 08628-0176

Topic Nos. N93-118 through N93-121

Mail Address:

Commanding Officer
Naval Command, Control and Ocean
Surveillance Center (RDT&E) Division
Attn: Code 21, SBIR Program, Topic No. N93-_____
San Diego, CA 92152-5000

Mr. Joseph Michel
(619) 553-3226

Handcarry Address:

Commanding Officer
Naval Command, Control and Ocean
Surveillance Center (RDT&E) Division
Attn: Code 21, SBIR Program, Topic No. N93-_____
271 Catalina Boulevard
San Diego, CA 92152-5000

Topic Nos. N93-122 and N93-123

Mail Address:

Commander
Naval Surface Warfare Center
Carderock Division
Attn: Code 0112, SBIR Program, Topic No. N93-_____
Bethesda, MD 20084-5000

Mr. Frank Halsall
(301) 227-1094

Handcarry Address:

Commander
Naval Surface Warfare Center
Annapolis Detachment/Carderock Division
Attn: Code 0112, SBIR Program, Topic No. N93-_____
Building #1, Room 211

Bethesda, MD 20084-5000

Topic Nos. N93-124 through N93-132

Mail/Handcarry Address:

Commanding Officer
Naval Civil Engineering Laboratory
Attn: Code L03BPM, SBIR Program, Topic No. N93-_____
Port Hueneme, CA 93043-5003

Mr. Nicholas Olah
(805) 982-1089

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DEPARTMENT OF NAVY TOPIC TITLES
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NAVAL COMMAND, CONTROL & OCEAN SURVEILLANCE CENTER
RDT&E DIVISION (NAVAL OCEAN SYSTEMS CENTER)

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NAVAL SURFACE WARFARE CENTER/CARDEROCK (DAVID TAYLOR RESEARCH CENTER)

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N93-123Active Control Systems For Ship Silencing

NAVAL CIVIL ENGINEERING LABORATORY

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OFFICE OF NAVAL TECHNOLOGY

N93-001TITLE: Space-Based Detection of Surface Platforms

CATEGORY: Exploratory Development

OBJECTIVE: Develop algorithms to process automatically multi-channel satellite imagery to detect anomalous curvilinear features in clouds, such as those induced in low level clouds by ships below ("ship tracks").

DESCRIPTION: Efficient, accurate, and robust algorithms are desired for the automatic detection of non-natural curvilinear features in remotely sensed imagery. Such features of Multi-channel Satellite Imagery may have low contrast against noisy highly variable backgrounds. An example would be tracks of enhanced spectral radiance in clouds induced by ships below. Such ship tracks in satellite images at certain spectral bands are apparent to the eye, but an objective automated detection procedure with low false alarm rate is required for operational applications. Conventional linear feature algorithms such as edge detection, matched filtering, or linear Hough transforms may not perform well enough for this problem. Methods utilizing mathematical morphology, neural networks, locally adaptive processes, or other advanced image processing tools may provide the key to a solution.

PHASE I: Provides initial candidate procedures that show greatest promise for further development into full-fledged algorithms. Results of tests using sample images with typical features, such as ship tracks, should be documented in a report. Of particular interest are success rate, false alarm rate, and robustness.

PHASE II: Provide final algorithms, with code adhering to modern programming standards, complete documentation, and a final report detailing results of test cases.

PHASE III: A follow on effort may be desirable, indicating how best to integrate the results of Phase II into the Tactical Environmental Support System (TESS), with full recognition of operational limitations on computer resources and environmental data access. Follow-on effort to be negotiated as a Task under the Office of Naval Technology Space Technology Area Block Program, RL1A.

N93-002TITLE: Automated Oceanographic Imagery Information

CATEGORY: Exploratory Development

OBJECTIVE: Develop a unified information structure for a system of automated information tools and methodology to provide its output to oceanographic forecast models efficiently.

DESCRIPTION: Satellite sensors are a logical choice to fill the gaps left by conventional oceanographic measurements, due to their capability for synoptic coverage. An oceanographic analysis that depicts the positions and sizes of mesoscale features can be valuable itself, but the benefit is potentially greater when the analysis provides input to a forecast model. An example is the assimilation of a map of front and ring positions along with other information (e.g., thermal gradients, ring rotation rates) into a three-dimensional description of the ocean thermal structure, with the analysis used to initialize a forecast of the upper ocean thermal structure. The forecast may provide data for a subsequent analysis.

PHASE I: Recommendations for integrating a system of automated analysis tools in the most appropriate manner. The Government will provide information on the details of techniques.

PHASE II: Development of a complete, end-to-end system (including assimilation into models) based on the recommendations that result from Phase I, and demonstrating and testing the system on data to be supplied by the Government.

PHASE III: Follow-on effort to be negotiated as a Task under Office of Naval Technology, Stennis Space Center's Environmental Acoustics Technology Area Block Program, (RL3C).

OFFICE OF ADVANCED TECHNOLOGY

N93-003TITLE: Advanced Systems and Technologies for Future Naval Warfare

CATEGORY: Exploratory/Advanced Development

OBJECTIVE: Enhance Navy's future warfare capabilities for the following top level needs, mine countermeasures, non-cooperative target recognition, ship self defense, cooperative engagement, torpedo defense, sensor technology for counterstealth-aircraft, missiles and ships, battle management, precision standoff strike weapons-munitions multipliers, targeting, bomb damage assessment (BDA), advanced air launched missile technology, reduced cost for munitions/expendables, global surveillance & communications, submarine stealth and affordability, ASW systems for shallow water, manning/training, and manpower utilization.

DESCRIPTION: Navy is seeking new, innovative, high risk/payoff ideas in technologies and or advanced systems concepts that supports the Navy's mission in the years 2000 and beyond. Ideas are required to enhance and solve technology problems detailed in the objective statement.

PHASE I: At the end of the six month effort work should have demonstrated the feasibility of a system concept or technology, identified critical subsystems or technologies that must be matured for transition into the Navy's acquisition system, clearly identified goals for system performance, outlined the state of current technology maturity, provide evidence that the scientific principles on which the proposal was based are sound and justify further work, and identified the work necessary in a phase II effort to demonstrate technical feasibility and increase the potential of the technology or systems concept to transition.

PHASE II: At the end of a two year effort, the technology or systems concept must have been developed enough to bring critical subsystems or technologies for transition to maturity, completed sufficient work to enable the technology to transition to an advanced technology demonstration, or into a higher category RDT&E, or become the basis for a statement of need and acquisition of the technology or systems concept for Navy applications.

PHASE III: A Navy phase III effort is anticipated.

N93-004Technology for Affordability

CATEGORY: Exploratory Development

OBJECTIVE: The objective of this project is to develop innovative process technology, concurrent engineering or manufacturing processes capable of effecting change in aircraft, ships, boats or components thereof that will be cost effective reliable and maintainable.

DESCRIPTION: At the present time the manufacturing and engineering sectors of the country have been slow to transition new developments into production; typically low volume implies high cost and there is a dependence on low yield production of critical components. As a rule, activities above the factory floor drive costs and there are high maintenance costs associated with new developments. Proposals are sought that will provide innovative developments in manufacturing processes, concurrent engineering and process technology that will effect the Navy and overall industrial production.

PHASE I: Identify improvements and detail where and why they will be effective. A minimum of three awards will be made.

PHASE II: Choose one of those improvements and develop a working model/prototype. Develop a Phase III plan.

PHASE III: Implement the Phase III plan developed in Phase II.

N93-005Technology Improvement

CATEGORY: Exploratory Development

OBJECTIVE: To gain/regain advantage in technology that the United States does not now possess.

DESCRIPTION: In recent years the United States has either lost its technological advantage in some areas to other countries for one reason or another; or has never had an advantage in particular technologies or products derived from those technologies that are critical to Navy's mission and the nation.

PHASE I: Using the Far East countries as a base, perform a study identifying technologies that should be pursued by the United States that would benefit the Navy and the nation. Identify the reason for the deficiencies, why particular technology gaps exist, and how those at technologies could benefit the nation. A minimum of three awards will be made in this area for quality proposals.

PHASE II: Establish a demonstration model of an appropriate technology detailed in Phase I and develop a Phase III plan.

PHASE III: Implement the Phase III plan developed in Phase II.

MARINE CORPS SYSTEMS COMMAND

N93-006TITLE: Laser Discrimination

CATEGORY: Exploratory Development

OBJECTIVE: To develop a device to discriminate between invisible near infrared, far infrared and ultraviolet lasers.

DESCRIPTION: Laser Discriminating Device - Near infra-red (1.06μm) and far infra-red (10.6μm) lasers are routinely used in ranging. Devices are available which can detect these radiations, but there is no reliable method to discriminate between them. For any countermeasure it is desirable to discriminate between them. The Naval Surface Warfare Center (NSWC) has identified materials and has developed a methodology by using this material to discriminate between near infra-red and far infra-red lasers by monitoring the color of the stimulated emission from this material. The color change is quite distinct and is a quick way to determine the wavelength region of incident radiation. This scheme can be further extended to discriminate ultraviolet lasers from the above mentioned lasers by monitoring the temporal profile of the incident lasers.

PHASE I: Phase I requirements include the development of the materials to optimize the emission and the color change of the stimulated emission when irradiated by 1.06μm and 10.6μm lasers. A feasibility study of making a device on this concept is desired.

PHASE II: In Phase II, a working prototype including the ultraviolet discrimination is desired.

PHASE III: Parts of this investigation have commercial applications.

N93-007TITLE: Multi-Purpose Tactical Antenna

CATEGORY: Exploratory Development

OBJECTIVE: To design and develop a prototype antenna with continuous receive and multi-band transmit capabilities that incorporates miniaturization and other state-of-the-art techniques to accommodate field use.

DESCRIPTION: To meet the requirements of many missions, it is necessary to utilize a variety of tactical radios and receive only equipment in the VHF/UHF spectrum. Current antenna systems are dedicated to specific frequency ranges, do not take advantage of new size reduction technologies, and do not meet tactical visibility requirements. The ability to provide tactical users a multi-purpose antenna capable of meeting a variety of send/receive applications is sought.

PHASE I: Concept exploration resulting in the provision of a feasibility study which outlines technologies or design approaches that could be utilized. Phase I will also include the delivery of a technical proposal which

outlines a specific design approach. The design approach will include: a development plan, the specification of manufacturing technologies to be used, and the specification of performance capabilities and trade-offs.

PHASE II: Implementation of Phase I design in the build of two engineering development models capable of being tested in a field environment. Data will be collected to verify performance capabilities and will be provided in a final product evaluation report.

PHASE III: Navy Phase III is anticipated from this topic.

N93-008TITLE: Receive-Only Radio Equipment

CATEGORY: Exploratory Development

OBJECTIVE: To design and develop a prototype tactical receive only radio with continuous HF/VHF/UHF band capabilities that incorporates modularity, miniaturization and other state-of-the-art techniques to accommodate field use.

DESCRIPTION: To meet the requirements of many missions, it is necessary to utilize a variety of tactical receive only equipment in the HF/VHF/UHF spectrum. Current receivers are dedicated to specific frequency ranges, do not take advantage of new size reduction technologies, and do not meet tactical mobility requirements. The ability to provide tactical users a man-packable, multi-purpose receiver capable of meeting a variety of single channel step, scan, and search applications is sought.

PHASE I: Concept exploration resulting in the provision of a feasibility study which outlines currently available or new capabilities, technologies, or design approaches that could be utilized in an integration effort to provide enhanced capability with a reduction in size. Phase I will also include the delivery of a technical proposal which outlines a specific design approach. The design approach will include a development plan, the specification of manufacturing technologies to be used, and the specification of performance capabilities and trade-offs.

PHASE II: Implementation of Phase I design in the build of two engineering development models capable of being tested in a field environment. Data will be collected to verify performance capabilities and will be provided in a final product evaluation report.

PHASE III: Parts of this investigation may have commercial application.

N93-009TITLE: Refrigeration for Combat Medical Units

CATEGORY: Exploratory Development

OBJECTIVE: To explore new concepts in providing front line military medical personnel with refrigeration capability.

DESCRIPTION: This solicitation is an attempt to take advantage of lessons learned during the Gulf War and to design and/or conduct comparative testing of available refrigeration techniques suitable under combat conditions.

PHASE I: Concept exploration resulting in the provision of a feasibility study which outlines currently available or new capabilities, technologies, or design approaches that could be utilized to provide suitable refrigeration. Phase I will also include the delivery of a technical proposal which outlines a specific design approach. The design approach will include a development plan, the specification of manufacturing technologies to be used, and the specification of performance capabilities and trade-offs. Characteristics of the Refrigeration for Combat Medical Units must be: (a) Capable of providing temperatures below 30 degrees F. in the freezer compartment and 40 degrees F. in the cooler compartment. (b) Capable of utilizing power supplied by military vehicles, with electrical generators and worldwide utility power as alternatives. (c) Does not use CFC's. (d) Does not use traditional compressors to compress gases.

PHASE II: Implementation of Phase I design in the build of two engineering development models capable of being tested in a field environment. Data will be collected to verify performance capabilities and will be provided in a final product evaluation report. If a working prototype is provided at Phase I, the scope of this effort would be expanded.

COMMERCIAL POTENTIAL: Exists in the medical industry and food industry.

N93-010TITLE: Miniature Electrical Generators

CATEGORY: Exploratory Development

OBJECTIVE: To explore new concepts in providing combat military personnel with electrical generation capability.

DESCRIPTION: This solicitation is an attempt to take advantage of lessons learned during the Gulf War and to design and/or conduct comparative testing of available generators that would be suitable under combat conditions.

PHASE I: Concept exploration resulting in the provision of a feasibility study which outlines currently available or new capabilities, technologies, or design approaches that could be utilized to provide enhanced capability with a reduction in size, weight, and noise. Phase I will also include the delivery of a technical proposal which outlines a specific design approach. The design approach will include a development plan, the specification of manufacturing technologies to be used, and the specification of performance capabilities and trade-offs.
Characteristics of the Miniature Electrical Generators must be:

Provide 0.5 KW output at 110-120 Volts.

Lighter in weight than comparable commercial generators.

Operate under full load at a noise level (db) measurably below comparable commercial generators.

PHASE II: Implementation of Phase I design in the build of two engineering development models capable of being tested in a field environment. Data will be collected to verify performance capabilities and will be provided in a final product evaluation report. If a working prototype is provided at Phase I, the scope of this effort would be expanded.

PHASE III: Navy Phase III is anticipated from this topic.

N93-011TITLE: Advanced Weapons Material: Exterior Surface

CATEGORY: Exploratory Development

OBJECTIVE: To design and develop prototype/proof of concept demonstrators for advanced material alternatives for the exterior of various weapons components which stops or significantly deters environmental effects to include saltwater.

DESCRIPTION: Material alternatives should be able to be durably or permanently bonded to the primary weapon component material. If the candidate material is useful as the primary material or as the interior coating, then that would be considered an enhancement. Adverse environmental effects degrade weapons readiness and cause additional cleaning and maintenance requirements. Primary environmental concerns are the effects of water, salt and sand. Other enhancements would be if the candidate material improved component strength and contributed to improved thermal management.

PHASE I: Concept exploration resulting in the provision of a feasibility study which outlines currently available or new technologies, capabilities, or design approaches that could be utilized in an integration and/or fabrication of systems possessing the above described attributes. Phase I will also include the delivery of a technical proposal which outlines a specific design approach. The design approach will include: a development plan, the specification of manufacturing technologies to be used, and the specification of performance capabilities and trade-offs.

PHASE II: Implementation of Phase I design in the building of two proof of concept/technology demonstrators capable of being tested in a field or range environment. Data will be collected to verify performance capabilities and will be provided in a final system evaluation report. The final system evaluation report will additionally include recommendations addressing noted deficiencies and for improving performance.

PHASE III: Navy Phase III is anticipated from this topic.

N93-012TITLE: Advanced Weapons Material: Interior Surface.

CATEGORY: Exploratory Development

OBJECTIVE: To design and develop prototype/proof of concept demonstrators for advanced material alternatives for the interior of various weapons components which significantly improves thermal management, deters environmental effects to include saltwater, and the adverse effects of interior ballistics.

DESCRIPTION: Material alternatives should be able to be durably or permanently bonded to the primary weapon component material. If the candidate material is useful as the primary material or as the exterior coating, then that would be considered an enhancement. Adverse thermal, environmental and interior ballistic effects degrade weapons readiness and cause additional cleaning, maintenance and logistic requirements. Primary environmental concerns are the effects of water, salt and sand. It would be considered an enhancement if the candidate material improved component strength. The primary focus of the effort should be the improvement of thermal management.

PHASE I: Concept exploration resulting in the provision of a feasibility study which outlines currently available or new technologies, capabilities, or design approaches that could be utilized in an integration and/or fabrication of systems possessing the above described attributes. Phase I will also include the delivery of a technical proposal which outlines a specific design approach. The design approach will include: a development plan, the specification of manufacturing technologies to be used, and the specification of performance capabilities and trade-offs.

PHASE II: Implementation of Phase I design in the building of two proof of concept/technology demonstrators capable of being tested in a field or range environment. Data will be collected to verify performance capabilities and will be provided in a final system evaluation report. The final system evaluation report will additionally include recommendations addressing noted deficiencies and for improving performance.

PHASE III: Navy Phase III is anticipated from this topic.

N93-013TITLE: Target Acquisition & Fire Control Solution

CATEGORY: Exploratory Development

OBJECTIVE: To design and develop prototype/proof of concept demonstrators for advanced target acquisition, identification, engagement and full solution fire control. Order of magnitude advances desired to compliment conventional and future weapons for engagements at 3000m plus range.

DESCRIPTION: System performance should approach suitability for line-of-sight/line-of-fire weapon systems at effective engagement ranges of 3000m, (2) should permit rapid target acquisition out to 6000m, (3) should provide for target identification, (4) should track the target during mutual movement for some applications, and (5) provide full solution fire control at least one kilometer prior to the respective engagement ranges. Application can be for individual, crew served or vehicle mounted weapon systems; small to medium caliber and rocket-fired direct fire weapons. Reductions in weight and size required. Potential desired for improved durability, reliability and maintainability.

PHASE I: Concept exploration resulting in the provision of a feasibility study which outlines currently available or new technologies, capabilities, or design approaches that could be utilized in an integration and/or fabrication of systems possessing the above described attributes. Phase I will also include the delivery of a technical proposal which outlines a specific design approach. The design approach will include: a development plan, the specification of manufacturing technologies to be used, and the specification of performance capabilities and trade-offs.

PHASE II: Implementation of Phase I design in the building of two proof of concept/technology demonstrators capable of being tested in a field or range environment. Data will be collected to verify performance

capabilities and will be provided in a final system evaluation report. The final system evaluation report will additionally include recommendations addressing noted deficiencies and for improving performance.

N93-014TITLE: Countermine Multisensor Fusion Detection Device

CATEGORY: Exploratory Development

OBJECTIVE: To design and develop Mine/ Countermine Detection Systems which apply Neural Networks to Multisensor fusion in detecting and classifying worldwide mine types both surface and buried.

DESCRIPTION: This solicitation attempts to take advantage of Neural Network technology related to multisensor fusion in properly combining Infra-Red sensor, Ground penetrating radar, and explosive "sniffers" for mine detection and classification. The envisioned concepts may replace classical mine detection devices and concurrently provide a system that is as easily attached to the Unmanned Ground Vehicle (UGV) and can significantly contribute to the assault breaching of minefields. Exclusive of the hand-held mine detectors, (and Marines with bayonets), devices to detect mines have been extremely limited in their ability to detect all mine types; especially when buried. The advantages of combining multiple sensors are: an increased ability to detect all mine types and a drastic reduction/elimination of "false alarms". The primary mission of the Countermine Multisensor Fusion Detection Device is Mine detection and classification. It's secondary capability would be the remote identification of mines / minefields because such secondary capability is easily incorporated into the UGV which utilizes Forward Looking Infra-Red (FLIR) and Optical sensors, and Teleremoting operations.

PHASE I: Phase I would consist of concept exploration resulting in a feasibility study, review of current documentation, and a preliminary design study which produces a System Concept Document (SCD), or equivalent. The SCD or equivalent must describe the proposed hardware design to include materials, proposed sensor suite, multisensor fusion strategy, neural network programming, mine/ countermine detection techniques, tactical employment, storage and use, flexibility, size and weight estimates.

PHASE II: Phase II would consist of preparation of detailed design drawings and assembly of the prototype devices. Prototype design will be verified by mine detection/ classification testing for effectiveness against simulated threat minefields.

PHASE III: Some parts of this investigation may have commercial use.

N93-015TITLE: Real-Time Image Fusion

CATEGORY: Advanced Development

OBJECTIVE: To combine imagery generated by both intensified TV and thermal-imaging night vision systems, thereby exploiting a greater portion of the electromagnetic spectrum and simultaneously maximizing content on a single display.

DESCRIPTION: A need exists to provide a mechanism to produce both intensified TV and thermal imaging night vision system on a single display.

PHASE I: Phase I will determine the technical feasibility of combining the best attributes of any two TV and thermal-imaging night-vision systems into a single image. The study will determine, at a minimum, whether the combined imagery will allow the operator to see into shadows, see subtle thermal variations in the scene, see low light emissions and reflections, while retaining individual detail from each sensor. It is expected that the study will spawn an engineering prototype (in the form of a circuit card) as an item deliverable, complete with detailed laboratory test and evaluation data.

PHASE II: Phase II will generate a "black box" encapsulating the prototype circuit card, free from any imperfections identified in Phase I. The "black box" should have 3 total video ports: one input port for thermal-imaging video, one input port for TV video, and one output port to "hand-off" the combined imagery. The "black box" must also compensate for variances in the thermal imaging and TV system fields-of-view and thereby permit a high-resolution image merger between any two given systems. Naval Surface Warfare Center

(NAVSURFWARCENDIV Crane) Night Vision & Electro-Optics will conduct a thorough independent evaluation to determine the merits and effectiveness of the "black box".

PHASE III: Navy Phase III is anticipated from this topic.

N93-016TITLE: Command Communications System Interface for Amphibious and Land Combat Vehicles

CATEGORY: Exploratory Development

OBJECTIVE: To explore innovative approaches to implementing lightweight, combat survivable communications control in military vehicles.

DESCRIPTION: Current communications control systems are limited by dated technology. Significant improvements in time, covertness and capability are possible if new products can be effectively used in the combat environment. The current system in the AAVC7A1 controls six (6) transceivers and five (5) receivers and provides a multifunction intercom system. The system is accessed by ten (10) user stations with each station having preprogrammed access to two (2) radio assets. Any proposed replacement must be based on current fiber-optic Local Area Network technology allowing the following options:

16 users (Maximum) each having both voice and digital terminal inputs (32 inputs)
Individual user access to 32 radio assets (Maximum)
Intercom able to provide one to one, one to many or one to all contacts
User friendly, fault tolerant
Able to fit into LAV, BFV, and AAVC7A1
Able to operate from unregulated 18-32 volt DC power
Draw less than the current MSQ-115 system on the AAVC7A1
Provide Tempest security

PHASE I: During the Phase I effort the contractor should provide a number of approaches that are possible solutions to the problem. The proposals should be of sufficient detail to allow for government review and selection for Phase II implementation.

PHASE II: During the Phase II effort the contractor should provide a detailed design of two approaches from Phase I with installation and demonstration on an AAVC7A1. The successful approach shall be documented for future installations or production.

PHASE III: If the Phase II is successful, it is anticipated that such an approach will have immediate benefit for AAV and likely other combat vehicle platforms. Additionally, techniques developed under this study will have transferability to the commercial area.

N93-017TITLE: All-Consumable Ration Pack

CATEGORY: Exploratory Development

OBJECTIVE: To design and develop a menu of ration packs which are appealing, nutritionally healthful, durably contained or processed and wholly consumable to include any required containment medium. The term "containment medium or process" is used so as not to dictate technology or design approach. This "medium" may be separate and distinct from the substance of the ration as in traditional packaging or indistinguishable from the substance of the ration as may be developed through chemical and/or physical process.

DESCRIPTION: Marine Reconnaissance teams carry a combat load of 90 to 120 pounds per man to include weapons and ammunition, water ,food, optics, communications equipment, and other mission essential gear. Food is the first item to be left behind. When it is carried, a seemingly innocuous U.S. military ration wrapper inadvertently left along a patrol route could compromise the clandestine nature of an operation if detected by counter reconnaissance.

There exists a requirement for a ration pack that is completely consumable to include any required containment medium. Though desired, it is not required that the containment medium itself have nutritional value.

The ration would be resistant to water, heat, cold, and other environmental effects. It would be of high caloric density, preferably with a day's nutrition contained in one or two meals. A variety of complete menu selections will eventually be developed. Nutritional value and caloric density of the objective meals shall be equal to or greater than that of the current combat rations. Weight and bulk shall be less than that of the current combat rations. The meals shall require no preparation prior to consumption. Because of the monumental logistic burden just to handle and dispose of combat ration packaging for operating forces at large, it is anticipated that All-Consumable Ration Pack technology may eventually be applied to all military rations.

PHASE I: Phase I would consist of concept exploration and feasibility study, selection of approach and process followed by the design and production of prototype menu items.

PHASE II: Phase II would encompass nutritional analysis and certification that developmental articles are safe to test. Production of test articles will be followed by technical and operational testing to include environmental durability and food preservation, long- and short-term depot and shipboard storage, field storage and consumption.

PHASE III: This product would readily lend itself to commercialization not only to limited uses such as outdoor and survival outfitters and space industry in parallel application but also to the entire food and food processing and packaging industry. Technology advancement would likely gain strong support from environmental interest groups.

SPACE AND NAVAL WARFARE SYSTEMS COMMAND

N93-018TITLE: Constraints and System Primitives in Achieving Multilevel Security in Real time Distributed Systems Environments

CATEGORY: Research

OBJECTIVE: Study trusted distributed systems which operate over a heterogeneous collection of processors.

DESCRIPTION: This effort should produce a preliminary design for a distributed operating system and develop an initial proof-of-concept prototype to investigate the principal mechanisms that support distributed operating systems. Central to this research effort is the examination of the network server interaction locally and across the network. Issues of object name space, user and machine identification and authentication, exploitable covert channels, and configuration control should be addressed. A design for audit across the distributed system should be developed. Issues associated with strategies for data replication and remote node authentication within the distributed system should also be considered.

PHASE I: Conduct analysis of trusted distributed systems which operate over a heterogeneous collection of processors.

PHASE II: Produce a preliminary design for a distributed operating system based on the analysis of Phase I.

PHASE III: Implement a distributed operating system as a proof-of-concept prototype to provide the basis for industry to produce and offer MLS Real Time Distributed Operating Systems for use in Navy and DOD mission critical systems.

N93-019TITLE: Tactical Data Transfer Protocol Accelerator

CATEGORY: Exploratory Development

OBJECTIVE: Develop and prototype the hardware and software needed to process data transfer protocols at the Network and Transport Layers in high performance local area networks.

DESCRIPTION: Develop a means to accelerate the processing of tactical (i.e., real-time) protocols at the network and Transport layers in order to provide a data transfer service at the Transport-Session layer boundary that runs at

the speed of the underlying media. The principal media of interest is the 100 Megabyte per second or better SAFENET Lightweight Suite Local Area Networks.

PHASE I: Phase I efforts will prepare a detailed design which will include the plan for incorporating the hardware and software developed in Phase II into a scientific workstation. the Phase I proposals should address how the key tactical features of the transfer protocol are to be accelerated. The key tactical features south are: Prioritized message transfer, acknowledged multicast and selectable error control.

PHASE II: Develop engineer develop models with the resulting software and hardware integrated into a scientific workstation.

PHASE III: Anticipated future use in high speed Navy shipboard networks.

COMMERCIAL POTENTIAL: Exists for technical workstations and file servers.

N93-020TITLE: Multi-Network Engineering Tool

CATEGORY: Exploratory development

OBJECTIVE: To develop a software tool to aid network engineers in the planning of the system topology, the equipment selection and the performance engineering of multi-network systems.

DESCRIPTION: The adoption of Fiber Distributed Data Interface (FDDI) as a U.S. Navy standard SAFENET II presents a new challenge to network engineers. The FDDI standard is well suited to small networks of 10 closely spaced stations or less. However, there are requirements for the internetting of larger land based facilities and larger ships, such as aircraft carriers, where the notion of one large network is being replaced by the concept of several interconnected small ones. Presently, a software tool is under development, through SBIR, to engineer the performance of single SAFENET II/FDDI networks. A multi-network system will require engineering in 3 specific areas: 1) specification of the optimum system topology; 2) selection of optimum hardware configurations to compliment the topology; and 3) engineering of overall system performance.

PHASE I: This phase should provide a methodology and a tool design for the specification of a system topology, selection of hardware configuration and the engineering of system performance.

PHASE II: This phase should provide a demonstratable software tool that implements the elements of Phase I.

PHASE III: Strong candidate users of this tool are the NTCS-A, OSS, NGCR and Copernicus programs.

N93-021TITLE: Critical-Time/Real-Time Database Management

CATEGORY: Research

OBJECTIVE: Develop critical-time/real-time database management capabilities that will provide the performance improvement demanded by mission critical applications with stringent processing/response requirements.

DESCRIPTION: The data requirements of mission critical Navy systems have been increasing dramatically, Navy C3I systems must mange land, sea, airborne and space data elements. Driving such systems are significant requirements for maintenance of thousands of objects, discriminating the real threats among them, and tracking them with real-time updates. Tactical weapons systems require performance in the highly real-time to critical-time performance envelopes. Autonomous sensor/weapon control systems must deal with an enormous quantity of unfiltered data coming in at very high data rates. Critical to success of mission critical Navy systems is the ability to mange large (gigabit) databases in a fast, predictable and reliable manner. The demanding mission critical environment will become even more challenging due to a substantial increase in the amount of data to be considered as a result of new sensor systems and communications capabilities, and reduced reaction time resulting from increasingly sophisticated weapons that can minimize detection time. Response to critical-time/real-time requirements for large databases is beyond the capability of currently available Database Management Systems (DBMSs). Such DBMSs lack an awareness of, and the ability to, meet the deadline and/or time-critical nature of the processing requirements. Additionally, currently available DBMSs are not able to offer the high throughput

rates required by Navy systems. Existing Navy systems utilize a significant level of hand tailored assembly level code to meet these types of performance requirements.

PHASE I: Identify research needed to develop the technology to permit database management systems to support the Navy's critical-time/real-time data management requirements.

PHASE II: Implement the research identified under Phase I.

PHASE III: Expected the results of this research will be incorporated into the Navy Commands' Systems and other systems that require real-time DBMS.

N93-022TITLE: Composibility Constraints of Multilevel Systems

CATEGORY: Research

OBJECTIVE: Research into techniques for achieving verifiable security levels when aggregating and integrating trusted elements, components, and sub-components.

DESCRIPTION: Current Information Security (INFOSEC) systems are networks of interconnected processing elements and databases connected to devices which allow human operators to interface with the data and computing resources. The concept of Trusted Computer Base (TCB) was initiated when computer systems were basically monolithic systems consisting of a mainframe or host computer which interfaced to the user by directly connected unintelligent terminals. These terminals had a unique I/O port or were multiplexed to a single port in such a way that the host computer terminal or group of terminals it was talking to by knowing the physical prot to which the terminals were connected. Present computer systems are networks constructed with many processing elements which may or may not include a host computer. Local Area Networks (LANs) have replace the direct connections. this effort should address the issues/constraints associated with developing trusted systems through the combination and integration of trusted components such as trusted operating systems, trusted Database Management Systems (DBMSs), and secure LANs. A composibility model is to be developed which will allow an evaluation of the security properties of a combination of trusted components whose individual security properties have been evaluated separately.

PHASE I: Analyze issues/constraints in systems development associated with combining trusted components.

PHASE II: Design a set of test cases as a proof-of-concept of the approach developed in Phase I. Demonstrate, through simulation, the effect of combining trusted components in the system development process.

PHASE III: Industry would use the results of Phase II to develop products and tools to help Navy and other system developers to produce MLS Mission Critical Computer Based Systems.

N93-023TITLE: New Electronic Warfare (EW) Identification (ID) Techniques

CATEGORY: Exploratory Development

OBJECTIVE: The objective is to develop and demonstrate a technique which will identify a single radio frequency emission to one certain weapon platform (emitter) - without alternatives or ambiguities.

DESCRIPTION: High quality radar and other emitter identification is a fundamental requirement for surface electronic warfare systems. Current EW warning systems have ID performance limitations and do not provide high confidence and unambiguous emitter ID.

PHASE I: The basic thrust of the Phase I development is to investigate and technically demonstrate an improved or new EW identification technique, which will solve key and current emitter ID ambiguity problems. The basic goal is to get unique emitter ID performance - no ambiguities. The Phase I development shall include the development of the new ID technique, theoretical or technical analysis and technical considerations related to and supporting the approach, and actual ID performance results using real world emitter signals and a final report summarizing the development.

PHASE II: Potential Phase II developments will include preliminary ID system design and integration into a surface EW system, and critical technological feasibility demonstrations, which are associated with the new EW ID technique.

PHASE III: Transition to Phase III will focus on surface ship self defense such as applications for the SLQ-32 or SLQ-54 upgrades, and applying the results of Phase II. Phase III will not be limited to surface warfare but provide for growth to aircraft self-defense, such as ALQ-109.

N93-024TITLE: Inter-Service Voice Communications Model

CATEGORY: Advanced Development

OBJECTIVE: Develop a model of voice communications processes for applications in interactive simulation systems which focus on joint force operations

DESCRIPTION: Large scale simulations currently in use to support research and development of command, control, and communications systems do not incorporate realistic models of voice communications use in joint warfare operations. A new model should be capable of simulating voice communications connectivity line-of-sight requirements, electromagnetic interference, jamming, circuit loading, crypto synchronization, and similar factors. Development of such a model for use with interactive simulation systems is desired to allow more realistic modeling of the joint C_3 environment so that system effectiveness can be more accurately estimated.

PHASE I: Should define a model concept and provide a detailed description of the model, including any hardware required for digitization or other requirements.

PHASE II: Should provide the software, hardware, and procedures to provide a complete working model.

PHASE III: The voice communications model would be implemented in the Research, Evaluation, and Systems Analysis (RESA) simulation system in a multi-service, multi-warfare exercise. The exercise would be designed to stress C_3 in an approved JCS scenario. Other potential users and implementations could be explored, including FAA applications, Emergency Management C_2, and local law enforcement C_2.

N93-025TITLE: Virtual Information Transfer Emulator (VITE)

CATEGORY: Engineering Development

OBJECTIVE: The objective is to test and adapt emerging video and model-modifying techniques to optimize data/video hybrid replication transfer over existing land and satellite links to and from Fleet units.

DESCRIPTION: As telecommunication bandwidths increase, either from allocation or virtually by data compression or improved protocols and management, it is predictable that the input information volume will increase. For many years a totally global link bandwidth will be limited by landline or ship cabling characteristics. This task will develop a prototype system optimizing an amalgam of commercial video formats and protocol, Defense Mapping Agency derived models with zooming capability from Battle Group to ownship area, and movable windows with video and data panes in Ada, I-CASE environment. The fundamental updates of previously modelled data or video/audio scenes. This schema would enable short, quick packages of data in real time or "quick batch" to reduce overall traffic demands and use low point to point bandwidth. It is anticipated that this approach will become a "force multiplier" for more advanced data links in the future.

PHASE I: Trade-off analysis of existing or low risk emerging techniques. Insertion of higher risk techniques with innovative risk reducers for optimizing payoff. A short loop demonstration using PC to PC remote connection, CD-ROM resident scenarios (30 to 60 minutes) with externally selected naval engagement overlays. Proposer may offer an alternate means of demonstration.

PHASE II: Implement a sender-to-user workstation environment based on the model(s) designed in Phase I for an initial evaluation at a Navy facility such as the Naval Command Control and Ocean Surveillance Center (NCCOSC).

PHASE III: A Navy Phase III effort is anticipated.

N93-026TITLE: HF Emulator for Adaptive Reception (HEAR)

CATEGORY: Engineering Development

OBJECTIVE: The objective is to test and adapt commercially available expert and phoneme based techniques to sharply reduce or eliminate operator requirements for HF communications links to and from Fleet units.

DESCRIPTION: Despite major improvements to HF communications reliability such as forward error correction, automatic link establishment and link quality analysis, HF systems bear the stigma of operator intensity. These are vital links to and among Fleet units as backup and alternative paths. This task develops the notion that a communications operator is not required and envisions the standard Navy console operator or non-console CIC evaluator literally calling up his desired connectivity by voice actuated commands.

PHASE I: Trade-off analysis of existing or low risk emerging techniques. Demonstrate the design at the PC to PC workstation level, assuming bit error rates now achievable with adaptive modems, illustrating networking adaptive routing possibilities in response to voice managed data streams at 1200 baud rates.

PHASE II: Implement the Phase I design in prototypes of transmitter and receive modifiers within a network emulation for test and evaluation at a Navy facility such as the Naval Command Control and Ocean Surveillance Center (NCCOSC). Software products from this stage must be transportable to an Ada, I-CASE environment.

PHASE III: A Navy Phase III effort is anticipated.

N93-027TITLE: Satellite Communications (SATCOM) Multi-Band Antennas

CATEGORY: Exploratory Development

OBJECTIVE: Develop smaller, lighter, higher performance SATCOM antenna (systems) operable across multiple frequency bands.

DESCRIPTION: To establish SATCOM connectivity in each frequency band (military UHF, SHF, and EHF and commercial (C, Ku, L, etc.)) the Navy must currently operate from separate antennas (systems). In order to minimize the topside space and weight required to install SATCOM antenna (systems) for operational use on Navy ships, methods are sought to combine operations of multiple frequency bands (two or more) on single antenna systems. This will allow increased channel bandwidth capacity in support of the Copernicus architecture.

PHASE I: Feasibility studies shall be presented which address the potential performance of antenna array(s) that operate over a minimum of two (or more) frequency bands that will satisfy current and future operational needs on a wide variety of Navy shipboard platforms. Higher transmission rates to be addressed shall include but not be limited to: UHF up to 64 ksps, SHF up to 2 X T1 (symbol rate), and EHF up to 2 X T1 (symbol rate) and commercial up to 2 X T1 (symbol rate). The studies shall consider the possibility of using existing pedestals and control mechanisms as a cost savings.

PHASE II: Develop the antenna system(s) defined in Phase I and provide models for potential shipboard testing and evaluation of the proposed improvements.

PHASE III: SATCOM project funds are available to support a Phase III effort, a multi-frequency band antenna.

N93-028TITLE: Flexible Bit Rate Voice

CATEGORY: Engineering Development

OBJECTIVE: Develop a flexible digital voice capability that permits fleet users to tailor call requirements (e.g., intelligibility) and commensurate voice bandwidth to the limited capacity communication links available between ship-ship and ship-shore.

DESCRIPTION: Naval voice communication requirements can be satisfied by sing a variety of vocoding techniques that provide minimum acceptable intelligibility to near toll quality speech. Similarly, Navy Communication link capacities available for voice use can vary dramatically depending on platform type, location, and tempo of operations. A flexible-bit-rate voice capability would permit users to match their call requirements (e.g., intelligibility, privacy, etc.) to available communication capacity.

PHASE I: Define the functional requirements and propose a top level design of a flexible-bit-rate voice capability.

PHASE II: Develop two prototype flexible-bit-rate voice units and complete laboratory back-to-back testing. Document the design and test within a final report.

PHASE III: Develop two prototype flexible-bit-rate voice capability within next generation Navy communication systems.

N93-029TITLE: Broadband Submarine Communications Mast Antenna

CATEGORY: Research

OBJECTIVE: Develop a submarine RF mast antenna system which provides SSN and SSBN submarines with Copernicus compatible communications.

DESCRIPTION: Develop submarine RF mast antenna system concepts that provide broadband, multiple link, multiple frequency, variable data rate, transceive capability to support future Copernicus requirements.

PHASE I: Shall address concept designs, RF and operational performance, and trade-off studies.

PHASE II: Will include test and evaluation to demonstrate feasibility of the concepts.

PHASE III: Anticipate Navy sponsorship to transition into the Submarine Integrated Antenna System Project.

N93-030TITLE: Submarine RF Communications Antenna

CATEGORY: Research

OBJECTIVE: Develop a submarine RF antenna for the SSN buoyant cable and towed buoy systems which allow SSN and SSBN submarines to operate and communicate at operational speeds and depths.

DESCRIPTION: Develop submarine RF antenna concepts that provide antennas and towed buoy auxiliary wire antennas with broadband, multiple link, multiple frequency, variable data rate, transceive capability to support future Copernicus requirements. The antennas shall also provide GPS and radar signal reception.

PHASE I: Shall address concept designs, RF, hydrodynamic and operational performance, and trade-off studies.

PHASE II: Will include test and evaluation to demonstrate feasibility of the concepts.

PHASE III: Anticipate Navy sponsorship to transition into the Submarine Integrated Antenna System Project.

N93-031TITLE: Development of a Planar Lens or Reflector for a Multiple-Beam Multi-Mission Broadband Antenna (MMBA)

CATEGORY: Exploratory Development

OBJECTIVE: Determine the feasibility and complexity involved with the development of a parallel plate planar lens or reflector to form the azimuth beam for the MMBA.

DESCRIPTION: Antennas for special purpose or single system data links are proliferating aboard ships where weight, moment, space and electromagnetic interference are critical considerations. A single antenna satisfying requirements for multiple data links between aircraft and ships is needed. A MMBA will provide connectivity to more than one aircraft simultaneously. A MMBA must ultimately satisfy the following requirements:

* Bandwidth
  - Frequency Coverage: 8 GHZ - 16 GHZ
  - Instantaneous transmit bandwidth: <300 Mhz

* Transmit Power
  - +70 dbm effective isotropic radiated power per link, average

* Receive Gain
  - Equivalent to a 1-meter dish over above frequencies.

* Sidelobe Levels
  - Less than -20 Db relative to main beam peak on transmit

* Azimuth Coverage
  - 360 degrees - Limited antenna location and resultant shadowing will require two or more antennas

* Elevation Coverage
  - -5 to +50 degrees relative to the horizon, with compensation for ship's motion (see Environment)

* Polarization
  - Right Hand Circular

* Environment
  - Compatible with CV/CVN shipboard environment
  - Compensation for following ship motion (+ deg Roll, +1 deg Pitch)

PHASE I: At the end of six months provide a report on the results of investigations of technologies and/or techniques which could be used to provide the planar lens or reflector design to meet the performance parameters outlined in the above DESCRIPTION section. The report should include a proposed course of investigation for Phase II.

PHASE II: At the end of two years provide analytical and/or experimental verification that technologies/ techniques recommended at the end of Phase I are feasible and affordable to justify initiation and funding of an Advanced and/or Engineering Development project.

PHASE III: Anticipated application under Navy sponsorship.

N93-032TITLE: Artificial Intelligence Tools for EHF SATCOM Management

CATEGORY: Exploratory Development

OBJECTIVE: Investigate the application of artificial intelligence to the management of EHF SATCOM communications.

DESCRIPTION: To establish an Extremely High Frequency (EHF) Satellite Communications (SATCOM) network, the communications planner must consider a large number of complex factors including network

precedence, throughput requirements, available satellite resources, uplink and downlink beam configurations and earth terminal locations and capabilities. Artificial Intelligence (AI) tools are sought to aid the communications planner in planning, establishing and managing EHF SATCOM network connectivity. The AI tools should overlay and enhance existing Navy tactical communications planning tools and procedures and must be compatible with the communications management concepts of the Copernicus architecture.

PHASE I: Define a set of artificial intelligence tools to enhanced EHF SATCOM management.

PHASE II: Develop the AI tools defined in Phase I and demonstrate their operation in the Naval Research and Development Center (Nrad) Communication Support System (CSS) test facility.

PHASE III: EHF IXS project funds have been programmed to support a Phase III effort.

N93-033TITLE: Data Structures and Architectures for Automated Image Interpretation

CATEGORY: Exploratory Development

OBJECTIVE: The objective of this effort is to develop representations of oceanographic satellite imagery which permit efficient automated analysis and interpretation of scene content.

DESCRIPTION: Oceanographic satellite imagery is used to support many Naval operations. Satellite imagery, by its capability for synoptic coverage of large areas of the ocean, is an important complement to traditional techniques for observing significant features in the world's oceans. Present image interpretive methods are largely manual and are highly subjective. Conventional image processing methods are not especially desirable for this task. new approaches and innovative ideas are needed to represent satellite imagery using data structures of software architectures that facilitate storage, transmission, processing throughput, and accuracy of automated analysis results. Symbolic, statistical, object oriented representations or other parameterizations are sought. Practical representations of oceanographic satellite imagery and representations of the mesoscale information content derived from such images, including the formation and time evolution of the features are sought.

PHASE I: This six month effort should produce an evaluation of data structures or software architectures in support of automated image interpretation.

PHASE II: A two year effort to complete development or structures or architectures to perform feature detection and other automated image interpretation functions.

PHASE III: A Navy Phase III effort is planned.

N93-034TITLE: Multi Sensor Data Visualization of Meteorological Features

CATEGORY: Exploratory Development

OBJECTIVE: To develop a method for fusing multi-sensor data in order to identify important meteorological features and data visualization methods to clearly and efficiently present the outputs of the data fusion.

DESCRIPTION: New sensors and weapons such as the AEGIS radar system, Tomahawk cruise missiles and precision guided munitions can be severely affected by changing meteorological conditions. Recent advances in sensor technology, particularly satellite based remote sensing, and numerical modeling techniques have increased tremendously the amount of meteorological information that is available to fleet users. New data visualizations methods are needed to allow quick, efficient interpretation of meteorological conditions affecting weapons and sensors performance.

PHASE I: This six month effort should provide recommendations of innovative methods for the fusion of multiple meteorological data sources and 2-D and 3-D data visualization methods.

PHASE II: A two year effort to demonstrate the use of the recommended advanced data fusion and data visualization methods to identify meteorological or oceanographic features.

PHASE III: A Navy Phase III effort is planned

N93-035TITLE: Environmental Data Base Compression

CATEGORY: Exploratory Development

OBJECTIVE: The objective of this effort is to develop and test a data base compression capability which will be suitable for fleet use with newly developed computer systems hardware and software.

DESCRIPTION: Environmental data is of four major types: imagery, floating point, binary and ASCII. Applications processes used in environmental systems may make use of any or all of these types of data at any given time. Data Compression technology which facilitates data base communication between a variety of different computer systems spread across thousands of kilometers and, at the same time, facilitates the selection of elements of the entire data base given selected attributes is urgently needed to support ne wand higher technology weapons platforms and sensor systems as well as super computer models.

PHASE I: Trade-off analysis of existing or modified data base compression technology adapted to environmental data.

PHASE II: Completed development of data base compression technology for support of environmental communications.

PHASE III: A Navy Phase III effort is planned

N93-036TITLE: Machine-assisted Submarine Passive Acoustic Classification

CATEGORY: Advanced Development

OBJECTIVE: Develop a machine-assisted ASW passive classification system

DESCRIPTION: Machine assisted anti-submarine warfare passive classification systems have seldom produced the spectacular results which had been promised because real experts in classification have not built up the classification data base and procedures used in these systems. In this task, it is desired that experts in submarine classification build a data base and set of rules which will help operators improve their ability to classify submarines, with primary emphasis on distinguishing submarines from anything else.

PHASE I: Phase I of this effort shall compile but not demonstrate algorithms and data bases which will classify submarines, based on the experience of experts.

PHASE II: Phase II shall code the classification algorithms generated in Phase I in an interactive computer system and demonstrate the classification capability in real time with recordings of signals from actual submarine encounters. Each phase shall require an initial brief including program objectives, actions and a milestone review; a final review and brief; and a final report. Phase I should report on feasibility, anticipated cost and estimated performance level achieved by the method. An outline of a Phase II demonstration of concept should be included. Phase II should demonstrate a proof of concept system. PHASE III: It is anticipated that successful Phase II contractors will transfer their technology into the Surveillance Direction System Research and Development program or the Integrated Undersea Surveillance System at the sensor system level.
Transition: Surveillance Direction System

N93-037TITLE: Adaptive Processing for Shallow Water Low Frequency Active Operations (LFA)

CATEGORY: Advanced Development

OBJECTIVE: Develop and test at sea effective monostatic and bi-static adaptive processing techniques for shallow water LFA operations

DESCRIPTION: Shallow water anti-submarine warfare operation is an increasingly important objective. Bottom reverberation is an extremely complex phenomenon owing to the diversity of ocean floor types, lateral inhomogeneity, and potential contribution of subbottom layers. The received backscattered return is typically a

composite process with two or more reverberation types contributing at any given instant. This is especially true in shallow-water environments. In this context, the spatial correlation characteristics of various reverberation components are critically important. The shallow-water environment creates some unique difficulties. As opposed to deep-water settings where the acoustic paths are few and identifiable, shallow-water reverberation returns arrive in rapid succession, imposing stringent adaptation requirements on the adaptive filter and complicating the performance evaluation process. Acoustic reverberation often limits the performance of active sonar systems and spatial reverberation cancellation is required to achieve adequate performance. Reverberation is a particularly difficult source of interference owing to its transient nature, wide dynamic range, and highly uncorrelated properties. Adaptive beamforming techniques offer the potential for reverberation suppression, typically employing an adaptive estimator in conjunction with directional constraints to ensure signal preservation.

PHASE III: Potential Phase III transition opportunities are SURTASS, SQQ-89, and Advanced Deployable Systems

N93-038TITLE: Coherent Processing for LOFARGRAMS

CATEGORY: Exploratory Development

OBJECTIVE: Develop, demonstrate, test, and evaluate for automatic LOFAR detection a coherent algorithmic processing chain with long time constant integration and determine the Receiver Operating Characteristics (ROC) curves for each integration period.

DESCRIPTION: The task is to develop, demonstrate, and measure the algorithms/techniques required to automatically extract stable signal information from a LOFARGRAM using 15, 30, 60, and 120 minute signal integration times and modify the original time series data for operator classification by a conventional resolution LOFARGRAM data presentation (no new training for the operator). Removal of clutter, interference, biologies, and profiler activity. Methods to reduce or identify processing artifacts to the classification operator are required. The measure of algorithmic performance include probability of detection, probability of false alarm, and recognition differential over the four required observation periods. Proper spectral preparation of the time series data in frequency time format is required with attention paid to both frequency and time redundancy of the presented data. Real (from the Full Spectrum Database) and simulated data will be supplied by the Navy for demonstrations and testing. A specific algorithmic processing chain from respondents is desired with the chain's estimated performance.

PHASE I: Develop as required and implement on a computer critical applications for testing with real (provided by the Navy) and simulated times series data. Determine and present the ROC curves for the four integration periods. Prepare a complete algorithmic specification. Provide a detailed technical and test report that provides for the transition of this technology into the Navy signal processing community.

PHASE II: Develop and implement on a commercial computer the algorithmic design of Phase I and perform a demonstration which detects a slow speed diesel-electric submarine from data supplied by the Navy's Full Spectrum Data base.

PHASE III: Develop and implement a complete coherent detection sub-system on a commercial workstation (programmed in Ada or C) for operational testing on existing or future IUSS array systems at an IUSS site. The products of this work will transition in FY96 into the upgraded image processing demonstrations at the IUSS site at STIC and DSVC.

N93-039TITLE: Transporting Ada and C Software to Arbitrary Processor Architectures Efficiently

CATEGORY: Exploratory Development

OBJECTIVE: Demonstrate efficient mapping of Ada and ANSI Standard "C" programs onto uni-processor architectures

DESCRIPTION: Demonstrate and transition to the Navy a software tool to map (compile) Ada and ANSI Standard C programs onto uni-processors architectures which have been described by the hardware description language (HDL) ANSI/IEEE-1076 which is called out in Requirement 64. The intent is to extend this software tool to multiple processors. For such computing hardware the requested tool will convert Ada and code to the correct micro-coded instructions which will execute at greater than 85% efficiency of good hand coded micro-instructions of the same function program. As an extension of the requested tool, the tool should be able to analyze user programs written in Ada and C and automatically and rapidly design the optimum processor for these programs based on HDL described parts in the tool's library. Each phase will require an initial brief including program objectives, actions and a milestone review; a final review and brief; and a final report.

PHASE I: Phase I will demonstrate on Anti-Submarine Warfare (ASW) processing programs the requested capabilities of the software tool plus any other features. Phase I should also provide a detailed test and technical report. An outline of a Phase II demonstration of concept should be included.

PHASE II: Phase II should extend and implement the tool for multiple processors and processors with co-processors architectures. An optimum signal processing workstation will be designed using off-the-shelf commercial components for a Navy provided algorithmic processing chain.

PHASE III: Phase III will develop and implement the ASW processing on the workstation designed in Phase II.

Transition: Surveillance Direction System

N93-040TITLE: Acoustic Warfare Management System

CATEGORY: Advanced Development

OBJECTIVE: Provide an acoustic warfare management system which
will coordinate U.S. Navy acoustic programs with U.S. air, surface and sub-surface forces

DESCRIPTION: The U.S. Navy requires a tactical decision aid to integrate information from the Integrated Undersea Surveillance System with that from other U.S. services. The system must include resource allocation and resource optimization, electromagnetic communications management, all-source data fusion, battle management, advanced graphics presentations and a tactical metric. These ends may be achieved through expert systems, Bayseian networks, gaming theory, or other methods. Each phase shall require an initial brief including program objectives, actions and a milestone review; a final review and brief; and a final report.

PHASE I: Phase I will consist of requirement definition, and high level and detailed design. A final report should be submitted summarizing the results of all analysis and comparing the performance of all systems analyzed. An outline of a Phase II demonstration of concept should be included.

PHASE II: Phase II should demonstrate a proof of concept system. In Phase II the design should be implemented on a DTC II computer. Test data will be supplied by the Navy.

PHASE III: It is anticipated that successful Phase II contractors will transfer their technology into the Surveillance Direction System Research and Development program or the Integrated Undersea Surveillance System.

Transition: Surveillance Direction System.

N93-041TITLE: Automated signal processing for the Integrated Undersea Surveillance System

CATEGORY: Engineering Development

OBJECTIVE: Improve timelate, system detection and classification through automated signal processing

DESCRIPTION: The areas of reporting time, detection and classification are currently very labor-intensive. Space and Naval Warfare Systems Command requests proposals to automate these areas either in part or in whole. Proposed systems should significantly reduce the amount of time required to analyze data or to produce accurate reports. Phase I shall be a concept review, analysis study and high level design for proposed area. In Phase II promising automation concepts shall be implemented, installed and tested at a Naval Ocean Processing Facility.

Each phase shall require an initial brief including program objectives, actions and a milestone review; a final review and brief; and a final report.

PHASE I: Phase I should report on feasibility, anticipated cost and estimated performance level achieved by the method. An outline of a Phase II demonstration of concept should be included.

PHASE II: Phase II should demonstrate a proof of concept system.

PHASE III: It is anticipated that successful Phase II contractors will transfer their technology into the Surveillance Direction System Research and Development program or the Integrated Undersea Surveillance System at the sensor system level.

Transition: Surveillance Direction System, Integrated Undersea Surveillance System

N93-042TITLE: Logistics Technology Forecast Tool for Hardware and Software including NDI

CATEGORY: Exploratory development

OBJECTIVE: Develop a Logistics Technology Forecast Tool to Improve Reliability and Maintainability performance

DESCRIPTION: Currently logistic support systems lack methods to accommodate the rapidly changing approaches to development and deployment of new and upgraded systems. For example, new technology or Non Development Items (NDI) make the potential reliability and maintainability (R&M) performance of a new system better or qualitatively different from predecessor systems. Yet, reliability and maintainability values which traditionally have been set at the outset of programs, are based on historical values from existing systems which may be very conservative compared to the current state of the art.

New systems are now characterized by a shortened development cycle, increased life-cycle costs, rapid and substantial advances in technology and, the use of off-the-shelf NDI hardware, software and systems. To reflect the current state of development and deployment, a logistics technology forecast tool needs to be defined and developed. An improved methodology would assist program office personnel and logisticians who specify logistics requirements to reduce costs, improve quality and mitigate risks. This tool should include an approach for 1) identifying technology opportunities relevant to the user's programs, 2) comparing technology time frames to program time frames, 3) setting requirements that are neither obsolete nor technically risky 4) adapting to technical risk implications and, 5) understanding cost. Each phase shall require an initial brief including program objectives, actions and a milestone review; a final review and brief; and a final report.

PHASE I: Phase I should present the concept, approach and a design for the Logistics Technology Forecast Tool. An outline of a Phase II demonstration of concept should be included.

PHASE II: Phase II should demonstrate a proof of concept system.

PHASE III: It is anticipated that successful Phase II contractors will transfer their technology into the Surveillance Direction System Research and Development program or the Integrated Undersea Surveillance System at the sensor system level.

Transition: Surveillance Direction Systems, Advanced Deployable Systems, Fixed Distributed Systems

N93-043TITLE: Automatic Detection and Tracking of Acoustic Signals of Low Signal-to-Noise Ratio (SNR) Using Innovative Beamforming and Three-Dimensional Tracking Algorithms

CATEGORY: Exploratory Development

OBJECTIVE: Develop, demonstrate, and test new and innovative beamforming, peak picking, and three-dimensional tracking algorithms for automatic detection and tracking of the full spectrum of acoustic signals including narrowband, SWATH, and broadband energy that have very low SNR

DESCRIPTION: Conventional Beamforming (CBF) is the optimum detector for a very idealized set of noise and signal characteristics that are virtually non-existent in the ocean environment. Matched filed processing addresses the actual signal propagation environment but requires extensive computer processing power. This task is to

develop non-intensive, non-conventional, plan-wave computer beamforming methods that use innovative data thresholding algorithms with new signal peakpicking techniques for application to low SNR signals. To reduce false targets, three-dimensional (level vs. time, bearing and frequency) trackers should be developed to process the beam output data. Dynamic ways to normalize the beam output data relative to highly directional noise fields should be incorporated into the processing method. The processing methodology should be able to detect and automatically track narrowband SWATH and broadband signals of low SNR.

PHASE I: Develop the processing method, implement it in software, and demonstrate its performance on real data (supplied by the Navy) for narrowband and SWATH type signals. Measures of effectiveness will be the s+N/N estimate levels detected and the number of false target tracks (per frequency bin and azimuthal sampling interval) at the output of the three dimensional tracker.

PHASE II: Extend the processing method to detect and automatically track broadband energy. Split-array beam correlation techniques should be integrated with the peak picking algorithm and three-dimensional tracker to automate detection and tracking of broadband signals. Real data will be furnished by the Navy for test and evaluation performance. If signal processing method proves to be successful, develop a software/hardware design to implement the method at low power for use in a remote site.

PHASE III: This work will transition to the SPAWAR PD-80 Fixed Distributed System signal processing and/or the Surveillance Direction System.

NAVAL SUPPLY SYSTEMS COMMAND

N93-044TITLE: Industrial/Supply Information Interface Development

CATEGORY: Advanced Development

OBJECTIVE: Design system interfaces between Industrial requirements ADP systems and retail inventory management ADP systems that enable two way transfer of material requirements and inventory data.

DESCRIPTION: DOD has directed Navy to significantly reduce its repair parts inventories. Prior to DOD's direction, three levels of inventory were authorized - wholesale, intermediate and consumer. In order to comply with DOD's direction, Navy will eliminate it's intermediate level of spare parts. In addition we are looking at the benefits of consolidating consumer level management and inventory position. Today, Navy's industrial activities (shipyards, aviation depots, etc.)maintain individual consumer levels, managed by their own ADP systems. Navy stock points use ADP inventory management and inventory processing systems designed to support intermediate level requirements. When industrial inventories are migrated to supply activities responsible for managing consolidated consumer inventories the necessary ADP system integration needs to be in place. The ADP systems need to be able to transfer material requirements data and inventory availability and requisitioning data between both the industrial customers and the supporting supply activity.

PHASE I: Determine feasibility of interfacing industrial ADP systems with new/revised consumer level supply ADP systems.

PHASE II: Development and delivery of the interfacing systems.

N93-045TITLE: Application of Desktop Manufacturing to Part Digitizing Systems

CATEGORY: Exploratory Development

OBJECTIVE: To use desktop manufacturing in part digitizing machines to aid design and manufacturing people in user friendly production of mechanical parts.

DESCRIPTION: The Navy reverse engineers mechanical parts to develop technical data packages on systems that are no longer supported by industry. The reverse engineering process is accomplished with automated laser scanners and manual methods. The resulting technical data packages are used for competitive procurements or for

manufacturing emergency parts. It is costly to manufacture a prototype mechanical part just to validate the technical data against the original part, before a competitive procurement.

PHASE I: Should conceptualize, design and assess feasibility of an interface between a part digitizing laser scanner and a desktop manufacturing system. Attention should be given to mapping of hidden part features into digital format resulting in a user friendly display.

PHASE II: Prototype and demonstrate an interface between part scanner output and input to a desktop manufacturing system. Included in this design prototype should be a CAD/CAE/CAM workstation interface to capture, edit and output intelligent digital data format.

PHASE III: Phase III is anticipated with other DOD laser scanners.

NAVAL AIR SYSTEMS COMMAND

N93-046TITLE: TOMAHAWK Command Information Accountability in a GLOBIXS Network

CATEGORY: Advanced Development

OBJECTIVE: Determine an end accountability scheme for TOMAHAWK Command Information (TCI) appropriate to systems residing on a virtual network.

DESCRIPTION: TOMAHAWK cruise missile missions are developed by planning centers subordinate to the Atlantic and Pacific theater commander. Under the Copernicus concept, TCI associated with these missions would be provided by the planning centers to the CINC Command Center (CCC) upon request, using a GLOBIXS network for data transfer. Algorithms suitable for ensuring proper end accountability for TCI with multiple systems cohabiting a virtual network are needed.

PHASE I: The contractor will develop technical data which identifies the unified commander's specific TCI information requirements (data types), the appropriate data path and projected network data loading, associated security requirements, and a scheme for maintaining end accountability of the command information. The contractor will develop and demonstrate a simulation of the network and accountability scheme.

PHASE II: The contractor will refine the accountability scheme developed during phase I and complete and deliver the final algorithms.

PHASE III: A Navy funded Phase III effort is anticipated.

N93-047TITLE: Fiber-optic Bundle Reliability Improvement Analysis

CATEGORY: Engineering Development

OBJECTIVE: Improvement of the manufacturing, wrapping, flexibility parameters of high density fiber-optic bundles used in Helmet Mounted Displays.

DESCRIPTION: High density fiber-optic bundles are being used to transmit projected images in helmet mounted display technology. The bundles contain up to 4 million fiber-optic strands, and are constrained by transmissivity to a length of 2 meters. At present, normal utilization and flexation cause thousands of strands to break over a very short term (two weeks to one month). Small business is to investigate industry wide approach to fiber optic manufacture, bundle composition, cause of breakage at flexation points, industry approach to improving reliability of fiber-optic bundles.

PHASE I: Small business will prepare a report describing the process for manufacture of fiber-optic strands and bundles, and explain properties causing currently experienced low reliability. Report will also address general industry practices being instituted to improve fiber-optic bundle reliability.

PHASE II: Small business will prepare a technical plan defining specific alternatives for improving the reliability of fiber-optic bundles while maintaining the flexation properties necessary for utilization in helmet mounted displays. Plan will address the technical requirements for modifying manufacture and/or construction of fiber-optic bundles to accommodate helmet mounted displays, and will include cost analysis and risk assessment.

PHASE III: Successful accomplishment of phases I and II would be followed by implementation of the most cost effective technical improvement product/process modification. The small business would participate in the overall evaluation of the technical process and provide a critique which quantifies potential cost savings to both government and industry.

N93-048TITLE: Field Replacement and Mass Discrete Retermination of V-22 Connectors/Flat Wire Cables Without Solder

CATEGORY: Engineering Development

OBJECTIVE: To develop a mass termination method and tool for rectangular connectors/flat solid-wire cables that can be hand-held and used on-board V-22 aircraft (in-place) in very adverse field environments without the use of solder.

DESCRIPTION: The current solder mass termination technique is an acceptable method for aerospace factory use but is unacceptable for military field use in adverse conditions such as sand/dust and low temperature on-board carrier environment. Also a broken contact in the current design requires the retermination of as many as forty (40) circuits and the retesting of these circuits.

PHASE I: This study must take into account the constrained work areas on-board the V-22 aircraft where connector replacement and retermination must be accomplished. Methods and tools will be studied that can be easily and permanently calibrated and which will sustain the abuse environment of hand-held tools. A permanent and reliable flat wire-to-connector contact connection (without solder) will be produced to meet the original performance specification requirements to which the connector/contact/flat wire cable assembly (previously with solder) was qualified. If no such existing method or tool can be found, the study shall propose the development of a specific method/tool/connector contact design that will be adaptable to the existing rectangular connector on the V-22 aircraft, and provide for individual replacement and retermination of one contact without disturbing others.

PHASE II: Phase II will either assemble existing tools and connectors, demonstrate an acceptable process and test to prove performance, or develop a prototype tool and connector contact and demonstrate performance of the new system.

PHASE III: Possible Phase III for V-22 in-situ repair kit.

COMMERCIAL APPLICATION: Exists in commercial aviation or where similar conditions to those described above exists.

NAVAL MEDICAL COMMAND

N93-049TITLE: Non-invasive In Vivo Tissue Bubble Detector

CATEGORY: Advanced Development

OBJECTIVE: Develop a bubble detector that can quantitatively measure a bubble population within the volume of an in vivo specimen, using non-invasive, non-destructive techniques.

DESCRIPTION: Advances in decompression research require the ability to detect and measure the number and size of bubbles that form and grow in situ in the soft solid tissues of biological specimens. Non-invasive, non-destructive detection techniques are mandatory. The detector must quantitatively measure bubble populations between 10 microns (Ï) and 1000 microns (Ï). Both the absolute size of the bubbles, and the bubble count for each size are needed. The device will be of practical research value if it can interrogate tissue volumes of at least one cubic centimeter (1 cc). Larger volumes are preferable. Since bubble formation and growth in tissue is a dynamic process, and may occur rapidly under conditions of severe decompression stress, shortest possible specimen interrogation times are desired. Interrogation times should be on the order of hundreds of milliseconds, if possible. Instrument output must be in a format that allows direct and real time use by computer hardware and software for data recording and statistical analysis. The final deliverable will include all hardware and software that is needed to

provide a computer monitor and hardcopy print out of absolute bubble size and population distribution. The device must be capable of enduring an indefinite number of exposures to rapid compression/decompression between ambient (sea level) pressure and approximately one thousand feet of sea water pressure (460 pounds/in^2).

PHASE I: At the end of the six month effort, the expected product is a detailed technical report evaluating the likelihood that a working prototype of the above-described bubble detector can be fabricated within the subsequent two years. The report should include an examination of all candidate technologies to achieve the objective, and a detailed justification for selecting the preferred technology. All anticipated theoretical and practical impediments to prototype development, including problems of instrument calibration should be addressed explicitly, along with the detailed strategy for overcoming those impediments.

PHASE II: At the end of a two year effort, the expected product will be a fully functional prototype bubble detector that meets or exceeds the specifications described above in the OBJECTIVE and DESCRIPTION sections of this document.

PHASE III: A phase III effort is anticipated, for refinement of the prototype, as well as for the preparation and delivery of finished units. Finished units will include an owner's manual containing both use and maintenance instructions. All items for user calibration will be included with the finished units if the detector design requires periodic user calibration.

NAVAL SEA SYSTEMS COMMAND

N93-050TITLE: SSN21 Battery Floating Voltage Equalizer

CATEGORY: Exploratory Development

OBJECTIVE: Develop a voltage equalizer ensuring proper floating voltage for full charge of each battery cell on SSN21, thereby also extending its life and reducing maintenance.

DESCRIPTION: Manufacturing tolerances, impurities in make-up distilled water and aging cause variations in floating conditions between the battery cells to remain fully charged. When a cell is not fully charged, its voltage level falls and its plates become sulphated. As a result, a cell will lose capacity.

PHASE I: Assess state-of-the-art systems for controlling battery float voltage. At the end of the first month, provide a letter report summarizing the results to the government for information.
Design and fabricate breadboards for testing with a minimum of two test circuits of six SSN21 battery cells at a Government battery test facility in accordance with a test plan provided by the Government.

PHASE II: Upon successful completion of Phase I demonstration, prepare for government approval a procurement specification for an Engineering Development Model.
Design and fabricate Engineering Development Models for testing with a minimum of two test circuits of the SSN21 battery cells for one year. Document the manufacturing process in detail as it actually occurs. Provide level 2 drawings for the Engineering Development Model. Prepare a final report on the Engineering Development Model test results. In this report, discuss test results, limitations of the design, design changes to improve performance and reduce production cost, recommend manufacturing process improvements and discuss lessons learned.

PHASE III: Navy funding - to qualify this hardware for shipboard installation - is contingent and may be provided depending upon the proposals received, the Naval priorities assigned the Phase III efforts, and the quality of the results produced.

N93-051TITLE: Crevice Corrosion Prevention

CATEGORY: Exploratory Development

OBJECTIVE: Development of a method to reliably provide cathodic protection (or other method of preventing Crevice Corrosion) at the flange faces of Alloy A-625 pipe flanged connections.

DESCRIPTION: The proposed method must apply to a large number of sites on shipboard piping systems (on the order of 100-500 sites). Cost should be less than or equal to the application costs of Hastelloy C-276 weld overlays. A cost breakdown for a typical C-276 welding task is available from the Defense Technical Information Center.

PHASE I: Develop the proposed approach by demonstrating that the proposed electrochemical (or other) solution is feasible and will probably be both effective and cost-effective. Provide complete schematics or diagrams of the proposed methodology as it would be applied to a simple pump loop piping system with at least five flanged connections. Identify associated operation and maintenance requirements. Provide a detailed test plan, schedule and cost estimate for Phase II.

PHASE II: Run a minimum of a one year test on no less than ten, 4î (pipe size) mated flange samples in 6 fps flowing ASTM (or natural) Seawater and ten similar samples in quiescent ASTM (or natural) seawater, each with at least five control samples. Demonstrate that the applied methodology prevents crevice corrosion well within the normal temperature range of natural seawater. Develop application or installation procedures for the proposed methodology as they apply to both piping systems already in operation, and those not yet built (if different).

PHASE III: Navy funding - to pursue installation of a fully operational prototype system on SEAWOLF - is contingent and may be provided depending upon the proposals received, the Naval priorities assigned the Phase III efforts, and the quality of the results produced.

N93-052TITLE: Electromagnetic Interference Qualification of Submarine Components by Extension

CATEGORY: Exploratory Development

OBJECTIVE: To develop an extension plan or tool for Electromagnetic Interference (EMI) qualification of equipment, specifically motors, used on SEAWOLF Class submarines, with potential use for future ships.

DESCRIPTION: SEAWOLF Ship Specifications require all motors to be tested to demonstrate the EMI requirements of MIL-STD-461C, "Electromagnetic Emission and Susceptibility Requirements for the Control of Electromagnetic Interference" are met. There are numerous motors used on SEAWOLF that are similar in design and could potentially be qualified by extension after successful EMI testing of similar motors (same manufacturer, same basic design). This effort is intended to provide a cost effective means for qualifying motors to the EMI standards of MIL-STD-461C.

PHASE I: Phase I should determine if a family of motors from one manufacturer and of similar design can be qualified by extension after testing a sample set of motors (i.e., the smallest size motor and the largest size motor). The criteria for motors to be considered for extension should be determined. The limits on differences between motors to be extended and the actual motor(s) tested should be established.

PHASE II: Develop a user friendly manual which provides quantitative and qualitative EMI extension methods. The Phase II effort shall verify the accuracy and determine the limitations of the quantitative and qualitative extension techniques. Phase II efforts would involve proving the acceptability of the Phase I developed plan and criteria through application and testing. Provide change pages for updating MIL-STD-461.

N93-053TITLE: Fault Tolerant Processor (FTP) Life Cycle Maintenance

CATEGORY: Advanced Development

OBJECTIVE: Define troubleshooting and repair requirements for SEAWOLF FTPs for life cycle maintenance including diagnostic software, card testers, and system analyzers.

DESCRIPTION: Submarine ship control requires highly reliably hardware components, which include FTPs. Life cycle maintenance of FTPs is an important aspect of ship’s maintenance, and state-of-the-art techniques for testing and troubleshooting need to be explored. Requirements for life cycle maintenance of the FTPs need to thoroughly examined in order to incorporate the latest diagnostic tools such as diagnostic software, specialized card testers, and system analyzers. A security level of CONFIDENTIAL is required for personnel and the facility.

PHASE I: Evaluate and analyze the FTP troubleshooting and maintenance requirements and how they can be accomplished. Produce a final report containing the maintenance requirements and outlining a plan for implementing the life cycle maintenance plan.

PHASE II: Design and develop prototype hardware and software to perform troubleshooting and diagnostics on the FTPs including specifications and drawing of the diagnostic and test tools that have been developed.

PHASE III: Navy funding - to develop finalized production specifications and drawings for the life cycle maintenance tools; code, build or procure the diagnostic and test tools based on the approved specifications and drawings; and develop an implementation/installation plan for the tools on board submarines and at testing facilities - is contingent and may be provided depending upon the proposals received, the Naval priorities assigned the Phase III efforts, and the quality of the results produced.

N93-054TITLE: Remote Battery Disconnect

CATEGORY: Advanced Development

OBJECTIVE: Minimize energy input from the SEAWOLF Submarine Emergency Propulsion Battery to a fire or other uncontrolled discharge by isolating the battery into as many segments as possible.

DESCRIPTION: The device or subsystem must be operable from a remote location, cannot be intrusive of normal battery operation, even under emergency conditions, and must be highly reliable, the system easily restored to normal operation after isolation, and the isolation device or subsystem maintainable by ship's force personnel.

PHASE I: Develop the concept proposed; schematically or pictorially show its operational and physical interfaces with the SEAWOLF battery installation, generally describe its operational and maintenance requirements; provide detailed Phase II development schedule and cost estimate.

PHASE II: Provide detailed design for Navy approval of the proposed `breadboard' prototype, build, test and demonstrate the approved `breadboard' prototype system on actual SEAWOLF battery cells. Submit a final report on the test results.

PHASE III: Navy funding - to pursue first article manufacture and qualification for use on the SEAWOLF Submarine - is contingent and may be provided depending upon the proposals received, the Naval priorities assigned the Phase III efforts, and the quality of the results produced.

N93-055TITLE: Light Weight Syntactic Foam

CATEGORY: Exploratory Development

OBJECTIVE: Develop a Syntactic Foam or similar material which can be used to provide positive buoyancy to submarines by filling void spaces.

DESCRIPTION: The material must have a density not greater than 20 pounds per cubic foot, and a coefficient of compressibility not less than 150ksi (200ksi is desirable). Water absorption must be near zero. Any containment must be included in the density calculation.

PHASE I: Locate and describe the current status of research for the basic material structure proposed, develop methodologies for manufacture and test of the proposed material; and provide justification supporting why the proposed material is expected to meet the objective requirements. Provide a detailed Phase II plan, schedule and cost estimate.

PHASE II: Manufacture and test sample material. Provide samples to the Navy for independent comparison tests. Demonstrate density, compressibility, water absorption, acoustic qualities (noise generation and/or absorption of a sample installation under simulated at-sea conditions) and shock resistance.

PHASE III: Navy funding - to pursue first article qualification for use on SSN 21 and other submarines - is contingent and may be provided depending upon the proposals received, the Naval priorities assigned the Phase III efforts, and the quality of the results produced.

N93-056TITLE: Galley Exhaust Hood Improvement

CATEGORY: Advanced Development

OBJECTIVE: To improve the grease and aerosol removal efficiency and thereby eliminate the fire hazard and maintenance burden of the Galley Exhaust hoods aboard Navy submarines and surface ships.

DESCRIPTION: The Primary considerations for design of the galley exhaust hoods are the ability to capture, contain, and remove the heat and aerosols (grease, smoke, water vapor, etc.) being generated during the cooking process. The hood design must prevent the aerosols from contaminating the exhaust ductwork and components located downstream of the hood. Present contamination creates a potential fire hazard and increases maintenance efforts in ductwork downstream of the hood. Studies completed by the Navy, as well as, experience reported from the fleet, indicate that the galley exhaust hoods used in both submarines and surface ships do not adequately remove grease aerosols from the galley exhaust air. The exhaust hoods use an inertial type mechanism for grease removal. ASHRAE has reported that inertial extraction methods are ineffective for particle sizes less the 5 microns. The Navy study also revealed that during the cooking process, the particle distribution ranged from less than 1 microns to 35 microns. The objective of this topic is to develop a galley exhaust hood that will remove all aerosols, including those less than 5 microns. The final hood design must meet the vibration, shock, and acoustic requirements for SSN 21. The ideal galley exhaust hood design would require minimal retrofit changes on submarines and surface ships.

PHASE I: Upon completion of Phase I, the proposer should have completed a concept demonstration of a device/system which will efficiently remove grease and aerosol particles ranging from 1 micron to 35 microns. Testing of the concept design shall demonstration particle removal efficiency versus particle size (from 0 to 45 microns), versus particle quantity in parts per million, versus time duration in hours, and versus air flow rate in cubic feet per minute. Periodicity for maintenance actions shall be developed and reported.

PHASE II: Upon completion of Phase II, the proposer should have a working model of a galley exhaust hood system which will replace Navy shipboard galley exhaust hood systems. Ideally the galley exhaust hood system design would replace the galley exhaust hoods on Navy submarine and surface ships without requiring modifications to the ship design. The model should incorporate the concept device of Phase I and meet the vibration, shock and acoustic requirements for SSN 21.

PHASE III: Navy funding - to complete first article qualification for installation aboard SSN 21 with potential backfit installations aboard Navy submarines and surface ships having galley exhaust hood grease removal problems - is contingent and may be provided depending upon the proposals received, the Naval priorities assigned the Phase III efforts, and the quality of the results produced.

N93-057TITLE: Seawater Distilling Plant Steam Overpressure Trip Valve

CATEGORY: Engineering Development

OBJECTIVE: Develop a design for a noise quiet cost effective seawater distilling plant steam overpressure trip valve for use on submarines.

DESCRIPTION: The Navy needs a low noise and low cost steam overpressure trip valve for use in the steam supply piping of seawater distilling units aboard submarines. Innovative low cost concepts are sought which meet distilling plant requirements and the SSN 21 acoustic requirements. Confidential level, facilities will be required for acoustic evaluation.

PHASE I: Develop multiple design concepts for Navy consideration. Provide a report with concept drawings which discusses the limitations, pros and cons of each design. Compare the production and life cycle costs of each design. Identify possible changes to Spec PSSSN21C-388 which would lower procurement costs while satisfying the valve functional requirements. Provide supporting rationale and analyses for recommended changes to PSSSN21C-388 for each concept. Emphasis of design attributes will be quietness, manufacturing cost, simplicity of concept, reliability and life cycle cost.

PHASE II: Design and build a prototype for the valve concept selected by the Navy and evaluate performance and acoustic capabilities by testing. Design the valve to satisfy PSSSN21C-388 with cost reduction changes, as approved by the Navy. Develop a manufacturing process plan prior to manufacture. Manufacture the valve and document the manufacturing process as it actually occurs. Simulate full scale production during the manufacturing process vice single prototype fabrication methods. Test the acoustic and functional performance of the valve. Make design changes and manufacturing process changes, based on manufacturing feedback and test results. Manufacture the new valve design and document the manufacturing process as it actually occurs. Test the acoustic and functional performance of the new valve. Document both valve designs and changes, manufacturing processes and changes, test results, and lessons learned in a final report. Identify recommendations which could further improve valve performance and reduce manufacturing cost.

PHASE III: Navy funding - to complete first article qualification (e.g. endurance, shock and vibration) for use on SSN 21 and other Navy ships - is contingent and may be provided depending upon the proposals received, the Naval priorities assigned the Phase III efforts, and the quality of the results produced.

COMMERCIAL APPLICATION: Commercial shipping, desalinization plants, etc.

N93-058TITLE: Effect of Fouling on Acoustic Performance of Fan Outlet Devices

CATEGORY: Research

OBJECTIVE: Quantify the loss of acoustic attenuation created by fouling of outlet devices on SSN 21 vaneaxial fans, and recommend maintenance practices necessary to sustain design performance.

DESCRIPTION: Outlet devices are used on SSN 21 vaneaxial fans to attenuate fan generated noise. Several of these devices use a compressed felt metal material which is known to be come less effective with fouling. The fouling is a combination of lint and condensed aerosols. Oil contamination is considered the primary reason for loss of acoustic attenuation. Inorder to develop an effective maintenance action plan, the Navy must be able to quantify the loss of attenuation versus fouling rate. A Confidential facility clearance is required for this effort.

PHASE I: Develop a test plan and procedure to measure acoustic levels downstream of several SSN 21 fan compressed felt metal outlet devices, and to evaluate several possible methods for cleaning the outlet devices. Prepare the test plan and procedure to simulate 15 years of use in a typical submarine engine room environment to evaluate a) the loss of acoustic attenuation versus in-service time due to fouling; b) the effectiveness of cleaning techniques; c) the effect drying time has on acoustic attenuation for wet cleaning methods; d) time required to clean the outlet devices; e) degradation of the compressed felt metal due to fouling and cleaning. Develop possible design changes to extend the effective operating period of the outlet devices. These design changes should be within the capability of Ship's Force. Include these design options in the test plan.

PHASE II: Conduct tests and evaluations per the Navy approved Phase I test plan and procedure. Provide an in depth report which discusses the test results and lessons learned. In the report, provide recommended periodicities for performing each cleaning method studied, and possible design changes to improve long term performance of the outlet devices.

N93-059TITLE: Improved Adhesives for Seawater Applications

CATEGORY: Exploratory Development

OBJECTIVE: Develop alternative adhesives for bonding non-metallic materials to metals for use on U.S. submarines in a seawater environment (this adhesive would be used primarily to bond a new proprietary polymer alloy bearing material to Cu-Ni and alloy 625).

DESCRIPTION: The Navy has develop a new acoustically superior propulsion system bearing design that uses a polymer alloy bearing material. The design requires that the polymer alloy material be bonded to copper-nickel and alloy 625 shells for installation into the bearing housing. The objective is to develop an adhesive material that is easy to apply, cures at room temperature and will not debond in temperature ranges of at least 0-100_F.

PHASE I: Conduct a study to evaluate alternative adhesive materials for the application described and make recommendation for the adhesive that best meets the stated requirements. Provide a report which describes the limitations, pros and cons of the adhesives studied. Describe the effort that would be required to complete a phase II effort.

PHASE II: Fabricate and test samples of bearing material adhesion to copper-nickel and alloy 625 to evaluate bond strength before and after thermally cycling the sample through the minimum temperature range specified. Conduct shock and vibration tests to evaluate structural integrity of the bond. Provide description of Phase III effort.

PHASE III: Navy funding - to pursue testing in the actual application - is contingent and may be provided depending upon the proposals received, the Naval priorities assigned the Phase III efforts, and the quality of the results produced.

N93-060TITLE: Methodology and Tools for Improving Logistics Information Systems in Ship Acquisition and Support

CATEGORY: Exploratory Development

OBJECTIVE: The development of methodologies/tools which facilitate the Navy's assimilation and display of logistic engineering data for ship acquisition and support.

DESCRIPTION: Various computerized tools and data bases have been developed which have improved the management and assimilation of logistics and engineering data associated with ship acquisition and support including the LSAR, ROMIS and SCLSIS. At some time in the future when the CALS initiative is realized these data bases will be integrated with others to facilitate integrated display and exchange of common data. A major need exists, however for additional methodologies and tools which can be implemented in the near term to help the Navy further improve the accuracy and availability of required data during the ship acquisition process and serve as a focus for the CALS architecture.

PHASE I: Develop concepts for the candidate architectures and methodologies and provide a rationale for; (a) the utility of the final product in increasing the efficiency and effectiveness of the ship acquisition and support process and (b) the feasibility of near term implementation of the proposed concepts.

PHASE II: Refine the concepts proposed in phase I and the development of prototype tools.

N93-061TITLE: Methodology and Tools for Improving the Effectiveness of Acquisition Logistics Training

CATEGORY: Exploratory Development

OBJECTIVE: To develop methodologies/tools to increase the effectiveness of the Navy's acquisition logistics training.

DESCRIPTION: In recognition of the fact that logistic requirements have increased dramatically over the past fifteen years, there is increased emphasis on streamlining the logistic process to (1) eliminate redundant requirements, (2) increase the quality of data, and (3) increase the level of integration between logistics and engineering. In concert with these streamlining initiatives, and in an effort to increase the degree to which logistic considerations are factored into the design process, a major need exists to provide training on the streamlined logistic requirements to acquisition support personnel within both the engineering and logistics communities.

PHASE I: Phase I should develop candidate training concepts, implementation methodologies and tools for providing acquisition logistic training to disparate groups of acquisition professionals and should provide strong rationale for both (a) the feasibility of implementing the proposed concepts and (b) the utility of the final product in increasing the effectiveness of the Navy's acquisition process.

PHASE II: Phase II would involve the refinement of the concepts developed in Phase I and the development/delivery of a prototype system.

N93-062TITLE: Microwave Filter

CATEGORY: Exploratory

OBJECTIVE: Development of a microwave tunable filter suitable for use in transmit/receive modules.

DESCRIPTION: Many modern radar and communications concepts employ microwave transmit/receive (T/R) modules. It is desirable to use a T/R module with a large bandwidth. However, using broad band modules with filter selectivity results in susceptibility to receiver spurious responses. Additionally, selectivity permits higher transmit power amplifier efficiencies. It is desired that an innovative tunable filter be developed and demonstrated for T/R module use. The primary purpose of the filter is to improve power amplifier efficiency. As such, the electrical and mechanical interface with the T/R module must be considered. Such a filter should have characteristics of the following order:

Frequency:1 to 20 Ghz (One filter type need only cover a 50% bandwidth)
Bandwidth:Less than 10% of center frequency with 30 Db suppression
Power handling:Greater than 40 Dbm
Tuning response: Less than 10 microseconds
Insertion loss: Less than 0.25 Db
Size: Compatible with a single element T/R module.
Power: Less than 250 milliwatts

PHASE I: Develop filter concepts for Phase II construction and evaluation.
PHASE II: Perform detailed design, build, and test of candidate filters.
PHASE III: Navy funding is contingent and may be provided depending upon the proposals received, the Naval priorities assigned the Phase III efforts, and quality of the results produced.

N93-063TITLE: Near Ocean Environment Sensor

CATEGORY: Exploratory

OBJECTIVE: Development of an near ocean environment sensor. Detailed knowledge of the near ocean environment is needed as an input to radar ducting and electro-optical sensor models used to predict the performance of shipboard surveillance systems.

DESCRIPTION: The primary requirement is for a sensor that provides near real time reports of refractivity profiles from a given surface ship to the horizon. Refractivity over both land and ocean should be considered. Additionally, it is desired that the sensor measure wave heights and provided directional information. The sensor must employ remote sensing techniques; i.e. radiosondes are not permissible. The sensor may be located shipboard, or existing offboard assets may be fused aboard ship to provide the required data.

PHASE I: Conduct a feasibility and design study. Sensor performance requirements should be defined, and a system concept formulated. A critical design review should be conducted and a final report issued.

PHASE II: Fabricate a field test unit, and define a production design. Preliminary testing should be conducted in a laboratory environment followed by at least two ocean trials. A critical design review should be conducted prior to each test. A complete system design will then be finalized and final report issued.

PHASE III: Navy funding is contingent and may be provided depending upon the proposals received, the Naval priorities assigned the Phase III efforts, and quality of the results produced.

N93-064TITLE: Sensor Tactical Decision Aid

CATEGORY: Advanced Development

OBJECTIVE: Development of a sensor tactical decision aid. In the future, the Navy may be faced with surreptitious attacks in a situation of undeclared war. The locale of the future is likely to be littoral. This environment stresses the performance of sensors such as radar and infrared. Threats may also be masked by terrain or countermeasures.

DESCRIPTION: It is desired that a system which predicts the performance of radar and infrared (IR) in a littoral environment be developed. The system should utilize fundamental radar parameters such as power, pulse width, beam programming, and sub-clutter visibility. Analogous factors should be considered for IR. Radar, but not IR, propagation factors due to non-linear refractivity profiles should assumed to be supplied. However, environmental factors such as target characteristics, weather, season, time of day, and terrain must be considered in this development.

PHASE I: The proposed design approach including data inputs and outputs, equipment, computer program functions, and operator interactions should be documented. A skeleton system with rudimentary capability should be demonstrated at completion of Phase I.

PHASE II: One system should be prototyped in its entirety and evaluated in a laboratory and field environment.

PHASE III: Navy funding is contingent and may be provided depending upon the proposals received, the Naval priorities assigned the Phase III efforts, and quality of the results produced.

N93-065TITLE: Frequency Synthesizer

CATEGORY: Research

OBJECTIVE: Development of a high performance affordable frequency synthesizer.

DESCRIPTION: Many radars and communications systems employ microwave frequency synthesizers. It is desired to extend the benefits of frequency synthesis to a broader range of applications including missiles. Such application has been limited due to cost, weight, and space constraints. Such a synthesizer should have characteristics of the following order:

Frequency Range: 12 to 14 Ghz
Tuning Response: Less than 10 microseconds
Frequency Settability: 1 Mhz
Size: Less than 0.2 cubic feet
Weight: Less than 5 pounds
Stability: Equivalent to best commercial synthesizers

PHASE I: Develop a concept for the synthesizer and quantitatively predict its performance.

PHASE II: Perform detailed design, build, and test of the Phase I concept.

PHASE III: Navy funding is contingent and may be provided depending upon the proposals received, the Naval priorities assigned the Phase III efforts, and quality of the results produced..

N93-066TITLE: Mechanical Seal(s) for Contra-Rotating Propulsion Shafts

CATEGORY: Exploratory Development

OBJECTIVE: Design a mechanical seal(s) for contra-rotating propulsion shafting.

DESCRIPTION: The seal(s) must meet the material and leakage requirements of existing Navy approved seals and be sized for a contra-rotating shaft arrangement driving a pair of contra-rotating propellers with a combined power

of 50,000 shp. The design must: adequately seal both shafts, provide for maintenance from inside the ship without drydocking the ship, and be affordable.

PHASE I: At the end of 6 months, the contractor should have designed the seal(s), identified the installation and maintenance requirements and limitations and estimate the unit production cost of the seal(s).

PHASE II: At the end of 2 years, the contractor should have built small (1/10th) scale model of the seal(s) for demonstration at the Navy's lab, incorporated any design changes required as a result of the testing and prepared final drawings of the seal(s). Special design parameters, relationships, etc. must be defined at that time.

N93-067TITLE: Structural Fabrication Tolerances and Structural Details

CATEGORY: Exploratory Development

OBJECTIVE: Develop the methodology to establish the shipbuilding tolerances and details for ship structures on a reliability basis so as to minimize ship construction cost.

DESCRIPTION: Current Navy specifications for structural tolerances are not based on failure and may be overly conservative. A recent survey, (Ref. (a)), found few criteria for commercial ships. The recommendation of Ref. (a) to develop criteria based on structural reliability is needed to reduce ship construction costs.

PHASE I: Review current ship structure specifications for tolerances and requirements for structural details. Determine if any rational basis other than tradition exists for these specifications. Develop the methodology for application of structural reliability principles to assess the significance of these parameters on ship structural performance. Develop means of assessing shipbuilding cost to evaluate the impact of alternative requirements.

PHASE II: Analyze ship structure designed in accordance with current specifications for the impact of shipbuilding tolerances and structural detailing on structural reliability. Develop alternative specifications based upon reduced shipbuilding cost. Estimate the cost savings associated with the implementation of these improved specifications.

PHASE III: Based upon the expertise developed in Phase II, market the technology to shipbuilders for the purpose of reducing shipbuilding cost. During this phase the technology should be expanded to include other fabrication techniques, including welding parameters, assembly procedures, and overall structural design. Further extend the methodology to assess defects that occur in service to establish reliability-based maintenance plans.

N93-068TITLE: Use of Composite Material for MCM Aft Deck Machinery

CATEGORY: Exploratory Development

OBJECTIVE: Development of fabrication method for utilizing composite material for aft deck machinery on minesweeping ships. Past and on-going R&D efforts have demonstrated the feasibility of using composite material for 33-inch diameter propeller shafts and for hydraulic cylinders withstanding 4500 psi internal pressure. Minesweeping machinery is a natural candidate for adopting the use of composite material due to the material's light weight, corrosion resisting and non-magnetic properties. Substantial weight savings would result if the cable reels could be fabricated with composite material.

DESCRIPTION:

PHASE I: Feasibility study on the use of composite material for the manufacture of minesweeping cable reels. Efforts will include investigating the candidate material, the method of fabrication and the method of attachment to metallic material.

PHASE II: Test and evaluation of selected fabrication sample of composite material cable reels will be conducted to verify the applicability of the Phase I study.

N93-069TITLE: Methods to Reduce Emissions from Diesel Engines

CATEGORY: Exploratory Development

OBJECTIVE: Develop methods to reduce or treat exhaust emissions from Diesel Engines and gas turbines.

DESCRIPTION: The EPA and the California Air Resources Board (CARB) are imposing tighter emission requirements for Diesel engines and Navy Diesel engines will have to comply. Most diesel engine manufacturers are addressing this issue to assure compliance with the proposed requirements. Some of this technology may be retrofitted to existing Naval diesels, however, the cost may be prohibitive. Furthermore, the Navy has diesels which are no longer supported by the manufacturer. Investigate various methods and technologies which could be used to reduce NOx to 600 ppm and 130 ppm for existing and new engines respectively. It is also desired that hydrocarbon emissions be concurrently reduced. Reduction of crankcase emissions should also be addressed. The methodology and hardware configuration should be adaptable to a variety of existing diesel engines.

PHASE I: Develop designs with drawings and engineering calculations which demonstrate the feasibility of reducing emissions from Diesel engine exhaust. The contractor shall provide the impact of the technology on weight, space, effect on arrangements and performance, and the expected unit cost.

PHASE II: Refine the design from Phase I with final engineering calculations and test the system on a Navy laboratory engine to determine its performance, reliability and maintainability. Also, provide an update of the cost estimate.

N93-070TITLE: Under-ice Remote Detection System (RDS)

CATEGORY: Advanced Development

OBJECTIVE: To develop a system for the detection of ice-borne vibrational signals from both in-transit and ice-picked submarines.

DESCRIPTION: The detection of under-ice targets is a very difficult task due to various environmental factors. Prior investigations using geophones and hydrophones have confirmed that submarines transiting at normal depths couple significant energy to the ice pack. A complete understanding of the coupling mechanisms is not well understood. The subject system should be capable of detecting energies at long ranges using any available sensing technologies. The system design should compensate for own-ship motion and should be designed for implementation within the limited space requirements of a submarine platform. The system should operate independent of all other surface/sub-surface systems and should require no off-board or AUV-type sensor. The proposed approach should not require any communication through the ice to a detection aircraft and should not require own-ship to come in contact with the ice canopy.

PHASE I: Develop concept design (30-50 pages) that will provide details on operational theory, system design, functional and operational characteristics, and projected cost requirements. Each proposal will be reviewed by a combined Navy, university and consultant team with the successful candidate being chosen for experimental development during Phase II.

PHASE II: Contractor shall develop a detailed system design package and fabricate one experimental sensor system. Contractors shall perform in-house laboratory (bench) testing of system to ensure operability and functionality according to contractor developed, Navy approved, test documentation. A report detailing the results of the in-house testing will be developed by the contractor. NAVSEA will then plan and coordinate at-sea testing of the system. Contractors will assist in at-sea testing and develop a "quick-look" test report 3 weeks after testing is completed and a final Summary Test Report within two months thereafter. The final test report should include an analysis of all recorded data and a detailed assessment of system performance.

PHASE III: Navy funding - for the design and fabrication of an Advanced Development Model (ADM) - is contingent and may be provided depending upon the proposals received, the Naval priorities assigned the Phase III efforts, and the quality of the results produced.

N93-071TITLE: Tactical Oceanography Support of Mining and Mine Countermeasures Operations

CATEGORY: Advanced Development

OBJECTIVE: Apply tactical oceanography principals to optimize the efficient employment of mines and mine countermeasure sensors and equipment.

DESCRIPTION: Tactical planners lack an automated planning tool for mining operations that uses detailed environmental and oceanographic data as an input into the development of an optimum minefield design. Environmental factors such as bottom slope, currents, and tides can have a significant impact on the effectiveness of individual mines and the entire minefield.
Airborne, surface and Explosive Ordnance Disposal (EOD) tactical mine countermeasures units currently lack automated sensor and equipment employment guidance based on detailed environmental and oceanographic data. The lack of employment guidance hinders effective operational planning and system effectiveness. Specifically, the environmentally driven deficiencies include: Predicted performance (detection and classification ranges against various mine threats) and employment recommendations (sonar depth, pitch, and track spacing) for the variable depth mine hunting sonar based on the historical or in-situ environment of the tasked area;Employment recommendations (such as output ratings and track spacing) for surface and airborne influence countermeasures equipment based on the historical or in-situ environment of the tasked area; and Predicted EOD diving and mine neutralization system employment windows based on predicted acceptable environmental parameters (currents, tides, and visibility). Advances in the connectivity of environmental data (including oceanographic and atmospheric) and the digitizing of related support products such as high resolution charts would permit the development of an automated tool that addresses these needs.

PHASE I: The phase I effort will result in:A detailed evaluation of the critical performance factors associated with current U.S. Navy mines and principal mine countermeasure sensors and equipment; A decision structure for optimum minefield design and optimum employment of the sensors and equipment based the operating environment; A module structure that will integrate within existing decision aids; and A proof of concept software demonstration.

PHASE II: The phase II effort will result in completed development of mining and mine countermeasures tactical decision aids in accordance with the phase I design. The module will be supported by an intuitive, user interface.

PHASE III: Navy funding - for transition of software modules to APP products and integration in existing fleet systems - is contingent and may be provided depending upon the proposals received, the Naval priorities assigned the Phase III efforts, and the quality of the results produced.

N93-072TITLE: Multi-Warfare Tactical Decision Aid

CATEGORY: Advanced Development

OBJECTIVE: To develop an embeddable, rule-based expert system to support decision making for multiple emergent Naval warfare missions. This expert system module will contain individual components (one for each addressed warfare area) tailored to the decision support requirements of that mission.

DESCRIPTION: Current tactical decision aids focus on providing commanders with environmental and tactical information necessary to conduct deep water ASW missions. As the focus of Naval warfare shifts to other mission areas (e.g., shallow water ASW, diesel ASW, mine warfare, special warfare, and strike warfare), the decision aids must adapt to new warfare roles. One of the problems to be solved is, given the correct information at the correct level for the current system user, how is the information used in conjunction with specific mission objectives and established mission conduct methods, to optimally employ assets to maximize the potential for success. Different warfare missions will require entirely different approaches and decision planning recommendations. The objective of this research will be to evaluate the decision support requirements for various warfare missions, establish a mission specific rule/knowledge base, and develop an expert system based software module that provides mission planning and execution recommendations as a function of warfare area.

PHASE I: A detailed study of mission related decision criteria and development of a rule base for a selected candidate warfare area (e.g., strike warfare).A design for an expert system based planning and execution module in support of multi-warfare missions planning and execution.A proof of concept software demonstration.

PHASE II: Complete development of the multi-warfare expert system based decision support module described above in accordance with the phase I design. The module will be supported by an intuitive user interface and will be ready for integration within existing fleet tactical decision aids.

PHASE III: Navy funding - for expansion to other identified warfare areas and potentially the tailoring of the module for cross-service applications - is contingent and may be provided depending upon the proposals received, the Naval priorities assigned the Phase III efforts, and the quality of the results produced.

N93-073TITLE: Sonar Search Tactics Optimization

CATEGORY: Advanced Development

OBJECTIVE: Perform advanced development of automated track planning optimization considering search mission constraints; searching platform characteristics and capabilities; environmental concerns; and threat definition.

DESCRIPTION: Traditionally acoustic performance prediction (APP) systems provide performance predictions and aid in the development of an ASW search plan, but provide little or no automated support for track planning based on current ASW search tactics. Advanced development related to track planning optimization is required to keep pace with more complex sensor suites, the addition and evaluation of new search tactics, and the increasingly complex task of track planning. The system should support generation of track plans based on search plan, mission constraints, environmental data, and threat definition inputs, and should evaluate candidate track plans with regards to overall search requirements. In addition, any system developed must allow operator interaction at various levels of the optimization process or provide the operator the ability to investigate and override the optimization recommendation.

PHASE I: Develop a prototype track planning optimization software module. The module must be ready for integration within existing fleet tactical decision aids for test and evaluation.

PHASE II: Expand the effort to cover additional sensors/platforms and tactical scenarios.

PHASE III: Navy funding - Extend module applicability to multi-ship track planning - is contingent and may be provided depending upon the proposals received, the Naval priorities assigned the Phase III efforts, and the quality of the results produced.

N93-074TITLE: Surface Ship and Submarine Automated Acoustic Search Planning

CATEGORY: Advanced Development

OBJECTIVE: Perform advanced development of automated sonar system employment optimization considering the search mission constraints; searching platform characteristics and capabilities; environmental concerns; and threat definition.

DESCRIPTION: Traditionally acoustic performance prediction (APP) systems provide performance predictions for one acoustic sensor at a time and do not truly support acoustic sensor suite search plan optimization. Advanced development related to sonar suite search plan optimization for both surface ships and submarines is required to keep pace with more complex sensor suites and the increasingly complex task of search planning. In addition, any system developed must allow operator interaction.

PHASE I: The phase I effort will result in development of a prototype surface ship or submarine sensor suite search planning optimization software module. The module will be ready for integration within existing fleet tactical decision aids for test and evaluation.

PHASE II: The phase II effort will expand the effort to cover additional sensor suites and tactical scenarios.

PHASE III: Navy funding - for transition of software modules to APP products for integration in existing fleet systems - is contingent and may be provided depending upon the proposals received, the Naval priorities assigned the Phase III efforts, and the quality of the results produced.

N93-075TITLE: STANDARD LOW COST DISPLAY CONSOLE

CATEGORY: Advanced Development

OBJECTIVE: Develop a low cost submarine combat system display console utilizing mil-std-2036 as a guide or technical requirements and commercial off the components

DESCRIPTION: Development of a low cost multi-function console to support the full range of combat system display functions and Navy requirements for operability (Man Machine Interface), performance, and supportability. Concept shall include initial design utilizing state of the art technology with methodology to allow future cost effective insertion of technology growth.

PHASE I: Phase I would involve development of a procurement specification detailing requirements to procure a universal Next Generation Computer Resources (NGCR) compatible display console to be capable of performing all submarine non propulsion electronics display functions (Combat Control, Acoustics, Communications, ESM, Ship Control, Photonics Periscope). The end item product would be a specification adequate to support competitive procurement of a low cost (maximum of $200K each) universal display console.

PHASE II: Phase II would involve utilization of the procurement specification to procure one display console and perform a demonstration showing the console meets the specified interface requirements.

N93-076TITLE: Passive Automation

CATEGORY: Advanced Development

OBJECTIVE: Develop data fusion techniques that will automate the detection and classification processes for acoustics.

DESCRIPTION: The shallow water, high noise environment that the sonar operator must deal with presents a very complex problem. The detection and classification processes must be automated to the extent possible in order to reduce this complexity and allow for reduced manning of existing and future acoustic systems. This project will focus incorporating non-traditional signal processing techniques into the association and correlation of target parameters to improve detection performance and minimize the false alarm rate. The resulting algorithms will be validated against recorded sea data.

PHASE I: Identify candidate non-traditional signal processing data to be incorporated into the passive automation algorithms and recommend techniques for including this data in the automated detection and classification algorithms.

PHASE II: Prototype the algorithms and validate performance against recorded sea data.

N93-077TITLE: Supportability of Commercial-Off-The-Shelf (COTS) Products in Military Systems.

CATEGORY: Advanced Development

OBJECTIVE: This project will address potential techniques for the support of commercial products in military systems and highlight those techniques that will provide the lowest cost, "best-value", life cycle support for those products.

DESCRIPTION: With the thrust of lower cost military systems comes significant emphasis on the use of COTS products for the implementation of those systems. There are two (2) key issues associated with the use of COTS

products in military systems. (1) Know performance limitations, and (2) Life Cycle Support. Relative to known performance limitations, commercial software products do not typically identify known limitations of "glitches". If these products are used in weapon targeting systems how can the Navy be assured that these limitations do not impact the performance of the system or the delivery of the weapon on target? How will software documentation be affected and what is the impact on standards such as MIL-STD-2167A? This project will address techniques and tools required to ensure performance and maintainability while maximizing the cost benefit of COTS. Relative to life cycle support, military systems have a typical life expectancy of twenty years or more while commercial products have a life cycle of 5 years or less. Various techniques for supporting the longer life cycle will be evaluated. An evaluation of these techniques will include cost modeling to determine the best technique for maximizing the cost advantages of COTS hardware.

PHASE I: Identify techniques and tools required to ensure performance, maintainability and acceptable life cycle cost for COTS implementations.

PHASE II: Using the candidate techniques and tools identified in Phase I, evaluate each of these techniques to show which are most cost effective. Compare with existing system implementation to show the overall cost advantage of commercial implementations.

N93-078TITLE: Utilization of High Resolution Color Displays for Sonar Data

CATEGORY: Advanced Development

OBJECTIVE: Reduce operator workload and improve operator response time through the use of high resolution color displays for acoustics.

DESCRIPTION: High resolution displays (i.e. 2048 x 1538 pixels) as well as multiple colors allow sonar data to be presented in ways not possible in today's systems. This project will address innovative display techniques for the presentation of acoustic data that will make it easier for the operator to understand the information being presented. For example, color can be used as a third dimension and relate additional information to the operator to understand the information being presented. For example, color can be used as a third dimension and relate additional information to the operator such as bearing rate. This technique has been shown to improve near MDL detections by as much as 2-3 Db. Other techniques such as quantizing to 256 grey shades instead of 8 make a significant difference in the operators ability to discern subtle patterns in the gram data. These techniques in addition to those needed to present top-level summary data will be evaluated as a part of this project.

PHASE I: Develop and demonstrate display enhancement techniques for acoustic data

PHASE II: Prototype the techniques recommended in Phase I using Commercial-Off-The-Shelf hardware and demonstrate using recorded sea data.

N93-079TITLE: High Frequency (HF) Skywave Recognition Using Small Baseline Antenna Arrays

CATEGORY: Exploratory Development

OBJECTIVE: To develop techniques to automatically differentiate, in "real time", HF (1 to 30 Mhz) signals that are propagating by pure groundwave.

DESCRIPTION: In some Naval scenarios it is valuable to be able to rapidly identify signals that are being transmitted from locations within the area of tactical interest. In case of HF transmissions, those signals that are propagating by other than direct groundwave can often be considered to be beyond the area of tactical interest. Additionally, the performance of some direction finding antenna arrays is degraded by signals arriving from high elevation angles with rotating polarization resulting from reflection off of the E-Layer. For these reasons it would be useful to be able to identify these skywave signals as they are received by the on board antennas. These antennas are generally less than 16 inches in diameter.

PHASE I: Develop a technical approach for the automated recognition of received HF signals propagated by a skywave path. This includes the analysis of the electromagnetic propagation mechanism and effects on the received signal characteristics. Define the receiving antenna and receiver characteristics required to process the

signal and describe and processing algorithms that must be developed. Show how existing submarine antenna types used in this frequency range can be used to provide this capability. Provide a detailed technical report describing the study results.

PHASE II: Design and construct a set of equipment to demonstrate the skywave recognition capability. This equipment must be suitable for use with existing submarine antennas or with modifications of these antennas. Demonstrate the performance of the equipment at a land-based site and subsequently install the equipment onboard a submarine for a test demonstration underway at sea.

N93-080TITLE: Knowledge Based Processing as Applied to Reduced Manning

CATEGORY: Research

OBJECTIVE: To develop knowledge based applications that can be incorporated on submarines to reduce the manpower requirements for submarine operations.

DESCRIPTION: Since future submarines will require reduced manning in order to reduce slip size and operating costs, knowledge based applications that can be incorporated on submarines to reduce manpower requirements are needed. Multiple applications which are currently performed on submarines require human operators. Several of these applications are candidates for incorporation of knowledge based processing.

PHASE I: Investigate the feasibility of incorporating expert systems into submarines systems to reduce the number of manned watch stations. This investigation will include combat systems (CS), non-propulsion electronics (NPE) and Hull Mechanical and Electrical (HM&E) systems. A report will be the product of this initial phase.

PHASE II: Prototype and demonstrate up to 3 applications of knowledge based systems reported in Phase I.

NAVAL SURFACE WARFARE CENTER/DAHLGREN

N93-081TITLE: Low Cost Miniature G-Hardened Inertial Navigation Sensor (INS) for Gun Launched Projectiles

CATEGORY: Exploratory Development

OBJECTIVE: Develop a miniature, low cost, gun launchable, three axis inertial measurement sensor.

DESCRIPTION: This SBIR topic seeks to develop a miniature INS which can be packaged within a 60mm projectile with a cylindrical interior volume 40 to 50mm in diameter not exceeding 50mm in length including all signal conditioning and I/O but exclusive of power source. The unit shall be capable of surviving and operating within specification after the application of at least 30,000 Gs of set back acceleration normal to the cylindrical face of the packaging volume. Lateral and set forward accelerations shall be 3,000 and 10,000 Gs, respectively. This INS configuration is intended as a sensor suite for an autopilot or airframe stability augmentation system. Performance specifications for the INS shall be developed by the contractor and should be applicable to a variety of missile and projectile systems. The INS does not have to operate before or during gun launch acceleration, however, the unit should be ready to operate in < 0.3 sec after the application of power. The INS shall also be insensitive to temperature variations and operate in a reliable fashion for at least 30 seconds. Production cost goal for 5,000 units is $3,000.

Alternative Configuration: An alternative packaging scheme will be for a 127mm (5") or 120mm projectile in which the cylindrical interior volume available for packaging will be 4.3 to 4.6 inches in diameter and less than 2.0 inches in length including all signal conditioning and I/O but exclusive of power source. This INS configuration is intended as a sensor suite for an inertial navigation system. Drift rate performance specifications for this INS configuration shall be < 1.0 nautical miles per hour (< 0.5 desirable) and < 10 degrees per hour (< 5 desirable). It may be assumed that the static offsets of the INS accelerometers and rate sensors can be effectively removed by an external and independent inertial reference system such as GPS. Other performance specifications shall be developed by the contractor and should be applicable to a variety of missile and projectile systems. The INS does not have to operate before or during gun launch acceleration, however, the unit should be ready to operate

in < 2.0 sec after the application of power. The INS shall also be insensitive to temperature variations and operate in a reliable fashion for at least 5 minutes. Production cost goal for 5,000 units is $3,000.

PHASE I: A final report describing theory of operation, estimated performance, technical risks and a proposed phase II and phase III statement of work.

PHASE II: Hardware demonstrations and other technical documents which verify predicted performance both before and after gun shock tests. Hardware may be "brassboard" (not necessarily form and fit) in areas of the design which are not affected by component size, mass, electrical configuration or packaging.

PHASE III: Navy funding - to demonstrate form, fit and function hardware performing as predicted and specified in the Phase I study portion of this program - is contingent and may be provided depending upon the proposals received, the Naval priorities assigned the Phase III efforts, and the quality of the results produced.

COMMERCIAL POTENTIAL: Exists in the automotive and oil industry.

N93-082TITLE: Long-Life Lithium Thermal Battery Technology

CATEGORY: Exploratory Development

OBJECTIVE: To develop high energy, long life, thermal batteries.

DESCRIPTION: Current ASW Surveillance Systems are emitted by the low power capabilities of their batteries. The objective of this topic is to develop lithium thermal batteries capable of delivering as succession of high power pulses over a period of 60 minutes. Clearly, significant advance battery lifetimes are called for.

PHASE I: Will evaluate transition metal compounds for alternative cathodes. Cathode materials are needed with capacities in excess of 0.2 Ah/g and are much more thermally stable than iron disulfide. Ideal candidates would be nontoxic and also have higher discharge voltage than iron disulfide. Tests will be done in single cells.

PHASE II: The best cathode will be evaluated in small 20 cell batteries and practical cells will be built and tested to verify the safe delivery of high power densities.

PHASE III: The results of Phase II will transition into the office of Naval Technology's High Energy Battery Project of the NS3B Block for further development. Follow-on effort to be negotiated as a Task under the Naval Surface Warfare Center's Mines Technology Area Block Program, SD3B.

COMMERCIAL POTENTIAL: Exists for portable electric welders.

N93-083TITLE: Energetic Phosphazene Polymers

CATEGORY: Exploratory Development

OBJECTIVE: Research and development of synthesis pathways to organic phosphites containing energetic groups, as precursors for the development of energetic phosphazene polymers.

DESCRIPTION: Polyphosphazenes are inorganic macromolecules containing a flexible backbone of altnerating P-N atoms. The properties of the polymer can be controlled or altered by varying the nature of the substituents attached to the phosphorus atoms in the polymers chain. An entirely new class of energetic phosphazene polymers should be capable of synthesis in which the substituents are nitroalkoxy groups. These polyphosphazenes may have great potential to exhibit a wide range of unique chemical and physical properties and superior performance-sensitivity characteristics compared to conventional (C-C or C-N backbone) polymers.

PHASE I: This research will develop synthetic methods for the preparation of phosphites containing energetic alkocy substituents such as fluorodinitroethoxy, 2, 2-dinitropropoxy and 2, 2, 2-trinitroethoxy. These compounds will be fully characterized by chemical and physical properties and superior performance-sensitivity characteristics compared to conventional (C-C or C-N backbone) polymers.

PHASE II: The Phase II plans of the research and development effort will address the large scale preparation of selected compounds prepared in Phase I. Additional basic research and development work will be required to maximize synthetic efficiency for selected target compounds. Sufficient material should be synthesized

and forwarded to the Naval Surface Warfare Center, Dahlgren Division, for larger scale preparation of polyphosphazene polymers for energetic performance evaluations.

PHASE III: Anticipated Phase III transitions are the investigation of these polymers as energetic plasticizers, binders in PBXs, melt cast explosives and homogeneous insensitive explosives comparable to RDX and HMX. Follow-on effort to be negotiated as a Task under Naval Surface Warfare Center Dahlgren Divisions Explosives and Undersea Warheads Technology Area Block Program, SD3A.

COMMERCIAL POTENTIAL: Exists in energetic materials, explosives and propellents.

N93-084TITLE: Near-Real-Time Data Fusion

CATEGORY: Exploratory Development

OBJECTIVE: Development of a tactical decision aid for employment of weapon system resources.

DESCRIPTION: In the world of the future, the Navy may be faced with surreptitious attacks, possibly coordinated, in a situation of undeclared war, or terrorism. The locale of the future is likely to be littoral. This environment stresses both the reaction time of weapons systems and the performance of sensors such as radar and infrared sensors. Threats may be masked by terrain, camouflage, or ECM. Threats may include missiles, aircraft, and tactical ballistic missiles. Additionally, the number and capability of onboard and offboard sensors is growing. Also, the options for countering these threats are increasing. Additionally, tactical databases are becoming larger and more readily accessible. To prevent saturating tactical decision makers, the Navy must rapidly fuse available data. It is desired that a near-real-time data fusion (NDF) system prototype tactical decision aid for employment of weapon system resources be developed and evaluated. Among the many variables this system must consider are the threat environment, operation of sensors and weapons in their natural environment against these threats, and the ship's location relative to threats.

PHASE I: The proposed system design approach including data inputs and outputs, equipment, computer program functions, operator interactions, networks, data flows and databases should be documented. At least one of the critical issues should be demonstrated in a prototype or model to be delivered upon completion of Phase I.

PHASE II: One system will be prototyped in its entirety and be evaluated in a laboratory environment.

PHASE III: Navy funding is contingent and may be provided depending upon the proposals received, the Naval priorities assigned the Phase III efforts, and the quality of the results obtained.

COMMERCIAL POTENTIAL: Exists in the aircraft communications industry.

N93-085TITLE: Improved Underwater Target Identification Through Optical Processing

CATEGORY: Exploratory Development

OBJECTIVE: Develop a high speed multichannel optical correlator for onboard sonar range-doppler processing of suspected underwater targets.

DESCRIPTION: The search for underwater targets with sonar results in a difficult data analysis problem to detect and identify moving targets in the presence of extraneous noise (clutter). Modern optical technology offers a way to significantly improve processing gain in both active and passive sonar systems. A parallel optical correlator will use light sources, detector arrays and storage media in time integrated correlation to produce processing gains on the order of 50 Db without the use of lasers or other methods of optical interference. A simple system would use either moving film or a rotating disk (or cylinder) to transmit target reference signals through an illuminated aperture. These signals are correlated with the light source modulated by signal data. Extremely reliable, compacts low cost and low power signal processing correlation should be possible by combining existing optical components. A system capable of 50 db processing gain in 1000 or greater parallel channels (at least 1000 points of each correlogram computed in parallel) is desired, signal conditioning techniques to enhance processor performance should be included.

PHASE I: Provide an optical correlator design which includes synchronization with existing sonar signal processing systems.

PHASE II: Build and test a breadboard optical processor based on the Phase I design. Deliverables should include a design analysis, a design documentation package and the breadboard processor.

PHASE III: Navy funding - to transition this work to further develop the prototype for use in existing or future antisubmarine warfare systems - is contingent and may be provided depending upon the proposals received, the Naval priorities assigned the Phase III efforts, and the quality of the results obtained.

COMMERCIAL POTENTIAL: Exists in oil exploration, undersea salvage and medical imaging industry.

N93-086TITLE: Safe, High Performance Rechargeable Batteries for Underwater Vehicle Propulsion

CATEGORY: Exploratory Development

OBJECTIVE: To develop safe, high performance rechargeable batteries for underwater vehicle propulsion.

DESCRIPTION: The Navy is developing a high energy, rechargeable lithium battery that will significantly extend the capabilities of naval underwater vehicles, such as the SEAL delivery vehicle. The lithium/cobalt oxide ($Li/LixCo0_2$) electrochemical couple has been successfully demonstrated in 30 Ah capacity, hermetic cells. When compared to 30 Ah silver oxide/zinc (Ag0/Zn) cells, the lithium cells gave more charge-discharge cycles with 40-50% greater energy density. Although $Li/LixCo0_2$ out performed the Ag0/Zn technology, its cycle life was limited by the formation of dendritic shorts when charging the lithium electrode. If the metallic lithium anode were replaced with a carbonaceous lithium ion electrode, significant improvements in cycle life might be attainable. It is anticipated, furthermore, that this system would also be safer since it reduces the I^2R heating caused by dendritic shorts.

PHASE I: Identify carbon anode materials that offer significant improvements in specific capacity over petroleum coke. The anode will be optimized for high rate capabilities, cycle life and energy density. Using data obtained from the Navy's 30 Ah $Li/LixCo0_2$ study, the energy densities of 30 and 400 Ah lithium ion/cobalt oxide cells will be projected.

PHASE II: The optimized anode identified in Phase I will be coupled with the cobalt oxide cathode. Small hermetic cells will be built and tested to verify the safety and performance of this system. Using these results, in combination with the ongoing $Li/LixCo0_2$ data, new projections will be made for a 30 and 400 Ah cell.

PHASE III: Navy funding - to transition into Office of Naval Technology's High Energy Battery Project (NS3B) for further development - is contingent and may be provided depending upon the proposals received, the Naval priorities assigned the Phase III efforts, and the quality of the results obtained.

COMMERCIAL POTENTIAL: Exists for electric vehicles.

N93-087TITLE: Refractory Diboride Composites

CATEGORY: Exploratory Development

OBJECTIVE: Develop a processing approach for a near theoretical density continuous fiber diboride/diboride composite.

DESCRIPTION: Diboride materials (of Zr and Hf) were investigated in the 1960's and were found to be highly ablation-resistant to oxidizing propellants. However, the thermal stress resistance of the monolithic materials was not satisfactory. Continuous fiber composite materials are attractive for very high temperature applications, such as rocket nozzles and reentry body leading edges, due to the possibility of incorporating high-strength fibers to eliminate brittle failure and, thus, improving thermal stress resistance. With current investigations underway to develop diboride fibers for intermetallic matrix composites, a process is needed to infiltrate and densify a diboride fiber preform with a diboride matrix.

PHASE I: Effort should provide evidence that the desired composite fabrication is possible. Ideally, analyses should be performed to show the feasibility of the approach and key experiments performed for verification. Process should allow for minor variation in matrix composition to provide augmented strength, oxidation resistance, etc. In addition, control of fiber/matrix interface characteristics is required and means for such control should be provided.

PHASE II: Effort would identify composition variations and respective processing parameters for improved strength or oxidation resistance, produce simple composite geometries, and provide mechanical and oxidation property data to show that scale-up to full-size components is warranted in Phase III.

PHASE III: Follow-on effort to be negotiated as a Task under the Naval Surface Warfare Center, Dahlgren Division's Weapons and Spacecraft Materials Technology Area Block Program, SD2A.

COMMERCIAL POTENTIAL: Exists in the satellite industry.

N93-088TITLE: Low-Earth Orbit Environment

CATEGORY: Exploratory Development

OBJECTIVE: Design and construct a laboratory facility which simulates the atomic oxygen environment of spacecraft in low-earth orbit.

DESCRIPTION: Currently there are few facilities capable of simulating the corrosive environment which atomic oxygen has on materials in low-earth orbit. A facility is sought which contains an ion source capable of producing a low energy atomic oxygen beam for irradiating samples in a vacuum chamber. Capabilities of this facility include:

Beam Energy Range - 2 - 10 ev/atom
Minimum Neutral Oxygen Atom Fluences - 5 x 10 (15) atoms/cm(2) - sec
Contaminant Level - <0.1%
(incl. molecular Oxygen, ionized oxygen,
ozone, nitrogen and other gases)
Uniformly Irradiated Sample Size - 1 - 10 xm (diameter)

PHASE I: Provide a facility design with a procedure for verifying the purity, energy, and fluence of the source device.

PHASE II: Construct, characterize and deliver a complete facility capable of evaluating spacecraft materials lifetime and survivability in low-earth orbit.

PHASE III: Follow-on effort to be negotiated as a Task under the Naval Surface Warfare Center, Dahlgren Division's Weapons and Spacecraft Materials Technology Area Block Program, SD2A.

COMMERCIAL POTENTIAL: Exists in communication satellites

N93-089TITLE: System Dependability Assessment Methodology

CATEGORY: Exploratory Development

OBJECTIVE: This research will develop a methodology and prototype to assist the system designer in quantifying trade-offs between dependability and other system attributes such as performance, cost, size, weight, power, and security.

DESCRIPTION: One of the crucial requirements of Navy systems is that they must be able to perform critical functions within specified real-time deadlines in stress situations. Systems which are not built on fault tolerant structures cannot handle faults without temporary loss of critical functionality. The purpose of this research is to develop concepts and technologies related to dependability, and provide a prototype to assist the designer in quantifying trade-offs between dependability and other system attributes such as performance, cost, size, weight, power, and security. The prototype will permit analysis of the impact of candidate fault tolerant structures on the

system's design and implementation. Fault avoidance, fault tolerance, adaptability, and graceful degradation are important considerations.

The dependable system design prototype may serve as a proof of concept vehicle for concepts and technologies related to dependability, or it may serve as a testbed for research on the integration of dependability automation support into the systems engineering process.

PHASE I: Work should show feasibility. The proposed methodology should be documented in an initial methodology report. The requirements and design of the prototype should be defined by the end of Phase I. Any critical risk areas of the design should be prototyped to show feasibility of the total approach.

PHASE II: Work should include the full scale development of the dependable system design prototype. Usefulness of the method and prototype should be demonstrated on a sample test case to facilitate transition of the products of the work into Navy systems development. The initial method report should be updated to incorporate Phase II research and any lessons learned during the development of the prototype.

PHASE III: Follow-on effort to be negotiated as a Task under Naval Surface Warfare Center Dahlgren Division's Engineering of Complex Systems Technology Area Block Program, SD2C.

COMMERCIAL POTENTIAL: Exists in various areas, such as commercial avionics, nuclear systems and telecommunication systems.

N93-090TITLE: High Speed Optical Processing for Antisubmarine Warfare

CATEGORY: Exploratory Development

OBJECTIVE: To exploit optical connectivity and the inherent high processing capabilities of optical signal processing and computational systems in order to satisfy the high speed detection and classification requirements of future antisubmarine warfare surveillance systems.

DESCRIPTION: The growth in the information processing demands of advanced antisubmarine warfare surveillance systems is outpacing the improvements in conventional electronic processing technology. For example, there is a square law relationship between sensitivity improvement versus number of passive sonar sensors versus computational power. Computational rates up to 10 to the fourteenth operations per second may be needed to satisfy future demands. Advanced optical signal processing and computing systems, exploiting emerging photonic materials and devices, can have enormous advantages over conventional electronic systems in terms of data throughput and speed. These advantages can be applied to a multiplicity of problems associated with antisubmarine warfare including wideband passive sensor data processing and Low Frequency Analyzing and Recording (LOFAR) analysis for detection, classification and tracking and reducing operator overload.

PHASE I: Develop the theory, concept, specifications and architectural description for a high speed optical processing or computing system for passive sonar signal conditioning, data processing and analysis. Provide detailed technical report.

PHASE II: Design, develop, demonstrate and deliver a working prototype optical processing system for passive sonar data processing and analysis. The system can be packaged as an optical breadboard in rackmount or air transport case size subunits, but must be easily transportable and must be capable of operating on actual sonar data stored on tape or magnetic disk.

COMMERCIAL POTENTIAL: Exists in spectrum analysis and voice recognition.

N93-091TITLE: Real-time Optical Synthetic Aperture Radar Signal Processing

CATEGORY: Exploratory Development

OBJECTIVE: To develop and demonstrate a real-time optical synthetic aperture radar processor for automatic target recognition.

DESCRIPTION: Optical signal processing has enormous advantages over conventional synthetic aperture radar (SAR) signal processing in terms of data throughput and speed. These advantage can be applied to identifying

targets from background scenery. The radar processing system could store information on all aspects of the target in a data bank in the form of templates for high speed pattern matching. The system could be both programmable and adaptive to changing parameters at the SAR input plane. The required SAR image scan rate should be greater than 2000 frames per second and the total system processing time, from radar return to output should be within a few seconds. New and novel optical processing architectures are sought which utilize advanced optical devices and techniques, such as spatial light modulators, two dimensional microlaser diode arrays, holography and high speed photodetectors. Dynamic range, compactness, power consumption and flexibility are also important considerations.

PHASE I: Development of theory, algorithm, architecture, proof of concept modeling and limited demonstration of key concepts.

PHASE II: Design, test, demonstration and delivery of prototype SAR image processing system.

PHASE III: Follow-on effort to be negotiated as a Task under Surface Launched Weaponry Technology Area Block Program, SDIA.

COMMERCIAL POTENTIAL: Exists in search and rescue operations.

N93-092TITLE: Coatings for Diamond Films Used on High Speed Missiles

CATEGORY: Exploratory Development

OBJECTIVE: Identify an oxidation-resistant coating and a procedure for applying it to diamond films which are proposed for
use over the infrared windows and radomes of hypersonic missiles.

DESCRIPTION: The unique combination of mechanical, thermal and optical properties of diamond make it extremely attractive as a protective film material for infrared windows and radomes. However, in these applications the diamond films will be subjected to elevated temperatures in an oxidizing atmosphere which may cause a catastrophic erosion of the film. An oxidizing resistant coating is sought along with a practical technique for applying it to Chemical Vapor Deposition (CVD) applied diamond films. These coatings should possess excellent oxidation resistance at temperatures up to 1573_K, have high erosion resistance, excellent adhesion, and be transparent to infrared and radar frequencies.

PHASE I: Identify a suitable oxidation resistant coating and specify the procedure for applying it to a diamond film which overlays a missile window or radome.

PHASE II: Develop the procedure for coating diamond films and provide coated samples for evaluation.

COMMERCIAL POTENTIAL: Exists in the aerospace industry.

N93-093TITLE: Optical Postprocessing Module for Improved Underwater Target Identification

CATEGORY: Exploratory Development

OBJECTIVE: Develop an optical processing module which acts as an interface between a future optical processor for underwater sonar signal processing and on-board tactical computers.

DESCRIPTION: Future optical processors for underwater signal processing systems will need to be integrated to an optical postprocessing module for efficient operation. This module will contain a Charge Coupled Device (CCD) detector to convert the output of an optical processor into a format which is useful to tactical computers. The module must correct for optical irregularities in illumination, pixel gain, offset nonuniformities due to dark currents and possible contaminants. Also clutter rejections or multispectral tests may need to be performed as well as baseline normalization, edge detection, pixel averaging or other convolution-type functions. In order to perform data reduction, the module should be able to supply the external processor with the addresses and values of individual pixel elements.

PHASE I: A PC board, hybrid or multichip module will be designed which performs the functions of a 12 bit frame grabber and image processing board. The module will be capable of digitizing, storing, summing and otherwise processing the data from a large pixel density CCD array. It is envisioned that a module will have the

capability of storing at least 4 full frames of 10-3 x 10-3 array or larger with the goal of 64 frames. Real time arithmetic processing is also a major goal. In addition, the CCD array support signals and buffering such as the power lines, pixel clocks and integration and reset pulses etcetera will be supplied by the module. The module will have CMOS compatible I/O for exposure and frame timing, pixel clock, programming, data, etc. Designs and design alternatives will be deliverable as a final report.

PHASE II: Definition and Deliverables: A large area CCD array of at least 10-3 x 10-3 pixels will be integrated into a compact processor module which performs the above functions. A complete processor and documentation package will be deliverable items.

PHASE III: This module would make a major contribution to inserting advanced optical signal processing technology into the fleet. A strong possibility exists that several ASW programs would consider using this module to support whatever optical processing technology their particular program used.

COMMERCIAL POTENTIAL: Exists in the oil exploration, undersea salvage, or medical imaging industry.

N93-094TITLE: Process Development for a New Oxidizer for Navy Missile Propellants

CATEGORY: Exploratory Development

OBJECTIVE: To develop a cost-effective method for the isolation of pure nitrogen pentoxide(N2O5) from its solution in nitri acid.

DESCRIPTION: A new candidate propellant oxidizer, ammonium dinitramide (ADN), for low signature propellants has been identified by the Navy. ADN has several advantages over the current oxidizer (Ammonium perchlorate or AP): (1) ADN allows melt-casting of the propellant grain, reducing the cost of the propellant grain and permitting closer control of composition; (2) propellants based on ADN will have a reduced signature and environmental impact because hydrogen chloride is not a combustion product. Further, theoretical calculations show that replacing AP with ADN does not reduce the specific impulse of the propellant.

In order to evaluate ADN-based propellant compositions, the cost of ADN must be significantly reduced. This can be accomplished if we can develop an efficient method to make pure, acid-free N2O5(required in the last step of ADN production).

PHASE I: A fundamental study of separation technologies will be applied to the N2O5/HNO3 system. Low-cost methods such as extraction, membrane diffusion, and phase separation should be explored. The final report shall document the cost, efficiency, operating parameters, product purity, and processing time.

PHASE II: The most promising separation technology identified in the Phase I study will be further refined to minimize cost and maximize N2O5 purity, and then scaled-up to a fully automated prototype system capable of producing ten pounds of pure, acid-free N2O5 per day. The final report shall include a detailed engineering package for the prototype system and typical data records generated during and after prototype development.

COMMERCIAL POTENTIAL: Exists in the pharmaceutical industry.

N93-095TITLE: Miniature, G-Hardened, Fast Acquisition GPS Inertial Navigation Sensor (GPS/INS)

CATEGORY: Exploratory Development

OBJECTIVE: Develop a miniature, gun launched, fast acquisition, 5 channel GPS receiver and antenna system which can be packaged in a 5 inch or 120mm projectile.

DESCRIPTION: This SBIR topic seeks to develop gun launchable, fast acquisition, GPS inertial navigation sensor with five or more channel which can be packaged in <= 2 inches of body length within the interior dimensions of a 5 inch or 120mm projectile exclusive of power source. The GPS/INS shall be capable of a first navigational fix within 2 seconds after the application of power in a non-jamming environment. Time to first fix shall be allowed to degrade as the jamming environment worsens. The GPS/INS shall have the capability to process information from

an Inertial Navigation Sensor (INS) via a navigation and attitude control computer (NAC) which shall be capable of total flight management of the airframe including event sequencing, autopilot functions, navigation & guidance, and fuzing.

The GPS/INS shall include a GPS receiver antenna array (GPS/RxA) which will allow the projectile to maintain a continuous GPS track of at least four satellites (5 preferred) while flying a nominal trajectory. It may be assumed that roll control of the projectile body may be used to point or orient the GPS antennae to facilitate the maintenance of satellite tracks, Other antenna requirements shall be, (1) antennae array(s) may be placed conformally around the projectile body but shall not consume more than 4 inches along the projectile body length, (2) regardless of the azimuth of the trajectory, satellite track shall be maintained while the projectile body changes its angular position In the vertical plane from 60 degrees above the local horizontal to 60 degrees below it at a steady (low-frequency) rate not exceeding 2.5 degrees per second, (3) the antennae system shall maintain satellite track while the projectile body is experiencing high frequency pitch-yaw body oscillations due to guidance, ≤ 3Hz with amplitudes not exceeding 5 degrees.

The entire GPS/INS shall be capable of surviving and operating within specification after the application of at least 30,000 Gs of set back acceleration normal to the cylindrical face of the packaging volume. Lateral and set forward accelerations shall be 3,000 and 10,000 Gs, respectively. The GPS/INS shall also be insensitive to temperature variations and operate in a reliable fashion for at least 5 minutes. Production cost goal for 5,000 units is $3,500.

PHASE I: A final report describing theory of operation, estimated performance, technical risks and a proposed phase II and phase III statement of work.

PHASE II: Hardware demonstrations and other technical documents which verify predicted performance both before and after gun shook tests, Hardware may be "brassboard" (not necessarily form and fit) in areas of the design which are not affected by component size, mass, electrical configuration or packaging.

PHASE III: Navy funding - to demonstrate form, fit and function hardware performing as predicted and specified in the Phase I study portion of this program - is contingent and may be provided depending upon the proposals received, the Naval priorities assigned the Phase III efforts, and the quality of the results produced.

COMMERCIAL POTENTIAL: Exists in the automobile industry.

N93-096TITLE: Low Cost Control System Components for Gun Launched Projectiles

CATEGORY: Exploratory Development

OBJECTIVE: Design/develop Miniature Modular G-Hardened High Torque Motors and Gear Reduction Components (HTM & GRC)for use in conjenction with a low cost, gun launched, dual mode inertial navigation unit, (DMINU).

DESCRIPTION: This SBIR topic seeks to develop gun-launchable, high-torque motor and gear reduction assemblies which will be used to deflect aerodynamic control surfaces on a wide variety of projectile and small missile configurations. The smallest volume constraint will be a single-axis configuration (one plane of control) for a 60mm projectile with a cylindrical interior volume 40 to 50mm in diameter not exceeding 100mm in length including the control shaft, gear reductions, control and power conditioning circuitry and I/O but exclusive of power source. The largest projectile and missile systems to be considered for these components will be approximately 155mm or 6 inches. Components shall be capable of surviving and operating within specification after the application of at least 30,000 Gs of set back acceleration normal to the cylindrical face of the packaging volume. Lateral and set forward accelerations shall be 3,000 and 10,000 Gs, respectively. It is highly desirable that a single high-torque, high-speed motor be capable of supporting a wide variety of control system configurations and performance requirements via multiple motors and a wide range of gear reduction ratios which cover at least one order of magnitude (ex: 10:1 to 100:1). The objective is to trade shaft speed for shaft torque and vice versa as dictated by individual applications. The more complex two-axis (pitch-yaw control) and three-axis (pitch-yaw-roll control) systems are to be constructed by the addition of motor, shaft and gear reduction assemblies. Circuitry containing control, power conditioning and I/O electronics may also be modular in design. Specifications for the smallest projectile application (60mm) is provided below as a point of departure:

Max. Control Deflection ≤ 15 degrees
Max. Airframe Roll Rate ≤ 30 Hz
Max. Control Shaft Rate ε 3000 degrees per second
Aero Control Torque Slope ≤ 5 oz-in per degree
Control Section Bandwidth ε 40 Hz
Damping ε 70% Critically Damped
Repeatability ≤ 1% Full Scale
Resolution ≤ 1% Full Scale
Absolute Accuracy ≤ 3% Full Scale
Production Cost (5,000 units) ≤ $2,000

PHASE I: A final report describing theory of operation, estimated performance, technical risks and a proposed phase II and phase III statement of work.

PHASE II: Hardware demonstrations and other technical documents which verify predicted performance both before and after gun shock tests. Hardware may be "brassboard" (not necessarily form and fit) in areas of the design which are not affected by component size, mass, electrical configuration or packaging.

PHASE III: Demonstrate form, fit and function hardware performing as predicted and specified in the Phase I study portion of this program - is contingent and may be provided depending upon the proposals received, the Naval priorities assigned the Phase III efforts, and the quality of the results produced.

COMMERCIAL POTENTIAL: Exists in the automobile and robotics industries.

N93-097TITLE: Multimode FEL Based Tracking Sensor

CATEGORY: Exploratory Development

OBJECTIVE: Adaptation of THOR Accelerator for Coherent IR Emission

DESCRIPTION: THOR is a long pulse electron accelerator located at NSWC/WO which produces a 1 microsecond, 1-2 kA pulse of electrons in the 2.5 to 3.0 MeV energy range. Recent studies indicate this apparatus has the capability to simultaneously generate high quality coherent mm and IR radiation. Demonstration of this capability would be the predecessor of a "quantum improvement" in tracker performance in the mm and IR regions. It may also lead to an important advance in EW capability.

PHASE I: A feasibility study and preliminary design for modifying THOR to provide IR emissions is the main goal. The preferred approach is to use the system as an oscillator to take advantage of the continuous tuning capability of a FEL. However, consideration of a fallback configuration where the system is used as an amplifier is also appropriate. It would also be desirable to provide an estimate of the expected beam quality.

PHASE II: Hardware implementation of the designs and results of the Phase I program. Any modifications to THOR for generating IR must be compatible with similar modifications for the production of mm waves. The contractor will thus have to closely coordinate work with personnel at NSWC to ensure this compatibility.

PHASE III: Navy funding - in conjunction with the ElectroThermal gun program - is contingent and may be provided depending upon the proposals received, the Naval priorities assigned the Phase III efforts, and the quality of the results produced. COMMERCIAL POTENTIAL: Exists in environmental monitoring.

N93-098TITLE: Self Adjusting Obturator

CATEGORY: Gun Round Improvement

OBJECTIVE: Provide self adjusting obturator seal to accommodate barrel wear in smooth bore advanced gun, firing guided projectiles.

DESCRIPTION: Barrel wear allows blow by of breech gases because the seal of the back pressure plate, or obturator, no longer has adequate squeeze pressure against bore wall. A self adjusting obturator located between cartridge case and the rear of the projectile is needed to improve the life of smooth bore gun barrels. Pressure plate thickness must accommodate 5" projectile dimensions, withstand 30,000 g accelerations, pressures up to 55,000 psi, temperatures of 400_C and bore wear of 0.25" or more.

PHASE I: An obturator solution is needed which will accommodate barrel wear such that the life of a future 5" advanced gun barrel can be extended. A design(s) with description of how it works and sufficient analysis is needed to select an approach(es) for Phase II implementation. A plan for Phase II is required.

PHASE II: A laboratory demonstration (could be conducted at a government test facility), of a sufficient number of samples of the selected design, will be the culmination of
Phase II.

PHASE III: Navy funding - to field test, using a 5" smooth bore gun, following successful laboratory demonstration - is contingent and may be provided depending upon the proposals received, the Naval priorities assigned the Phase III efforts, and the quality of the results produced.

COMMERCIAL POTENTIAL: Exists in industries where self adjusting mechanisms are required.

N93-099TITLE: Instrument for In-Situ Measurements of Special Hull Treatments

CATEGORY: Advanced Development

OBJECTIVE: Develop an instrument to provide real-time in-situ dynamic modulus and state of cure measurements of special hull materials based on an existing laboratory prototype.

DESCRIPTION: The trend towards mold-in-place installations of special hull materials requires that in-situ techniques be developed to insure good quality control of installation. Visual inspections and shore hardness tests are available but no instrument exists to provide the in-situ dynamic modulus measurements which are critical to performance. Measurements of the state of cure are desirable since cure time depends on cure mixture ratio. The Naval Surface Warfare Center has developed a laboratory prototype instrument which can provide dynamic Young's modulus and state of cure measurements of a polymeric system. (Specifications are provided in the reference). This laboratory device needs further development for providing measurements at Navy mold-in-place installations. Specifically, the prototype needs modification and theory development for data reduction to measure thin coatings applied to rigid hull material.

PHASE I: Design a dynamic hardness tester and cure meter based on an extension of the Government prototype for in-situ measurements. Design should include the necessary theory development for data reduction.

PHASE II: Build a commercial prototype instrument based on the Phase I design. Participate in testing instrument at a Navy special hull treatment facility. Provide design documentation and a user's manual.

COMMERCIAL POTENTIAL: Exists in the metal, plastic, rubber and polymeric industries.

N93-100TITLE: Rapid Detection Methods for Biocorrosion

CATEGORY: Exploratory Development

OBJECTIVE: To develop a rapid method for early detection of microbiologically influenced corrosion occurring in Naval seawater piping systems.

DESCRIPTION: Laboratory and field studies, as well as ship corrosion surveys, indicate that microbiologically influenced corrosion (MIC) may be a significant hazard to shipboard seawater piping and heat exchanger systems. Failures have largely been attributed to the action of sulfate-reducing bacteria, but other microorganisms also may be involved. MIC of these systems generally is not detected until failure of the materials occurs. Methods are sought which will detect MIC in shipboard systems before major damage occurs so that preventive treatments can be implemented.

PHASE I: The Phase I product will be the feasibility demonstration of a novel method for rapid detection of MIC.

PHASE II: Navy funding - to develop and test the method for in situ monitoring or periodic testing of shipboard piping and heat exchanger systems - is contingent and may be provided depending upon the proposals received, the Naval priorities assigned the Phase III efforts, and the quality of the results obtained.

PHASE III: A Navy-funded Phase III effort is anticipated if a useful detection system is provided in Phase II.

COMMERCIAL POTENTIAL: Exists in the electric power or any industry using seawater piping or seawater coolant in heat exchangers.

N93-101TITLE: Formulation of Method to Integrate Design Views

CATEGORY: Exploratory Development

OBJECTIVE: This research will develop a methodology and toolset for interchanging and transitioning between alternative system design techniques.

DESCRIPTION: Navy system architectures today are very large scale, complex, and require real time processing. To minimize the cost in the design stage of such a system, a complete detailed analysis needs to be performed. Current methodologies that were used to capture and analyze systems are very divergent and incomplete in terms of supporting today's Navy systems. Because each methodology only tends to cover one specific view of the system, there is the need to integrate all of these views for better understanding in system analysis.

The method developed within this research should show the understanding of different views of the system, such as: Object Oriented, Functional, Behavioral, Scenario Orientated, Implementation. The method should also show the relationship between views. The method should define how to capture the transition between design views. Special attention should be dedicated to the automatic or semiautomatic generation of alternate views and maintain their consistency across all views. Any method or techniques that will be developed should be integrated into a toolset. This toolset should be integrated into existing systems analysis development tools. A structured data base is required to support various type of captured information as well as the relationship between them. This toolset should also have the capability to integrate or interface with various analysis tools to allow the evaluation of system performance.

PHASE I: Phase I work should show feasibility. The proposed methodology should be documented in an initial methodology report. The requirement and design of the tool should be defined by the end of Phase I. Any critical risk areas of the design should have been prototyped to show feasibility of total approach.

PHASE II: Phase II work should include the full scale development of the automated tool. By the end of Phase II, a sample test case needs to be demonstrated to show the usefulness of the method and tool. The initial report should be updated to incorporate the lessons learned during the formulation of the method and the development of the tool.

COMMERCIAL POTENTIAL: Exists in the automobile and communication industries.

N93-102TITLE: Driver for Pointer-Tracker Radar Systems

CATEGORY: Exploratory Development

OBJECTIVE: The objective of this research is to provide and demonstrate a technique for constructing a compact high power, low emittance electron beam source

DESCRIPTION: The purpose of this research is to develop a compact, high power electron beam source. This source should have the following characteristics. The source should be capable of producing a 1 microsecond electron beam with a beam energy adjustable in the range from 1 MeV to 5 MeV with a repetition rate variable up to 1 Khz. The beam voltage flatness should be within 1 % or better for the microsecond pulse duration. The beam current deliverable should be at least 100 amperes at 1 MeV and 20 Amperes at 5 MeV. Preference will be given

for higher current capability and voltage flatness less than 1 percent. In addition, it is desirable to have a minimum instantaneous axial energy spread in the beam or low beam emittance.

PHASE I: The design shall be completed with all pertinent calculations showing its viability. In addition particle in cell simulations should be performed which show the evolution of the electron beam emittance as it passes through the accelerator. In addition, a small benchtop proof of principle demonstration may be performed.

PHASE II: an actual operational device should be constructed. This may be a scaled down version of the final system, however it should incorporate all of the final systems features and successfully answer any design issues which remain before proceeding to a final full scale device.

PHASE III: Transition to a Navy program is anticipated and should be justified on the basis of radar (pointer-tracker) applications. The electron beam source is needed for innovative microwave, mm wave, IR sources.

COMMERCIAL POTENTIAL: Exists in the material processing industry.

N93-103TITLE: Explosions of Coated Boron Particle Clouds in Air

CATEGORY: Exploratory Development

OBJECTIVE: To develop dispersion and ignition of coated boron particle clouds in air and measure blast pressures.

DESCRIPTION: Previous NAVSWC SBIR projects have developed the technology to prepare thinly coated (10 to 100 Angstroms) small boron particles (diameters less than 10 microns) with metals such as magnesium and aluminum. Of interest is the dispersion of the coated boron particles in air to form clouds with subsequent explosion.

PHASE I: Research should focus on proving the ability to inject and form coated boron clouds in air and understand the ignition conditions and measure the explosion blast pressure.

PHASE II: Research should further develop the experimental techniques to disperse and ignite the coated boron clouds with measurement of blast pressures. Experimental conditions such as dispersion conditions, type of metal coating (Mg versus A1), particle size, coating thickness, and coated versus uncoated particles should be systematically studied and related to blast pressure.

COMMERCIAL POTENTIAL: Exists in propulsion systems

N93-104TITLE: Electromagnetic Millimeter Wave Nondestructive Evaluation of Radomes

CATEGORY: Exploratory Development

OBJECTIVE: Develop Measurement System for the nondestructive evaluation of radomes and relate such evaluation to antenna performance.

DESCRIPTION: Glass/epoxy and ceramic radomes are used by the Navy in communication and weapon systems. Radomes affect the performance of the enclosed antenna in regard to boresight error, signal power, phase distortion, sidelobe levels, etc. Anomalies and defects sometimes exist in as-fabricated radomes, and are searched out via a variety of nondestructive evaluation techniques. Special approaches based on minimeter wave technology are sought that can quantitatively relate the anomalies so detected to the performance characteristics of the transmitting and the receiving antennas.

PHASE I: Demonstrate the principles for the design of the proposed measurement system and the analysis for the effects of defects in a radome on antenna performance. Proof of concept testing is required on specimens provided by the Navy.

PHASE II: Construction and delivery of prototype equipment, analysis and software to the Navy.

COMMERCIAL POTENTIAL: Exists in the communication, aerospace and weapon industries.

N93-105TITLE: Equipment Specification Authoring Tool with Multimedia

CATEGORY: Exploratory Development

OBJECTIVE: Develop software to author equipment specifications.

DESCRIPTION: A rules based expert system for authoring specifications based upon MIL-STD-2036 (Navy), "General Requirements for Electronic Equipment Specifications" is required by Navy Program Managers and engineers to assist in tailoring equipment requirements in accordance with Navy policy to allow for the deployment of commercial, ruggedized and full-mil hardened equipment.

By exploiting the technologies of artificial intelligence and multimedia, one integrated software package can be developed to provide a multimedia instruction delivery system about military environments and custom tailor specifications for equipment.

The expert system will be rules based using forward or backward chaining algorithms to reduce equipment requirements. The instruction delivery system will tutor the user on commercial, ruggedized and full-mil equipment. The multimedia images will be sourced from stock Government videos of shock trials, Gulf War deployments, missile launches and environmental testing of equipment.

PHASE I: Show the feasibility of the concept.

PHASE II: Develop a complete user-friendly system for automatically producing specifications for electronic equipment according to MIL-STD. Package system on CD-ROM including all documents relating to MIL-STD-2036 for easy on-line access. Provide users manual for system.

PHASE III: If successful, the application would be of interest throughout the Department of Defense and Industry.

COMMERCIAL POTENTIAL: Exists in industries using expert system databases.

NAVAL UNDERSEA WARFARE CENTER/NEW LONDON

N93-106TITLE: Visualization of Complex Active Sonar Information

CATEGORY: Exploratory Development

OBJECTIVE: To develop innovative techniques for presenting complex tactical sonar information, particularly that used for classification and environmental acoustics analyses, to sonar operators on displays in an easily understandable form.

DESCRIPTION: Active classification data and active sonar environmental acoustics data is multidimensional and complex. Complexity derives from the uncertain quality and the quantity of data to be presented. A wide variety of efforts in developing visualization of scientific data should be relevant to this specific problem. Software and hardware development is not sought under this topic. The techniques would be implemented on independently developed Navy systems. Display technology is no longer an issue, support for visualization techniques exists. The issue is in organization and presentation of information to a sonar operator who has particular experience and education, not to engineers and scientists.

PHASE I: Identify several visualization approaches and methods for evaluating their effectiveness. Develop static representations of approaches.

PHASE II: Would consist of development and evaluation of selected approaches using measurements of effectiveness from Phase I. Prototypes would be developed on displays, furnished by the Government, consistent with tactical system capabilities. Evaluations would be conducted with actual processed data furnished by the Government.

PHASE III: Navy funding - to support development of system requirements for implementation of selected approaches in one or more tactical systems - is contingent and may be provided depending upon the proposals received, the Naval priorities assigned the Phase III efforts, and the quality of the results produced.

N93-107TITLE: Composite Periscope Mast

CATEGORY: Advanced Development

OBJECTIVE: To study the feasibility of using a composite material to replace the existing periscope outer tube.

DESCRIPTION: U.S. submarine periscope outer tubes are designed and manufactured based on the mechanical constraints of stainless steel (Type 304/316 or similar). Given that the periscope is located in the upper part of the ship, the added weight of stainless steel increases the center of gravity, and further, the mechanical strength limits the upper operating speed of a submarine when the periscope is extended. Composite materials offer the possibility of a much higher strength to weight ratio and in some cases, a higher ultimate strength.

PHASE I: Study the applicability and suitability of using composite materials to replace the existing periscope outer tube. The strength of and mechanical characteristics to support the periscope inner mast structure and SUBSAFE issues shall be addressed. Properties which will enable an increase of the existing operating envelope and overall survivability during UNDEX exposure are of specific interest. Phase I will conclude with performance predictions and a trade-off study.

PHASE II: Develop and test prototype hardware. Full design disclosure and test data will be provided to enable transition to and follow-on production.

PHASE III: The possibility exists for full scale production for new periscope masts.

N93-108TITLE: Multispinning of Directionally Solidified Terbium-Dysprosium

CATEGORY: Exploratory Development

OBJECTIVE: Develop melt spinning techniques to form directionally solidified terbium-dysprosium polycrystalline alloy.

DESCRIPTION: The design of rare earth magnetostrictive transducers utilizing terbium-dysprosium at 77 K presents several technical challenges. One is the need for a consolidated laminated stack of thin sections of the material in order to minimize eddy current losses. Fabrication of the pieces using traditional techniques involving machining pieces is very costly. There is a need for thin sections of directionally solidified terbium-dysprosium polycrystalline alloy manufactured in a cost-effective manner. The utilization of melt spinning techniques to form the Tb6 Dy4 material in a directionally aligned thin section will result in a more attractive driver material for inclusion in high power, underwater sonar transducers being exploited under the auspices of the ONT NU3B Block.

PHASE I: The effort will result in a conceptual study and complete plan for the metallurgical techniques. The contractor shall identify technical issues and problem areas expected in the process and construct a specification for the material process. A technical report shall include background and past efforts in the field, plans for Phase II, and expected performance.

PHASE II: The effort will result in the demonstration of the technique in forming thin (much less than 10 mils) strips of aligned material and a pilot run of material for evaluation of its magnetoelastic and magnetostrictive properties. The contractor shall deliver samples of the material (strips not more than one inch in width and weighing approximately 5kg) for testing and characterization at planned intervals in the development. The final delivery shall consist of 10kg of material and a complete technical report.

PHASE III: The Phase III effort will be a transition of the material fabrication technology to the Tactical Active Transducers task under the ONT N03B Submarine/Surface Ship ASW Surveillance Block. Follow on effort to be negotiated as a Task under the Naval Undersea Warfare Center, Newport Divisions Submarine/Surface Ship ASW Surveillance Technology Area Block Program, UN3B.

N93-109TITLE: Low Storage Volume Vertical Array

CATEGORY: Exploratory Development

OBJECTIVE: Develop a low storage volume vertical array construction which, when deployed in the ocean, expands to become a low drag, faired shape.

DESCRIPTION: A vertical array anchored to the bottom and held vertical by an underwater float is a useful sonar array for many shallow water Navy applications. Deployment of these arrays is envisioned to be by submarine, airplane or UUV (unmanned underwater vehicle). These deployment methods place a premium on storage volume. They also make recovery of the array difficult if not impossible which requires that the overall array be low enough in cost to make it disposable. A 200 foot long vertical array requires only 100 pounds of float tension to hold it in its prescribed vertical position. The required cross-section of the vertical array could be less that 0.25" in diameter, and the majority of that is required for a coaxial cable to support data transmission. The overall deployed volume of the array and float can be minimized if the low drag shape is used for the vertical array as opposed to a simple cylindrical shape. This volume can be further reduced for storage if the faired shape is composed of a thin membrane which is inflated after or during deployment of the vertical array. The inflation can be achieved by a small pump, osmotic pressure from the surrounding sea water, or any other method which minimizes storage volume. The task will be to develop such a low storage volume construction while stressing low overall array assembly costs.

PHASE I: Identify low volume array construction and deployment scenarios. Develop and test prototypes. Document advantages and disadvantages of different concepts along with expected construction costs and storage volume.

PHASE II: Develop the equipment and manufacturing technology needed to make long low cost lengths. Produce 200 foot lengths; measure drag coefficient at low speeds and determine packing efficiency.

PHASE III: The Navy would recommend this construction to various Navy vertical array programs where deployment volume is at a premium and low cost is important.

N93-110TITLE: Alternate Periscope Antenna Radome Development

CATEGORY: Advanced Development

OBJECTIVE: To develop a replacement periscope antenna radome using a composite material.

DESCRIPTION: Recent changes in the chemical composition of NORYL syntatic material has had a detrimental effect on the mechanical properties for its use in periscope applications. The Naval Undersea Warfare Center, which is the In Service Engineering Agent for submarine periscopes has been pursuing the problems associated with NORYL used in periscope radomes. While there does not appear to be any direct replacement material, some of the composites have RF and mechanical characteristics that lend themselves to radome applications.

PHASE I: Phase I of this effort is to study and compare several new composite materials which have both structural and RF properties that are suitable for radome applications (i.e., high strength, low radar cross section and low insertion loss). This study shall be based on the Type 8L(Mod T), 15L(Mod T), and 18B/D Periscope applications. Further, a conceptual design(s) will be modeled for those materials which are most suitable, and a table of performance predictions/trade-offs will be provided.

PHASE II: Phase II will fully develop and test prototype hardware. Full design disclosure and test data will be provided to enable transition to and follow-on full scale production.

PHASE III: A possibility exists for full scale production of new periscope antenna radomes and retrofit on existing models.

N93-111TITLE: Nondestructive Inspection Techniques for Composite Material Components

CATEGORY: Engineering Development

OBJECTIVE: To develop and demonstrate nondestructive techniques for internal inspection of composite material components with complex surfaces and a thickness of at least three inches.

DESCRIPTION: The Navy anticipates increasing use of composite materials because of their lower costs and their potential material advantages including acoustic characteristics. One application area for composites is in the fabrication of components for underwater vehicles - for example propellers, launcher impellers. Required are innovative nondestructive techniques for internal inspection of such components both at initial fabrication and during the life of the component. Techniques should be capable of inspecting, in-situ, components at least three inches thick, with complex surfaces and with overlapping parts closely spaced together. The ideal techniques would also permit inspection in seawater.

PHASE I: Proposals should include discussion of: (a) the defect indicators covered by the proposed technique-for example, delamination, presence of voids, fiber direction, fiber waviness, conformation to the design drawings; (b) the resolution of the proposed technique. Develop the technique and demonstrate it sufficiently enough for the Navy to determine whether further work is warranted.

PHASE II: Design, fabricate, and test a prototype of the inspection equipment.

PHASE III: The Navy may be a limited potential customer for some commercial equipment.

N93-112TITLE: Shallow Water Sonar Model for 10 Kilohertz through 500 Kilohertz

CATEGORY: Engineering Development

OBJECTIVE: sonar model, shallow water, predictive sonar model, active sonar, passive sonar, coastal waters

DESCRIPTION: The Navy is concentrating considerable effort to develop hardware systems and tactics to conduct ASW and ASUW in shallow water environments. To further these efforts, a requirement exists for a sonar model that can predict the acoustic environment for active and passive sonars operating at frequencies from 10 Khz to 500 Khz in water depths of 600 feet and less. In the long term, the model should be applicable to the variety of shallow water environments in which future conflicts are likely to occur and should be capable of dealing with the range of bottom types, bottom morphologies, and other critical environmental factors characteristic of such environments. For the SBIR effort, documented data should be used from representative shallow water coastal environments; other models for these environments, to the extent available, should be used as checks.

PHASE I: Demonstration of a partial model operating up to 100 Khz with a check, insofar as possible, against other models.

PHASE II: Development and demonstration of a full model for representative environments.

N93-113TITLE: High Energy Density Propulsion Systems for Underwater Vehicles

CATEGORY: Exploratory Development

OBJECTIVE: To design and demonstrate innovative, high energy density propulsion systems for small underwater vehicles.

DESCRIPTION: The Navy uses a variety of small underwater vehicles such as torpedoes, mines, unmanned underwater vehicles (UUV's). These vehicles can differ considerably in size, but an outer hull diameter of 21 inches maximum is generally not exceeded. The need is for innovative, high energy density propulsion systems for such vehicles. Issues of concern include: cost; environmental compatibility; human physical safety; shelf life. Design issues to be addressed include: type of power; recharge or regeneration time (if proposed power source is reusable); type of propulsor; run time in terms of vehicle size, speed, and depth; size and mass of propulsion system relative to vehicle size; vehicle applicability range. Since a range of proposed approaches is possible, proposals must show sufficient evidence of understanding of problems to be addressed, of system feasibility, and of contractor's ability (experience and knowledge) to carry out proposed work for the Navy to make an informed Phase I award decision.

Proposals can be provided for entirely new innovative systems or for innovative improvements to present systems which will result in significant performance improvements.

PHASE I: Perform system study and analysis. Provide sufficient design decision support to allow the Navy to determine whether additional effort is warranted.

PHASE II: Perform more detailed design and demonstrate key technologies.

PHASE III: Navy funding - for successfully demonstrated key technologies - is contingent and may be provided depending upon the proposals received, the Naval priorities assigned the Phase III efforts, and the quality of the results produced.

N93-114TITLE: Active Vibration Isolation

CATEGORY: Exploratory Development

OBJECTIVE: To develop techniques to actively cancel machinery generated, low frequency vibrations.

DESCRIPTION: Methods of actively canceling low frequency vibration are required to reduce hull transmitted noise from machinery mounted inside torpedo hulls. Current passive mounts are ineffective in attenuating this low frequency energy. Cancellation techniques must be able to identify and cancel a number of discrete frequencies. The active cancellation system must integrate with existing passive mounts and physically fit within the limited space available. Cancellation techniques should be able to address dynamic forces in the 1 - 10 lb range, be as compact as possible and be integrated with a miniaturized control/feedback system.

PHASE I: Project should demonstrate a technique's ability to identify, follow, and cancel a minimum of the 3 highest amplitude peaks in the vibration spectrum of a mounted machinery item between 0 and 1500 Hz.

PHASE II: Expected results from a Phase II project would be a prototype system which would be installed in an actual torpedo and be tested under normal operating conditions.

PHASE III: Navy funding - for a production item in Phase III - is contingent and may be provided depending upon the proposals received, the Naval priorities assigned the Phase III efforts, and the quality of the results produced.

NAVAL AIR WARFARE CENTER/WARMINISTER (NAVAL AIR DEVELOPMENT CENTER)

N93-115TITLE: Satellite Imagery Transmission Technology Development

CATEGORY: Advanced Development

OBJECTIVE: To develop an efficient means of satellite imagery transmission

DESCRIPTION: Currently, the Navy has developed near real-time reconnaissance systems which transmit imagery acquired from high resolution cameras to remotely located command centers via satellite communications link. However, due to the limited data transmission bandwidth (2 to 25 KH_z) available from secured satellite channels, the need exists to develop a means of efficient imagery transmission without sacrificing resolution in areas of interest within the imagery. Thus, innovative methods are sought for representing (compressing) and processing reconnaissance imagery prior to transmission via satellite and for reconstructing the imagery at the receiving station. Issues such as compression, segmentation, feature extraction, error correction and modelling must be addressed.

PHASE I: Will develop performance requirements and provide analysis on best-case, worse case and mean probably performance levels of candidate techniques, and will develop a high fidelity work station conceptual design and a program performance specification.

PHASE II: Implementation and delivery will be accomplished in Phase II.

PHASE III: Transition to surveillance platforms such as the P3, S3 and existing laptop imaging transmission equipment

NAVAL AIR WARFARE CENTER/TRENTON (NAVAL AIR PROPULSION CENTER)

N93-116TITLE: Development of a Barkhausen Noise Technique for Aeronautical Bearings and Gears

CATEGORY: Engineering Development

OBJECTIVE: Develop a Barkhausen noise technique that can be utilized for detecting and preventing detrimental residual tensile stresses in mechanical components.

DESCRIPTION: In the manufacturing of rolling element bearings and gears, finish grinding processes can cause local changes in material properties which impart residual tensile stress into the near surface region of the part. These stresses are detrimental to component life and should be avoided. Unfortunately, current industry-wide NDI techniques are inadequate to detect subsurface tensile stress. The Barkhausen noise method has demonstrated an ability to characterize subsurface stresses up to a depth of 0.0005 inches, but further development is required before this method can be fully utilized.

PHASE I: Consists of evaluating the capabilities/limitations of this method using currently available equipment, and identification of areas in need of further development, including alternate measuring techniques.

PHASE II: Entails further development of the method and application to current materials and design used in aeronautical bearings and gears for possible incorporation into a military specification.

N93-117TITLE: Helicopter/Tilt-Rotor Gear Box Debris Monitoring System

CATEGORY: Engineering Development

OBJECTIVE: To develop and efficient and reliable system for monitoring gear box wear debris, providing advanced warning of impending failure, and capturing the debris for analysis.

DESCRIPTION: Current chip detectors in use in aircraft do not provide adequate early warning of impending failures. When indication occurs, it is not known how quickly the debris was generated, or what size the particles(s) were. Current systems have three drawbacks, they are prone to false indications, they do not provide adequate warning because they do not trend the debris generation and they do not adequately collect the debris for analysis. The goal of this effort is to develop a debris monitoring system that eliminates false indications, improves the wear particle capture efficiency, and develops associated algorithms for accurate failure identification.

PHASE I: Conduct the design review of all available technologies for debris monitoring, and demonstrate the enabling technologies meeting the design requirements. If no such technology exists conduct a study with recommendations for a design that will meet the requirements.

PHASE II: Use Phase I results to integrate and evaluate the monitoring system in an aircraft gear box. Evaluation may be during aircraft ground testing or gear box rig testing.

PHASE III: A Navy Phase III effort is anticipated.

NAVAL COMMAND, CONTROL & OCEAN SURVEILLANCE CENTER/RDT&E DIVISION (NAVAL OCEAN SYSTEMS CENTER)

N93-118TITLE: Thermally Conductive Coatings for Aluminum Hardware

CATEGORY: Advanced Development

OBJECTIVE: To develop a thermally conductive coating for the protection of aluminum hardware from the effects of corrosion and abrasion in the marine environment.

DESCRIPTION: The Navy requires a protective coating for aluminum alloys which provides protection from corrosion in the marine environment and abrasion due to frequent handling. "Hard anodize" (MIL SPEC MIL-A-8625C, Type III) has been used for years for this purpose, but has been found to be too thermally insulating to be

used for high-efficiency steam condensers which are used in marine propulsion. Recent tests at Nrad have shown that certain plated metal coatings have potential for providing the necessary protection as well as good thermal conductivity. Electroless Nickel coatings carefully applied on 6061-T6 aluminum (4 mil thick) showed minimal corrosion after 1000 hours in a B117 salt spray chamber. The desired operational performance desired is several years lifetime in a marine environment without significant corrosion and without scratches due to handling.

PHASE I: Produce a metal coating with the potential of withstanding the equivalent of 2000 hours in 5% neutral salt spray with no significant corrosion failure and no penetrating scratches due to handling. In this effort evaluate the following aspects of the coating procedure:
(1) Pretreatment of the aluminum hardware.
(2) Use of undercoats to reduce porosity or galvanic corrosion due to pinholes.
(3) Electrolytic versus electroless plating.
(4) Multilayered coating strategies.
(5) Post-treatments, sealants.
(6) Tests for the prediction of the coating performance.

PHASE II: Optimize the potential coating(s) developed in phase I and apply to a SCEPS condenser.

PHASE III: Navy funding - to transition the technology into the MK 50 torpedo production and other advanced torpedo and underwater vehicle systems - is contingent and may be provided depending upon the proposals received, the Naval priorities assigned the Phase III efforts, and the quality of the results produced.

N93-119TITLE: Multi-Octave Passive VHF/UHF Antenna Technology

CATEGORY: Exploratory Development

OBJECTIVE: To develop a small, lightweight, broad-beamwidth, multioctave antenna which has a useable gain greater than 0 dBi and which can operate without degradation of these characteristic parameters in the presence of a 3.3 Watt per meter squared power density.

DESCRIPTION: There is an existing need within the Navy to remotely monitor shipboard radio frequency (RF) emissions over the specified frequency spectrum. As a result, affordable, broadband electromagnetic field probes which may be packaged into small, lightweight systems are being sought. For frequencies above 500 Mhz, small multioctave antennas are already available. Below 500 Mhz, the antennas become excessively large with less relative frequency coverage. The present task addresses this problem and requires the entire 30 - 500 Mhz frequency range.

PHASE I: Should include design, fabrication, and demonstration of a proto-type antenna.

PHASE II: Should involve the further development, packaging, and performance improvement required for system insertion of the candidate antenna.

PHASE III: To be negotiated as a Task under Surface Ship Technology Area Block Program, SCIB.

N93-120TITLE: Integrated Broad Band Receiver-Transmitter Technology

CATEGORY: Exploratory Development

OBJECTIVE: To solicit new concepts and approaches in integrated broad band receiver-transmitter technology which satisfy current deficiencies in size, weight, signal distortion, phase coherency, rapid scanning, programmability, adaptability, and receiver processing of sophisticated signal formats.

DESCRIPTION: Rapid Advancement of Ultra Broad Band Radar technology has created a very apparent need to refine the architecture and organization of surveillance/targeting and provide a fully integrated ultra broad band receiver-transmitter system to detect, classify, and identify a wide range of covert radar emitters. The fully integrated system must also be capable of (1) detecting extremely small radar cross section targets such as sea skimming and cruise missiles, (2) providing high resolution range measurements of the order of a few centimeters which can discriminate between objects such as real missile warheads and decoys, (3) providing improved

capabilities for penetrating foliage, earth, or walls which is of particular interest for detecting relocatable targets, and (4) reducing sensitivity to electronic countermeasures. The methods of search, acquisition, and tracking must be addressed with plans for maximizing the throughput of useable data, while achieving rapid acquisition. A system of autonomous operation for the accurate direction finding/location, classification, and identification of radio emitters as applied to drone aircraft and missiles requires improved solutions.

PHASE I: Will address approaches to increasing the signal bandwidth of a radar system, will identify the most suitable approach, and will perform sufficient analysis and design to indicate a reasonable probability of success in Phase II for feasibility demonstration.

PHASE II: Will use the approach defined in Phase I to develop and deliver hardware/software to the Government for test and evaluation.

N93-121TITLE: Tunable Narrow Band Optical Filters for the Blue-Green Spectral Region

CATEGORY: Exploratory Development

OBJECTIVE: To develop tunable narrow optical filter in the blue-green spectral region between 450 and 550 nm.

DESCRIPTION: The Navy has sponsored the development of optical filters for various communications systems over the last two decades. Generally these filters have had very narrow optical narrow bandwidths, but only operate at fixed wavelengths. The Navy currently has application for narrow band (on the order of 1 angstrom) filters that are tunable over the entire blue-green spectral region. The filters must be capable of tuning to any arbitrary wavelength in the spectral range in less than 1 second. Filters proposed under this topic need not have large apertures (apertures down to one square centimeter are acceptable), but the technology should lend itself to scaling to larger apertures (perhaps as large as 1 square meter).

PHASE I: Should address the design and critical technical issues associated with the production of these new filters. PHASE II: Should provide a high quality prototype filter with a maximum bandpass of a one Angstrom, that is tunable over a spectral range from 450 to 550 nanometers.

PHASE III: Follow-on effort to be negotiated as a Task under the Naval Command, Control and Ocean Surveillance Center, RDT&E Division Laser Technology Area Block Program, CS2C.

NAVAL SURFACE WARFARE CENTER/CARDEROCK (DAVID TAYLOR RESEARCH CENTER)

N93-122TITLE: Malone Cycle Compressor and Expander

CATEGORY: Exploratory Development

OBJECTIVE: Develop Malone Cycle Cooling for Potential Shipboard Use

DESCRIPTION: The Navy has a requirement to replace CFC refrigerants in shipboard air conditioning and refrigeration machinery. The Navy solicits proposals that address development of compressors and expanders for use in Malone Cycle cooling.

PHASE I: Demonstrate compressor and expander that will operate using Malone Cycle (liquid) fluids with a critical temperature of approximately 70 to 200 degrees F.

PHASE II: Develop prototype Malone Cycle Cooler system that uses sea water at 88 degrees F as the heat rejection reservoir. Size, weight, power consumption, reliability, and safety are critical parameters.

PHASE III: If Phase II is successful, full scale development will be considered for future ship systems (PE63721N or PE63513N).

N93-123TITLE: Active Control Systems For Ship Silencing

CATEGORY: Exploratory Development

OBJECTIVE: Develop active controllers for more effective ship silencing.

DESCRIPTION: Devices currently used for ship silencing have been designed by passive means such as isolation and damping treatments. To further reduce the noise on the shipboard and noise generated through interaction with water, active means for controlling the ship noises in various aspects should be considered. Current interest particularly lies in mounting active devices on the ship hull to isolate the shipboard noise from being transmitted to the water or preventing the reflection of the incoming acoustic signals from the echo-ranging projector. Active control systems for such applications are needed. This topic solicits proposals for innovative concepts to advance the technologies involved, with emphasis on the following areas: Design Analysis Tools. This effort is to develop new generation integrated design, analysis and simulation software tools in a computationally efficient environment for predictive evaluation of the silencing performance by different control system designs. Active Control Systems. Innovative controllers consisting of system architectures, actuators, sensors, algorithms, etc. for affordable effective ship silencing.

PHASE I: A complete survey of the state-of-the-art design analysis tools for active controller design and its structural-acoustic performance. A specific approach to develop and integrate these tools and how this integrated approach can be used to identify a practical control system for this specific application. Status report of the development effort and delivery of the developed software.

PHASE II: Delivery and demonstration of the integrated software package with full documentation. Laboratory demonstration/verification of the performance of the identified active control system on a small scale finite cylinder model being on the surface of and under the water subject to internal excitation and external acoustic signal incidence.

PHASE III: Navy funding is contingent and may be provided depending upon the proposals received, the Naval priorities assigned the Phase III efforts, and the quality of the results produced.

NAVAL CIVIL ENGINEERING LABORATORY

N93-124TITLE: Fuel Oil and AFFF Removal

CATEGORY: Exploratory Development

OBJECTIVE: Develop a combined treatment system to separate and remove residual fuel oil and AFFF from firefighting training waste.

DESCRIPTION: Treatment and disposal of fuel and AFFF-laden wastewater generated from firefighting training facilities and shipboard equipment testing has been a major Navy operational problem. A cost effective removal technique for these contaminants must be developed for the Navy application. A combined gravitational and air flotational separation method can cost effectively be employed to treat such waste.

PHASE I: Determine the separation characteristics and requirements. Other methods may also be practical for a treatment system. Conduct lab evaluation experiment to integrate the system configuration.

PHASE II: Design and fabricate prototype system for lab and field testing. Conduct the test and evaluation of the prototype system. Develop the design specs for the field application system.

PHASE III: Phase III effort is anticipated to take advantage of the results of this effort.

N93-125TITLE: Non-distributing Asbestos Detection System

CATEGORY: Exploratory Development

OBJECTIVE: Identify and evaluate mechanisms and components to detect and measure asbestos fibers in an environment.

DESCRIPTION: Measurement of asbestos fibers in an indoor environment has been a time consuming, inaccurate, and expensive process. A non-disturbing (of the air), rapid, accurate and inexpensive detection system will be developed using combined laser beam and mass spectrometry technologies.

PHASE I: Investigate the detection mechanism/requirements. Evaluate laser beam and mass spectrometry components capabilities and functionalities. Establish integrated principles and configuration of the components.

PHASE II: Design and fabricate the asbestos detection system. Test and evaluate the system and generate design criteria for a pilot type system. Develop a field test protocol.

PHASE III: Phase III effort is anticipated to take advantage of the results of this effort.

N93-126TITLE: Decontamination of Pentachlorophenol (PCP)-Treated Wood

CATEGORY: Exploratory Development

OBJECTIVE: To identify and evaluate suitable technology for the decontamination of wood contaminated with pentachlorophenol.

DESCRIPTION: Six million pounds of wood were treated with the wood preservative pentachlorophenol (PCP). PCP concentration in the wood is approximately 1,000 ppm. High concentrations of heavy metals Cr, As, and Cu have also been found in the wood. The installation recently got a "Notice of Violation" from the State (CA) for failure to maintain the site. In addition, the installation has been monitoring air vapors and soil in the vicinity of the wood, and apparently there's no air nor soil contamination. NAVWPNSTA Seal Beach has also tried to leach some of the PCP out of the wood but have been unsuccessful. Incineration is not a viable option since the metals may present air pollution control problems. Bio-remediation has also been ruled out as the high concentration of heavy metals will render the microorganisms ineffective.

PHASE I: Identify techniques for determining physical and chemical characteristics of the wood in order to assess a suitable technology to be implemented for remediation. A detailed report will be produced including wood characterization data, factors limiting a specific remediation approach, and recommendations for ultimate disposal.

PHASE II: Evaluate the technology of choice proposed in Phase I in an on site pilot scale evaluation.

N93-127TITLE: Determination of Factors Affecting Complete Mineralization of Ordnance Compounds (TNT)

CATEGORY: Exploratory Development

OBJECTIVE: To determine factors that allow mineralization of TNT to innocuous end products.

DESCRIPTION: Numerous studies have revealed that TNT has been found to be bio-transformed but not mineralized by a diverse group of microorganisms in a numbers of environments. These microbes generally catalyze nitro group reduction but are not known to cleave aromatic ring structures. The resistance of the ring structure to degradation results in a number of metabolites binding to organic materials and in the formation of toxic by-products.

PHASE I: Perform a survey of existing data and identify the factors that contribute to degradation. Analyze results of previously performed experimentation in the degradation of TNT. Develop a computer relational database that will incorporate factors affecting degradation of TNT and predict degradation rates under similar environment scenarios. A report containing results, computer models and recommendations will be delivered.

PHASE II: Laboratory Scale Evaluation. Degradation factors identified in Phase I will be assessed in a series of laboratory experimentation procedures. A set of contaminant standards as well as representative samples will be subjected to identified degradation factors by the computer model. The progress of a control group not subjected to the identified biodegradation factors will also be monitored.

N93-128TITLE: Soil Slurry Bio-reactor for Ordnance Compounds

CATEGORY: Exploratory Development

OBJECTIVE: To develop a soil slurry bio-reactor system for bio-remediation of soils contaminated with TNT and RDX.

DESCRIPTION: Results from a bench-scale study using soil from an Army Ammunition Plant (Joliet Army Ammunition Plant) demonstrated that it is feasible to biologically treat soil and groundwater contaminated with ordnance compounds TNT and RDX. In the Army study, a silicone tubing, fixed-film reactor was tested with two different microbial populations, white rot fungus Phanerochaete chrysosporium and a bacterial based consortium. In the reactor containing the white rot fungus, TNT was removed from the liquid solution under nonligninolytic and ligninolytic conditions. The development of a "soil-slurry bio-reactor" for ultimate treatment of soil contaminated with ordnance compounds is required.

PHASE I: Perform a survey of existing data and identify and analyze results from previously performed efforts. Contacts with the Army and Argonne National Laboratory will be established in order to obtain information already generated from the Army's study.

PHASE II: System Design. Based on the data generated by previously performed experimentation, a soil slurry bio-reactor system suitable for remediation of soil contaminated with ordnance compounds will be developed.

PHASE III: Phase III effort is anticipated to take advantage of the results of this effort.

N93-129TITLE: Lead Hyperaccumulators

CATEGORY: Exploratory Development

OBJECTIVE: To identify and evaluate lead hyperaccumulators for adaptation to hazardous waste site cleanup.

DESCRIPTION: Lead is an ubiquitous environmental contaminant of our air, soil, and water. Studies have shown that lead is uptaken by vegetation growing in heavily contaminated soils. Algae have also been identified to remove heavy metals from aqueous solutions.

PHASE I: Identify potential candidates from vegetative, fungal, and bacterial sources that have the potential to uptake lead from the environment. A field survey will then be conducted from known lead contaminated sites, DOD and non-DOD. Preliminary pot studies will be conducted of potential species to determine uptake capabilities.

PHASE II: Laboratory Evaluation: After several candidate species have been identified, detailed laboratory investigation will ensue to determine mechanism of uptake and concentration factors. This will entail water and soil media. A detailed report of findings will be prepared with recommendation for field testing.

N93-130TITLE: Subsurface Landfill Barrier

CATEGORY: Exploratory Development

OBJECTIVE: To identify, develop and evaluate methods and materials for implementation as subsurface barriers between hazardous waste landfills and an aqueous environment.

DESCRIPTION: Navy landfills were often constructed in coastal areas that have resulted in severe infiltration of water, both from groundwater and tidal fluxes. This influx of water carries potential harmful constituents into the environment. This creates a difficult situation to remediate. Containing the contaminants within the landfill confines will assist in final remediation.

PHASE I: Identify methods and materials for barriers that can be installed at abandoned hazardous waste landfills. Potential methods and materials will be subjected to tests for effectiveness, both cost and functional. Take into consideration factors such as intrusion of animals, tree roots, etc.

PHASE II: Field demo. After laboratory investigation, a detailed field test will be conducted at an actual site or one that simulates actual conditions that may be encountered.

PHASE III: Phase III effort is anticipated to take advantage of the results of this effort.

N93-131TITLE: Rapid High Rate Lead in Air Monitor

CATEGORY: Exploratory Development

OBJECTIVE: To develop and evaluate rapid air monitor for lead monitoring at rifle ranges.

DESCRIPTION: Lead, along with other metals, is a concern to users of both indoor and outdoor small arms firing ranges. It is dispersed through the air, soil, and water. Studies have shown that lead is found in significant quantities in air samples from indoor ranges. Air samples need to be taken quickly so not to interfere with the shooters concentration and results must be obtained in the field for safety reasons.

PHASE I: Identify potential methods of monitoring lead from rifle range field exercises. Calibrate and demonstrate monitoring techniques and technology.

PHASE II: Field demo. After laboratory investigation, a detailed field test will be conducted at an active range to determine viability under range of conditions that may be encountered.

PHASE III: Phase III effort is anticipated to take advantage of the results of this effort.

N93-132TITLE: NDT Technique(s) for Detecting Delaminations in High Temperature Pavements

CATEGORY: Exploratory Development

OBJECTIVE: Investigate fundamental nondestructive testing (NDT) principles, select the most applicable principle, and develop an innovative detection system based on that principle.

DESCRIPTION: Current pavements become delaminated after repeated exposure to aircraft jet exhaust. The delaminations normally occur at a depth of about 1/4 to 1/2 inch but depths of about 1/8 to 3/4 inch have been observed. The areal extent of the delaminations could range from several inches to many feet in diameter. Indications of the delaminations are usually not visible on the pavement surface. Existing NDT techniques, such as impact echo, chain drag, and infrared tomography, are deficient, not applicable, or inappropriate to satisfy requirements for the required system. A new system that has the following capabilities is needed:

a. For a specific x,y location on an airfield pavement, detect whether or not delamination exists.

b. For each location where delamination was detected, provide a measurement of the depth to the plane of the delamination from the surface.

PHASE I: Make an assessment of applicable fundamental NDT principles, perform a tradeoff analysis of candidate principles based on a selection criteria, select the best principle(s), and develop and demonstrate a laboratory model of the desired detection system. Prepare a final report that documents all Phase I efforts and design criteria for a prototype system for field application.

PHASE II: Develop, test, and evaluate an NDT system(s), which has the capabilities described above and the principle(s) of which was demonstrated in Phase I, for use in conducting field surveys of airfield pavements. Prepare a final report to document all Phase II efforts including field validation test results.

PHASE III: Phase III effort is anticipated to take advantage of the results of this effort.