N A V Y

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
Navy SBIR Program Manager
800 North Quincy Street, BCT #1, Room 922
Arlington, VA 22217-5000
(703) 696-4286

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 provide a portion of the problems encountered by the Navy in order to fulfill its mission.

The Navy has identified 77 technical topics in this DOD Solicitation to which small R&D businesses may respond. This is in addition to the 290 topics identified in DOD SBIR Solicitation 91.1 which closed 11 January 1991. A brief description of each topic is included along with the address of each originating office. In addition, there are index and topic title sections which are provided for quick reference. This information is contained on the ensuing pages.

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.

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. This year the Navy's SBIR budget was reduced by 25%. While this will not impact funds of Phase awards that result from the topics listed in this solicitation, it makes it extremely important that Phase award recipients influence the end uses of the technology since Phase II SBIR funds will be limited and thus highly competitive.

A new participant in the Navy's SBIR Program is the OFFICE OF ADVANCED TECHNOLOGY (OAT). They are responsible for identifying R&D projects, programs or Systems which meet critical fleet needs that can be taken to the full demonstration phase. As you read through the topic descriptions you will notice topics that are asterisked after the title. Those topics have been identified by OAT as having the potential to be full demonstration projects.

OFFICE OF NAVAL RESEARCH

N91-291 TITLE: Nonlinear Dynamics for Signal Processing

CATEGORY: Research

OBJECTIVE: To employ novel concepts from nonlinear dynamics and fractals to develop new techniques for signal processing and forecasting.

DESCRIPTION: Recent advances in nonlinear dynamics have broadened our appreciation of complex signals by relating chaotic signals to dynamical processes. Ideas of deterministic noise, fractal dimensions, and strange attractors can be useful in detecting complex signals in noisy backgrounds. One may or may not know the signal being sought or one may be trying to forecast natural phenomena. A range of techniques involving embedding dimensions, attractor smoothing, wavelet transforms, stochastic resonance, noise squeezing, periodicity functions, multi-fractals, invariant characterizations, Lyapunov exponents, etc., may be of use. Automated techniques for signal processing which take advantage of modern advances in dynamical systems and fractals are of interest.

Phase I is to identify issues and qualify concepts to demonstrate the viability of novel nonlinear dynamic methods for signal processing.

Phase II would produce devices/software capable of implementing the Phase I concepts.

N91-292 TITLE: High Temperature Transistors (HTT)

CATEGORY: Research

OBJECTIVE: To investigate semiconductors and develop transistor designs for high temperature applications.

DESCRIPTION: Nuclear reactors and turbine engines operated by the Navy could be operated more efficiently if onboard active sensor technology were available. While sensors capable of operating at 325 Celsius are available, the accompanying active electronic devices are not readily available. These devices require a semiconductor having a bandgap of 2.2 electron volts or higher and a compatible metallization technology.

During the Phase I program, a candidate semiconductor capable of sustained 325 Celsius operation will be demonstrated and a transistor design completed.

During the Phase II effort, the transistor would be demonstrated and an operational amplifier would be designed and tested to operate at 325 Celsius and with supply voltages between 5 and 24 volts.

N91-293 TITLE: 4-Dimensional Oceanographic Instrumentation

CATEGORY: Research

OBJECTIVE: To develop innovative instrumentation to measure oceanographic/meteorologic parameters.

DESCRIPTION: Innovative sensors/projectors and measurement techniques are solicited to obtain marine atmospheric, oceanographic (acoustical, optical, physical, biological, chemical, and geophysical) variables in 3D space and time. The emphasis is on (1) novel approaches and concepts for measuring multiple parameters coherently in 4D; (2) new methods of measuring fluxes, acoustic wavefields, or fluid motion of mixtures (i.e. water/bubbles/sediments/biological). Instruments can be towed/tethered sensors/projectors, elements in arrays, or suites of instruments on ROVs (remotely operated vehicles) to cite a few examples. Low cost, reliable, and/or

expendable sensors/projectors and components (e.g. broadband, large dynamic range, high efficiency, compact, low power consumption projector/receivers) are particularly desirable. Full depth capability is desired in instrumentation planned for sub-surface use.

The Phase I proposal should provide a description of exactly what will be measured and to what accuracies and coherence as well as providing the design concept for achieving the measurements. Phase I should produce a proof of concept by demonstrating untested concepts or instruments.

Phase II would develop hardware and demonstrate feasibility in the laboratory. Field testing should be addressed via coordination with ongoing ONR field efforts. Potential approaches to industrial development that transitions program output should also be outlined.

N91-294 TITLE: Remote Environmental Data Link

CATEGORY: Research

OBJECTIVE: To provide user instrumentation for a broadband environmental data retrieval system.

DESCRIPTION: There is a growing need for remote environmental data retrieval systems that link data from surface/sub-surface oceanographic/acoustic sensors at sea to retrieval stations. Plans by Motorola indicate that a large number of broadband satellites could be placed in orbit in the near future that will create a network that can be tapped with cellular telephone technology. Other concepts such as acoustic telemetry, ground wave RF, meteor burst, and error corrected AM offer opportunities for data retrieval.

The Phase I program will design prototype field instrumentation with capabilities for multi-channel temporal storage, data transmission, and reception of instrument command functions to ensure that remote environmental/acoustic sensors can communicate to shore stations. Systems and/or components that are crucial to any/all network approaches can be propose Design considerations should emphasize low power consumption and costs. Data message sizes of 100 K Bytes including glob positioning and data error flagging and correction are desired. Transmission rates from sensors should be explicitly defined with desired rates sufficient to accommodate acoustic array data.

Phase II would initiate the plan by developing the transmitter/receiver, global positioning module if appropriate and temporary storage instrumentation. The probability of Phase II support will be strongly influenced by Phase I findings an external additional support from agencies willing to cooperatively fund early deployment of such instrumentation.

N91-295 TITLE: Identification of Microbially Influenced Corrosion

CATEGORY: Research

OBJECTIVE: To develop identifiers and identifying concepts for microbially influenced corrosion.

DESCRIPTION: Microbially influenced corrosion (MIC) has been recognized for more than 50 years but has frequently been ignored as a significant contribution to the degradation of structural materials. More recently the unexpected corrosion failure corrosion-resistant materials in relatively benign environments have re-emphasized the importance of MIC, and there is a need be able to identify MIC by simple and quick procedures. The correct diagnosis is particularly important in situations where preventive treatments for MIC, such as oxidizer additions, are expensive in terms of time, materials, equipment and environmental impact. Presently used techniques for the identification of MIC often rely on the general appearance of the corroded region such as shape of deposits and penetration, characteristic colors and location of attack. These may be followed by sampling, by specialized techniques, of the corroded material and of bulk fluids and by chemical, metallurgical and microbiological analysis. Less time-consuming and less expensive identifying techniques for MIC are much needed by failure analysts.

During the Phase I program, research will address identifying concepts for MIC which are capable of being developed into rapid diagnostic procedures.

During the Phase II effort, the Phase I concept would be further developed and verified in service environments and a diagnostic procedure for the quick identification of MIC will be made available. This diagnostic procedure may be developed as a test kit and/or service.

N91-296 TITLE: Concurrent Design System for Manufacturing

CATEGORY: Research

OBJECTIVE: To develop an integrated system for the rapid design and fabrication of custom parts for use in hydrodynamic: experiments.

DESCRIPTION: There is a need for the flexible, rapid and reliable production of physical part prototypes for hydrodynamic experiments. With recent advances in computing technologies, computing theories and manufacturing technologies, it may be feasible to develop an integrated concurrent product/process design system satisfying this need in specific domains. Manufacturing technologies such as stereolithography, selective sintering, plasma coating and others may have the potential for the rapid fabrication of part models. The size of these model parts is less than 0.3 meters in linear dimension. Computing technologies such as artificial intelligence, computational geometry, robust geometric modelers, an others are emerging important components of design systems. It is envisioned that an engineering design system built from these engineering will have the capability for synthesis and extensive analysis of product and process designs, for the graphical depiction of the product and process, for the real-time monitoring and controlling of the part production, and the creation of a physical part.

The objective of the Phase I effort is to specify an engineering product/process design system that facilitates the rigorous analysis and formal development from conceptual design through to physical model. The specification should describe: an open-system architecture using a client/server (or object-oriented) model; the human-computer interface and how this interface facilitates product and process design; and the underlying fabrication technology. A description of the operation of the system should be provided. Designs building upon ONR sponsored research in engineering sciences are encouraged.

The objective for the Phase II effort would be the development of an experimental research prototype based surface on the Phase I design.

N91-297 TITLE: Condition Based Machinery Maintenance

CATEGORY: Research

OBJECTIVE: To develop methods of detecting small, but permanent, changes in the condition of mechanical systems for the purpose of scheduling preventive maintenance.

DESCRIPTION: Recent developments in signal processing (e.g. wavelets) and the use of new classifiers such as Artificial Neural Networks (ANN) have shown promise for real-time pattern recognition. The vibrational response of machinery changes with the onset and propagation of a component fault. Substantial cost savings can be realized by detection and classification of this and abnormality prior to catastrophic failure. This effort will focus on mechanical systems such as gearboxes and bearings in noisy environments as found on ships and helicopters.

During Phase I, research will address the development or identification of signal preprocessing appropriate for 1 filtering diagnostic signal parameters and feature extraction for classification. A rational approach to choice and demonstration of preprocessors combined with suitable classifiers and learning algorithms is desirable. Use of real gearbox or bearing data is preferred, and will be provided by ONR if requested, although use of synthesized data may be acceptable. (This data is not required for proposal submission).

During Phase II, the Phase I system concepts would be further defined and implemented in hardware. In Phase II, a demonstration must be given of the chosen analysis method(s) as applied to a Navy data set and the correlation of the inferred condition with the true state of the mechanical system over its duty cycle.

OFFICE OF NAVAL TECHNOLOGY

N91-298 TITLE: Adaptively Compensated Hydrophones

CATEGORY: Exploratory Development is.

OBJECTIVE: A miniature piezoelectric hydrophone used in broad bandwidth applications can suffer from a loss in sensitivity due to loading by cabling between the hydrophone and its first preamplifier. A method is needed to minimize this loading effect while maintaining both broad bandwidth and an acceptable level of signal to noise performance.

DESCRIPTION: The Phase I effort should quantify the bandwidth and noise limitations of typical hydrophones both in production and in advanced development. The proposed method to alleviate the problem should be detailed and modeled to ascertain its ability to correct the problem. A sensitivity/tolerance study should be an integral part of the investigation to determine if the method can be reduced to practice. A breadboard circuit should be delivered along with a final report.

The Phase II effort should culminate with the final design and fabrication of a device which could be added to a typical hydrophone for the purpose of increasing its useful bandwidth without reducing the noise performance of the hydrophone. A small quantity of devices would be fabricated and tests undertaken to confirm the predicted performance. The final report would include a complete analysis of the receive subsystem of hydrophone, compensating device, and preamplifier.

N91-299 TITLE: Anti-Reflection Coatings for Use on Ultrahard Conformal Infrared Windows

CATEGORY: Exploratory Development

OBJECTIVE: The aim of this program is to develop materials and deposition processes to fabricate optical thin films to provide anti-reflection (AR) coatings of ultrahard conformal domes with sapphire, spinel or poly-crystalline diamond films for severe high temperature, oxygen-containing environments.

DESCRIPTION: The durability and extremely high thermal shock resistance of sapphire, spinel and poly-crystalline diamond offer a means to protect IR window and dome materials from erosion and environmental attack while improving optical performance, thermal shock resistance and lifetime. Optical quality coatings that can be deposited and adhere to diamond must be developed to provide useful AR coatings that can survive extreme environments. The AR coating should be optimized for transmission in the 8-12 um region. Ideally, it should retain good transmission from the ultraviolet to millimeter wavelengths. A secondary function of the AR coating is to protect the diamond from oxidation by the atmosphere at temperatures up to 10000C. Optical- quality finishes of about 25A RMS roughness or better will be needed for coated flat and curved surfaces up to 2 inches in diameter. Present diamond abrasive methods are slow, expensive and result in substrate subsurface damage which may limit optical and rain erosion performance. Deposition techniques supplying dense, uniform films will be needed. An emphasis will be placed on scaleable processes. Reflectance and transmittance will be used for optical property measurement. Mechanical properties such as stress, adhesion and thickness uniformity using optical microscopy and scattered light analysis of the films will be determined.

Phases I and II should also address the effects of chemical/mechanical or ion beam finishing techniques on performance and dome cost.

N91-300 TITLE: Reverse Engineering of Assembly Code

CATEGORY: Exploratory Development

OBJECTIVE: To develop an automated approach for the reverse engineering of assembly code.

DESCRIPTION: When the aggregate, integrated, real-time functions of a Navy battle group -carrier, surface combatant ships, aircraft -are modeled, it becomes clear that the U. S. Navy develops and deploys some of the world's largest, most complex information processing systems. The software that battle group operations depend on consists of millions of lines of source code. Many programs are written in computer languages (such as dialects of CMS-2) which support embedded assembly code. During the system life cycle, many software maintenance changes are made. These changes are rarely reflected in the supporting system documentation. This leads to the state where the only true representation of the existing system is the current source code implementation. Reverse engineering provides support for the standard systems engineering process by providing a means for extracting as much high level information as possible to be represented in a detailed design. This high level design information is needed in order to improve maintenance, reduce costs, encourage reuse, and aid in the transition of older systems to new Ada implementations. This research will develop a strategy for automating the reverse engineering process of assembly code. This methodology should integrate to existing development and maintenance environments and automated support tools such as CASE t' products.

Phase I work should show the feasibility of reverse engineering assembly code for existing systems that are very large and have real-time characteristics. The proposed strategy should be documented in an initial report. The requirements and design for a tool to automate this strategy should be available at the end of Phase I.

Phase II work should include the complete development of the automated tool. A test case providing proof-of-concept for the strategy and tool should be completed and documented.

N91-301 TITLE: Design Technique for Automatic Generation of Support Documentation for Large Real-Time Systems

CATEGORY: Exploratory Development

OBJECTIVE: To develop an automated approach for generating documentation (i.e., user's guides, specifications and reports) which provides high level textual representations of systems.

DESCRIPTION: When the aggregate, integrated, real-time information processing requirements of a Navy battle group -carrier, surface combatant ships, and aircraft -are modeled, it becomes clear that the U. S. Navy develops and deploys some of the world's largest, most complex information processing systems. The development of these systems generally takes several years, requiring the large development teams working together to fulfill the system requirements. Massive documents describing the functionality of the system support the system once it is deployed. These documents are often written early in the development process and can be inconsistent and incomplete with respect to the actual system implementation. Modifications made to these systems after delivery are often not reflected in the supporting documentation. Some commercial products which generate documentation are available for small or mid-size systems. They cannot handle the large-scale systems used by Navy.

This research will develop a strategy for generating support documentation such as user’s guides, specifications, and other reports describing the functionality, behavior, and data structure of systems. The proposed strategy should be automatable in order to minimize the time and manpower required to perform the documentation generation. The tool should integrate with existing development and maintenance environments and automated support tools such as CASE products.

Phase I work should show the feasibility of generating documentation for existing systems that are very large and have real-time characteristics. The proposed strategy should be documented in an initial report. The requirements and design for a tool to automate this strategy should be available at the end of Phase I.

Phase II work should include the complete development of the automated tool. A test case providing proof- of - concept for the strategy and tool should be completed and documented using a typical Navy system which will facilitate the transition into the maintenance environment of the Navy.

N91-302 TITLE: Methodology and Tools for Improving the Navy Acquisition Process

CATEGORY: Exploratory Development

OBJECTIVE: To develop methodologies/tools which facilitate the Navy's planning process for acquiring developmental systems.

DESCRIPTION: Various computerized tools have been developed to support the management of technology development and systems acquisition programs, including PERT/Gantt charts and other project schedule/resource management programs and the "what-it" capabilities of spreadsheet programs. A major need exists, however, for additional methodologies and tools to help the Navy plan, evaluate and select Development and Acquisition programs.

Phase I should develop concepts for candidate methodologies and tools, and provide a strong rationale for both (a) the feasibility of implementation of the proposed concepts and (b) the utility of the final product in increasing the effectiveness and efficiency of the Navy's acquisition process.

Phase II would see the refinement of the concepts developed in Phase I and the development/delivery of prototype tools.

OFFICE OF ADVANCED TECHNOLOGY

N91-303 TITLE: Advanced Systems and Technologies for Future Naval Warfare *

CATEGORY: Advanced Development I

OBJECTIVE: Enhance Navy's future warfare capabilities in ASW, AAW, STK/ASUW, MIW, AMW, C3I, EW, Space, Special Warfare, Manpower/Personnel/Training, Medical, Strategic Offense/Defense, Logistics, and Coordinated Battle Force Operations.

DESCRIPTION: Navy is seeking new, innovative, high risk/payoff ideas in technologies and/or advanced systems concepts that support the Navy's mission in the years 2000 and beyond.

Phase I: Proposal should address: a) the system concept or technology being proposed, b) the expected operational utility in future naval warfare, c) description of critical subsystems/technologies, d) required subsystem/technology performance, e) current subsystem/technology maturity, f) the scientific principals involved (show quantitative formulation where appropriate), and g) the work planned to demonstrate technical feasibility and transition of the system into the Navy's acquisition system.

Phase II: Development of the system concept/demonstration of critical components to reduce the acknowledged risk to acceptable levels and transition the proposed system into the fleet at the earliest time.

OFFICE OF THE CHIEF OF NAVAL RESEARCH

N91-304 TITLE: Evaluate and Recommend High Performance Local Area Network Based DBMS HW/SW Configurations

CATEGORY: Advanced Development OBJECTIVE: Evaluate selected local area network (LAN) based data base management system software against selected hardware to determine high performance and cost effective hardware-

software configurations for supporting a multiple platform (LAN, PC, mainframe) cooperative processing environment for business applications.

DESCRIPTION: The need exists to determine whether high performance cooperative processing can t effectively be achieved using existing LAN based database management systems (DBMS) with hardware such as RISC machines, Unix-based workstations, or 486 processor based machines, plus related peripherals. LAN based DBMS packages include Focus, Oracle, SyBase, and CA-IDMS/PC. The required analysis will involve studying each DBMS with each hardware option to determine workable and optimum high performance t effective solutions (i.e., hardware/software configurations) for achieving cooperative processing in a multiple platform business application environment. The analysis must also examine the ability of each DBMS to link with CA-IDMS/R VM software located on an IBM 4381 mainframe computer, and determine the feasibility of such a link. First to be evaluated is whether such a solution exists. Second, if there are several solutions, they should be rank ordered and recommendations made accordingly. The study should develop criteria for this rank ordering.

MARINE CORPS

N91-305 TITLE: Bottom Attack Anti-Armor Device (BAAAD)

CATEGORY: Exploratory Development

OBJECTIVE: To design and develop lightweight devices that will give the individual Marine the capability to seriously disrupt armored attacks within tactically reasonable scenarios. Simultaneously, or alternatively, this device would serve as an anti-personnel weapon in a variety of scenarios to include Military Operations in Urban Terrain (MOUT).

DESCRIPTION: The primary mission of the BAAAD is anti-armor. Its secondary capability would be anti-personnel because such secondary capability is easily incorporated in the device to give it more military utility and flexibility. This solicitation attempts to take advantage of new technologies in properly combining energetic explosives, insensitive munitions, lightweight materials, and smart sensors, and programmable fuzes. Exclusive of mines, ordnance and devices to counter tanks and other armored vehicles have focused their attention on attacking the vehicle from directions other than the bottom. The advantages of attacking from the bottom are that protection is minimum and the target area is large. This solicitation envisions the development of concepts that may replace classical hand grenades and concurrently provide a device that is as easily carried and employed which can become a force multiplier in deliberate defense, retrograde, anti-armor ambush, and barrier planning at the company level.

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 safeing, arming, sensing, aiming, fuzing, programming, explosive chemistry, armor defeating techniques, and tactical employment flexibility.

Phase II would consist of preparation of detailed design drawings and assembly of the prototype devices. Prototype design will be verified by target engagement testing for effectiveness against simulated personnel targets and armor replicates.

N91-306 TITLE: Electrical Re-Charge System

CATEGORY: Exploratory Development

OBJECTIVE: To design and develop lightweight non-burdensome system that will provide the individual Marine the capability to recharge standard issue batteries in the field.

DESCRIPTION: This solicitation attempts to take advantage of materials technology related to energy conversion and transfer. There are many sources of non-electric energy available to the individual Marine in the field which, if a conversion method were available, he could use to re-charge batteries for such things as radios, lights, optical

systems, sensors, etc., thus reducing the logistic train that is now necessary to support those batteries. Sources include the natural movements of the Marine which involves work that is not recovered (piezoelectric generators in boot soles, etc) and chemical energy available in small arms ammunition. This effort is not limited to recharging currently fielded batteries, but may focus on "new" battery materials that would accommodate the requirements of energy conversion rates and techniques required by the solicitation responses.

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 L describe the proposed hardware design to include materials, principles of energy conversion, storage and use, size and weight estimates, or alternatives to individual devices such as company-level devices.

Phase II would consist of preparation of detailed design drawings and assembly of the prototype devices. Prototype design will be verified by demonstration.

N91-307 TITLE: Micro-Climate Body Temperature Control System

CATEGORY: Exploratory Development

OBJECTIVE: To design and develop lightweight non-burdensome system that will provide the individual Marine the capability to operate effectively physiologically over a broad spectrum of temperature extremes.

DESCRIPTION: This solicitation attempts to take advantage of materials technology related to energy conversion and transfer. Concepts may consider full or partial body coverings that act to regulate the core temperature to within safe limits during heavy workloads typical of wartime military duties in both high and low temperatures. High and Low may be separate solutions. System should sustain the individual for 6 hours. Rejuvenation must be at company level or below.

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, principles of energy conversion, storage and use, size and weight estimates, or alternatives to individual devices such as company-level devices.

Phase II would consist of preparation of detailed design drawings and assembly of the prototype devices. Prototype design will be verified by demonstration.

N91-308 TITLE: Optical Scatter Communications

CATEGORY: Exploratory Development

OBJECTIVE: The objective of this topic is to design and develop communications systems which use optical scattering and/or atmospheric absorption to advantage, resulting in short-ranged, low-probability-of-intercept (LPI) tactical communications.

DESCRIPTION: Initial exploratory investigations into the performance characteristics of electromagnetic emissions at near-light me a frequencies indicate that propagation in this frequency range offers some tactically useful properties. Atmospheric absorption in this frequency range results in very high propagation losses over very short distances, while optical scattering reduces the dependence on optical line of sight between the transmitter and receiver. Several applications are conceivable which would permit must omnidirectional, networked communications among voice and data subscribers. Also, by using directional antennas, range can be extended while maintaining other desirable properties. Such a directional system could provide wideband communications point-to- point if a suitable multiplexing scheme could be devised. The current limiting technologies appear to be achieving frequency diversity and the high cost of transmitter and receiver components.

Phase I would consist of concept exploration resulting in a preliminary design study which produces a system design drawing supported by theoretical determinations of system performance. These calculations should verify that the specified performance goals can be achieved.

Phase II would consist of assembly and demonstration of the prototype systems. The demonstration(s) must be designed to verify the theoretical calculations from Phase I.

SPACE AND NAVAL WARFARE SYSTEMS COMMAND

N91-309 TITLE: Tactical Cryptologic Exploitation of Over- The-Horizon (OTH) Radar

CATEGORY: Advanced Development

OBJECTIVE: Explore the feasibility of using tactical cryptologic assets of U.S. Navy ships to take advantage of the back scatter from known Over- The-Horizon (OTH) radars as an enhancement of cryptologic system capabilities.

DESCRIPTION: Tactical cryptologic systems on U.S. Navy ships provide vitally important information in support of the ship's various mission areas by exploiting the electronic emissions of ships and aircraft. Emission Control Measures (EM CON) and other defensive electronic countermeasures are used by opposing force units at sea to nullify or reduce the effectiveness of those t must cryptologic systems. Land based OTH radars detect and track aircraft and ships at extended ranges by the bistatic processing of t ionospheric back-scatter from high power transmissions in the High Frequency (HF) range. Because of the nature of these transmissions and their reflections, it may be feasible for ships equipped with HF radio Direction Finds (HFDF) to establish a line of bearing to reflections from an individual unit.

PHASE I: The Phase I effort should determine the additional benefits if the ship were equipped with its own bistatic processor for the OTH radar pulses and the design of an interface and processor to combine the OTH radar information with the DF information obtained through HFDF.

PHASE II: A prototype of the processor would be developed and tested in Phase II.

NAVAL SUPPLY SYSTEMS COMMAND

N91-310 TITLE: Voice Data Entry in NISTARS Warehouses

CATEGORY: Advanced Development

OBJECTIVE: Emerging voice recognition systems have the potential to improve the productivity of Navy personnel working in warehouse operations.

DESCRIPTION: The Naval Integrated Storage Tracking and Retrieval System (NISTARS) integrates physical distribution operations in a paperless warehouse environment. Issues/receipts, stows and inventories are directed by interactive on-line UNIX workstations linked to a NISTARS central controller (Tandem TXPs) in. NISTARS workstations may be fixed in place at carousel storage, storage/retrieval machines, or at packing and receiving stations; or they may be portable radio frequency hand held terminals, allowing worker autonomy and permitting NISTARS control in remote warehouses. The NISTARS warehouse uses bar code identification with issue documentation printed at a packing station.

Warehouse workers are required to input numerous simple keyboard entries while using NISTARS, e.g., "Y", "N", "[Entry complete]", "[Task complete]", and "[type in quantity]". During the stow/issue process the workers must set aside material being handled in order to utilize workstation keyboards. This process costs several seconds per data item entered multiplied by several thousand times per day, equates to many hours of lost productivity.

Implementation of an effective voice data entry technology, reducing keyboard data entry, could reduce response time in providing materials and services to the fleet and improve productivity of the warehouse worker. Voice data entry would be especially useful in cold storage warehouses, where heavy gloves make keyboard data entry cumbersome. NISTARS fixed workstations at various Naval Supply Centers are either 80286 or 8O386SX chip based computers and use the SCO Xenix operating system. Hand held terminals are Teklogix model 7015. Contractor can expect to visit a designated Naval Supply Center and the Naval Fleet Material Support Office, Mechanicsburg, Pennsylvania.

Phase I should provide a feasibility study which includes the cost benefit analysis and implementation methodology of incorporating voice data entry technology into the existing NISTARS application software and workstation hardware--all of which is Government owned.

N91-311 TITLE: Non-Plastic Substitute for the Plastic Milk Bladder

CATEGORY: Advanced Development

OBJECTIVE: To develop an operationally and environmentally acceptable substitute for the plastic milk bladder currently used in all military and institutional food service systems. This new milk bladder would assist the Navy in meeting the objectives of Public Law 100-220 and the International Convention for the Prevention of Pollution from Ships (MARPOL 73/78) banning the overboard disposal of plastic wastes.

DESCRIPTION: Due to legislation which bans the disposal of plastics into the sea, the U.S. Navy is looking for substitutes for high volume plastic items currently used aboard Navy vessels. Food related plastic waste poses the most serious problem since it becomes both an odor and potential health problem when stored. The plastic milk bladder has been identified as a priority target for replacement. Market surveys have not yet yielded an acceptable substitute for this item. An acceptable solution is an environmentally friendly, non-plastic, bulk container, that can be disposed of by standard shipboard practice. The container shall comply with the guidelines in CID-A-A-20113B for Milk and Milk Products dated 12 December 1986.

Anticipated travel requirements: 1 trip to Natick, MA; 1 trip to Norfolk, VA; 2 trips to Washington, DC.

Phase I: Survey of emerging technologies and solicitation of novel ideas that meet the requirements previously: stated. Evaluation of the environmental acceptability, industry acceptability and economic feasibility, given Navy's current system and demand.

Phase II: Development and field testing of an acceptable milk bladder.

N91-312 TITLE: Automated Passenger Order Recognition

CATEGORY: Advanced Development

OBJECTIVE: To develop an optical scan or holographic recognition system for in check processing of DoD travel orders (computer generated by all Services) using a common bar code which will contain all data fields in PCS/TAD/TDY orders.

DESCRIPTION: Cargo checked for airlift movement within the MAC airlift system is now processed using bar codes with radio transmission to on-site central computers using newly fielded handheld terminals (HHT's). Passenger processing is still accomplished by laborious manual input into the MAC PRAMS computer system despite the fact that nearly all travel orders are computer generated. The nature of flight schedules often causes large lines of travelers who must be individually processed under the current methods to gain seat assignment. Interpretation of priority based on the nature of the traveler's orders or leave papers takes time and can frustrate customers. This process needs to be streamlined to avoid processing delays and traveler in frustration. Manual processing will always have to be an option in case bar codes are obliterated or missing. Coordination with HQ Military Airlift Command, Scott AFB, Illinois (code TRQ) is required for eventual software development in the

MAC passenger system (PRAMS) to allow recognition of the bar codes and instantaneous determination of seating priority or qualification. (Source: MAC Regulation 76-1, chapter 14 and DoD Regulation 4515) One trip to Norfolk, Virginia IX (NAVAIRTERM and PSD, Norfolk); One trip to HQ MAC, Scott AFB, Illinois and possibly a trip to AF computer design center (PSD Crystal City can also advise utility of concept to order issuance for Navy).

Phase I: Survey of Navy Personnel Support Activity to verify efficiency of creating required orders with bar codes (codes could also assist PSD system). Also survey civilian airline practices now in effect for using bar coding of purchased tickets to check in and issue boarding passes. Development of recommended system description responding to survey.

Phase II: Development and field testing of the system (with HQ, MAC) concurrence and simultaneous software development necessary in the PRAMS system.

NAVAL MEDICAL RESEARCH AND DEVELOPMENT CENTER

N91-313 TITLE: Lyophilization of Liposome Encapsulated Hemoglobin

CATEGORY: Exploratory Development ice,

OBJECTIVE: The proposed objective of this topic is to develop methods for large-scale lyophilization of the liposome encapsulated hemoglobin (LEH) consistent with GMP standards.

DESCRIPTION: LEH has been developed by the Navy as an oxygen-carrying fluid. During storage, at four degrees Celsius in liquid, the hemoglobin slowly oxidizes to the methemoglobin form. Storage stability can be enhanced by fabrication and lyophilization of the LEH in the presence of disaccharides. We desire the development of manufacturing procedures for making multiliter quantities of LEH containing disaccharides and lyophilizing the material under carefully controlled conditions. It is essential that sterility of the LEH be maintained throughout the procedure.

NAVAL AIR SYSTEMS COMMAND

N91-314 TITLE: Antenna & Transmission Line Test

CATEGORY: Exploratory Development

OBJECTIVE: Develop end-to-end built in test/fault isolation and detection (BIT/FID) for antennas and associated transmission lines that will isolate to a single point failure with 98 per cent accuracy.

DESCRIPTION: Current testing of communications systems and electronic counter measures requires external test equipment. These external equipments are bulky, labor intensive to operate, and require extensive logistic support. For aviation units deployed aboard ship they present a storage and space problem. External tests are accomplished on a periodic inspection cycle that does not provide operators with high system confidence. Therefore, there is a requirement for BIT/FID to eliminate the requirement for external test equipment, and to provide preflight verification of antenna and transmission line continuity across stem any given width. If faults are detected, BIT/FID must isolate the fault so it can be repaired quickly without the use of external troubleshooting aids.

Phase I: Concept design and evaluations.
-Breadboard construction and demonstration.

Phase II: Concept development.
-Brassboard construction and system demonstration.

N91-315 TITLE: Superconductivity Research for Aviation Uses.

CATEGORY: Research

OBJECTIVE: To investigate and make specific recommendations concerning the supportability of emerging high temperature superconductor hardware sub-systems and maintenance and support techniques, practices and procedures to be used and supported in avionic systems in fleet use. Efforts will also focus on reliability predictions.

DESCRIPTION: Currently, extensive research is being conducted concerning the design and performance of superconductors in avionic systems. It is conceivable that within the next six years aviation systems containing superconductors will enter fleet use. To date, sufficient research has not been conducted to determine how superconductors will be supported and maintained once they are introduced into the fleet. If a supportable product is to be delivered to the fleet, research of this type must be conducted immediately or we lose the opportunity to influence current and emerging superconductor designs.

Phase I shall consist of a general research study of the specific areas of the design, maintainability, testability, and support needs for high temperature superconductors. At the completion of Phase I, the government will receive a summary conclusion, and recommendations for each area covered.

Given favorable results from Phase I, Phase II shall be a more in-depth research including experiments and field studies to make specific recommendations regarding types of high temperature superconductors and delivery of logistic support analysis products.

N91-316 TITLE: Development of High Temperature Superconductive Systems and Subsystems for Aviation Uses

CATEGORY: Exploratory Development

OBJECTIVE: Devise, design, and demonstrate technology applications for high temperature superconductors for use in aviation applications that will improve system reliability.

DESCRIPTION: Power consumption, space, and weight are restricting factors in aircraft design that have overshadowed reliability requirements in the past. The advent of high temperature superconductors will offer relief, in some applications. Increased life span of aircraft and subsystems is a driving factor in the requirement for higher reliability in future aircraft design. Innovative applications of high temperature superconductors that will increase reliability in Naval Aviation are requested.

Phase I: During this phase, innovative concepts will be recommended and feasibility established via mathematics, computer simulation, prototyping or a combination of these.

Phase II: Using the results of Phase I the contractor will develop and demonstrate the high temperature superconductor applications proving increased reliability of the system or subsystem.

N91-317 TITLE: Attack Helicopter Alternative Tail Rotor Applicability

CATEGORY: Advanced Development

OBJECTIVE: Investigate feasibility of modifying AH-IW attack helicopters employing alternative tail rotor concepts. Explore technology to allow integration without creating major airframe design changes.

DESCRIPTION: The US Marine Corps, through new development and a block modification program, will achieve an all AH-l' attack helicopter fleet by the early 1990's. This aircraft must remain capable of meeting the threat well into the 21st century. This effort will focus on employing alternative tail rotor technology to yield an attack helicopter which is more maneuverable, quieter, and less susceptible to battle damage. Feasibility investigations

should examine all capabilities of current airframe configurations, as well as address the following: 1. Systems integration. 2. Composite material technology. 3. Noise signature. 4. Ability to land in unimproved areas such as forests. 5. Maintainability enhancements such as reduction in parts, wiring and mechanical devices. 6. Overall survivability of the aircraft. 7. Stability in rapid turn-around maneuvers versus drag penalty. 8. Optimized vertical/horizontal stabilizer configuration for high-speed forward flight.

Phase I is envisioned as a feasibility/design study exploring incorporation of the improvements discussed above

Phase II of this effort would focus on developing a conceptual design.

N91-318 TITLE: Air Vehicle Requirements for Automatic Landing

CATEGORY: Exploratory Development

OBJECTIVE: Establish a methodology to determine the control system requirements for automatically landing an air vehicle in the 200-10,000 lbs class onto the deck of a small ship.

DESCRIPTION: Control system requirements and specifications need to be defined for automatically landing unmanned air vehicles onto the decks of Navy ships. Current retrieval methods such as landing into a net or wet landings at sea are often 8' difficult and can cause damage to the vehicle. An automatic landing onto the deck would eliminate these deficiencies. However, .a methodology is first needed to determine the significant parameters and their acceptable ranges to ensure that the air vehicle is ors in agile enough to automatically land on the moving deck of a small ship in various sea states. Parameters such as control power use side force generation, desired vehicle accelerations, etc. need to be defined for combinations of air vehicle gross weight and sea state.

Phase I would include a survey of current techniques used to land unmanned air vehicles on small ships and an evaluation of the significant parameters involved. A methodology would be developed and applied to evaluate the landing ability, requirements for air vehicles in the 200-10000 lbs range.

Phase II would apply the guidelines developed to an actual air vehicle under design.

N91-319 TITLE: Active Vibration Control For Buffet Alleviation

CATEGORY: Exploratory Development

OBJECTIVE: To develop advanced active control concept for application to buffet relief in twin vertical tail tactical aircraft.

DESCRIPTION: A concept is required to alleviate tail buffet which is encountered at high angle-of-attack and maneuvering flight conditions. With the advent of higher agility for future tactical aircraft the current tail buffet issue will only become more aviation pronounced and will reduce the aircraft's maneuvering performance as well as service life.

An innovative approach to alleviate tail buffet throughout the entire flight envelope, which now includes the post stall flight regime, is needed. The objective of this topic is to apply flight control technology using the existing aircraft reliability surfaces or possible auxiliary aerodynamic surface modifications to the vertical tail, to actively control the tail surface vibrations.

Phase I would include a survey of prior applications of active flight control technology to buffet alleviation or similar application. This phase would also include a feasibility study of the proposed solution with some experimental demonstration desirable.

Phase II would likely comprise the development of the proposed solution for experimental verification and demonstration.

N91-320 TITLE: Advanced Integrated Helmet-Display Systems

CATEGORY: Exploratory Development

OBJECTIVE: To conduct essential literature reviews, empirical research, operational analyses and technology assessments in order to establish design and acceptance criteria, and a lessons-learned database, for a performance-optimized, multi-mission, advanced integrated helmet-display system. Results will be used to support concepts for an advanced integrated system that capitalizes on new technology, provides full threat protection, (i.e., Laser protection, crash protection, escape/ejection safety), as well as enhanced capabilities for night vision and other sensor integration, improved data interface, complete inter- and intra-aircraft usability, compatibility with other man-mounted systems, improved off-boresight capability with reduced complexity (not requiring cockpit mapping), and reduced transmissivity burdens within the cockpit "canopy-to-eye optical chain". Principal areas include Human Engineering, Display and Life Support System Integration, Mission Analyses, and Escape Engineering.

DESCRIPTION: Current Helmet-Mounted Displays (HMDs), for use in both fixed and rotary wing air vehicles, have not g and successfully demonstrated their capabilities in view of safety, mission and user needs. Further, there is little research data to substantiate optimal human interface and aircraft integration characteristics of such systems. Analyses, research, and assessments are needed to investigate existing issues and establish firm design criteria for an advanced system. Reviews will be performed on available literature (e.g. human visual interface to displayed data, optimal FOV and display of concurrent scenes of real world and sensor generated data, helmet design qualities and operational usage characteristics, NVIS and helmet user interface improvements, NVIS operational data, mishap and accident data, and current HMD evaluation results). A function analysis will be conducted on a notional advanced system design to orient research and eventual criteria. Analyses will be conducted on aircraft and life support integration issues, threat protection impacts, aircraft escape systems and fixed/rotary wing missions as they pertain 1 to HMD design criteria. Essential research will be conducted on issues associated with display interfaces, human use during escape and others where insufficient data exists. New and emerging technologies will be assessed to document potential advancements vehicle in that can be achieved in a future integrated system, in view of the various requirements above and the criteria established by the results of research/analysis efforts. Results of all work will be used to develop a "lessons learned" database, and to document criteria and recommendations for the design and evaluation of an advanced integrated system. Examples of research issues can be obtained from NAVAL AIR SYSTEMS COMMAND (AIR-05TE).

A comprehensive report will be delivered at the end of Phase I defining approaches, plans, schedules, facilities, data sources, research issues, initial findings and other supportive efforts.

Phase II: Should provide sufficient research/analysis data to substantiate evolving criteria. At the end of Phase II reports will be delivered for each of the major efforts and products defined above.

N91-321 TITLE: Artificial Intelligence Data Generation Unit

CATEGORY: Advanced Development

OBJECTIVE: Artificial intelligence data generation unit for engagement training aids

DESCRIPTION: Engagement training aids have been developed and deployed at fleet operational sites that take full advantage of Z-248/Z-386 architecture and provide state-of-the-art scenario simulation for a variety of ordnance weapon systems. A requirement exists to explore development of an artificial intelligence data generation unit for the engagement training aid that would further increase its system capabilities to simulate mission scenarios.

Phase I should consist of a general research study covering specific options and designs for the system. At completion of Phase I, the government will receive a summary, conclusion, and recommendations for each option and design study.

Phase II should be more in-depth research including prototype experiments and possible development of prototype systems for further evaluations.

N91-322 TITLE: Aircrew and Passenger Water Survival Training for the V-22 Osprey Tiltrotor Aircraft

CATEGORY: Research

OBJECTIVE: To assess the V -22 water survival training requirements with regard to the aircrew and its passengers by comparing them with those of helicopters and other passenger carrying aircraft and to recommend a method of training for this Vertical/Short Takeoff and Landing (V/STOL) aircraft.

DESCRIPTION: The U.S. Navy is currently developing the Osprey for the U.S. Marine Corps for its medium air assault weapons system whose primary mission will be to transport combat troops and cargo of the landing force to forward areas. The V -22 Osprey will be the world's first production aircraft with proprotors installed in tilting engine nacelles. With its proprotors in the horizontal position, the V-22 can takeoff, hover, and land like a helicopter. Once airborne, the V-22 can transition into a fixed wing forward flight mode aircraft. The uniqueness of this aircraft and its flight characteristics has introduced questions as to the adequacy of currently used water survival training systems. The contractor will use the following documents in preparation of the study:

MIL-T-23991E General Specification for Military Training Device
MIL-T-29053B Requirements for Training System Development
MIL-STD-1379C Military Training Programs

Phase I: Provide an assessment of the V -22 water survival training requirements for aircrew and passengers. Compare the requirements with those currently in existence for helicopter aircrew and passengers and make recommendations as to how the difference can be addressed.

N91-323 TITLE: Human Factor Considerations for Tactical Aircraft Symbol Sets

CATEGORY: Research

OBJECTIVE: Define symbol sets optimized for human factors considerations for display of information in tactical Navy aircraft. If successful, the optimized symbol sets will allow tactical information to be displayed in a more concise, readable format, greatly reducing aircrew workload and enhancing tactical capability.

DESCRIPTION: A wide range of information is available to the aircrew of modern tactical aircraft. This includes data from on-board sensors such as radars, infrared search and track systems, and television camera systems; ECM data; IFF data; and information from other platforms via data link networks. Displays to present the data include Heads Up Displays (HUDs), raw radar displays, dedicated tactical displays, and Multi-Function Displays (MFDs). The latter will soon have the capability to display data in color. The approach to date has been primarily to layer additional data displays onto current ones using minor variations of existing symbol sets. The result has been an exponential growth of the data displayed to aircrew with the potential to saturate them with more information than can be easily interpreted and understood. A fresh approach to the problem of displaying tactical information -one based heavily on human factors considerations -will enhance the ability to operate in the modern tactical environment.

Phase I will define an approach to present tactical information on the F-14D as a representative aircraft; the approach will:

- Define how to distribute information among available displays.
- Define proposed symbology (size, color, placement of symbols).
- Define the display of information updates and track confidence levels.

Phase II will code and demonstrate a simulation of the proposed symbology. For purposes of the simulation, manual inputs (e.g., keyboard entries) for target parameters and information updates (e.g., data link, target maneuvers) will

be permitted. The simulation should include provisions to provide hard copies of selected runs for evaluation by Navy F-14 flight crews.

N91-324 TITLE: Multi-Sensor Integration in F-14D Fighter

CATEGORY: Exploratory Development t

OBJECTIVE: Define algorithms for tracking and targeting airborne threats using multiple sensor sources.

DESCRIPTION: Modern tactical aircraft have the capability to track or target airborne threats using more than one sensor. The most advanced example of this capability is the F-14D aircraft, which can track targets -independently or in combination -with the APG-71 radar, the Television Camera Set (TCS), or the Infrared Search and Track System (IRST). Additional target information is also available through on-board ECM systems and even through other platforms using aircraft-to-aircraft and ship- to-aircraft data links. Unfortunately, tactical software has not kept pace with the capabilities inherent in having a wide range of available sensor sources; current software focuses on sensor sources as independent trackers rather than as part of an integrated data fusion package. Recent advances in neural networks/artificial intelligence provide the potential to define tracking schemes using multi-sensor integration. Such an approach can provide the capability to passively track and target airborne threats, presenting a significant advancement in tactical flexibility. This project would use the sensor data available to the F-14D as the basis to develop:

- An automated data fusion tracking algorithm for multiple targets, including the optimum use of active (radar) data.
- A semi-passive tracking algorithm (active sensor data intermittently available).
- A passive tracking algorithm

The project would require access to classified information on F-14D sensor capabilities.

Phase I: Provide information to the contractor on the parameters of F-14D sensor data, nominal initial target I acquisition parameters and allowable target maneuvers (speed, altitude, heading changes) after acquisition. Define the approach as to for developing all three algorithms (active, semi-passive, and passive), starting from a time slice/initial condition basis and In of proceeding to a time dependent basis (i.e., sensor utilization to maintain track using predicted target position). The approach should address schema to show track confidence levels.

Phase II would define the algorithms in ADA and write appropriate device drivers to demonstrate a simulation using the algorithms.

N91-325 TITLE: Command Launch Computer (CLC) Improvement Program

CATEGORY: Engineering Development

OBJECTIVE: To reduce parts count, printed circuit board card quantity, and card size of the HARM Anti-Radiation Missile Command Launch Computer.

DESCRIPTION: The HARM missile is interfaced to aircraft platforms using a Command Launch Computer (CLC). The CLC is a 1970's Texas Instruments design containing over 1200 Integrated Circuits (IC). The result is an avionics box which is large and heavy by modern standards, and difficult to integrate into aircraft because of that size. This project would examine the product baseline list (PBL 704AS5951), Prime Item Development Specification (AS 5015), and Prime Item Product Specification (AS 5080) to combine current CLC 1970's memory and IC functions into smaller, more efficient integrated circuits. The reduction in 11 parts count, card count, power requirements, and weight will benefit existing CLC users. It will also provide capability for I alternative CLC implementations for future efforts to integrate HARM capability into additional aircraft types.

Phase I should be a study to identify current combinations of ICs which could be combined using existing off- splay the-shelf components. It should also provide a preliminary study to identify additional components which could be combined if redesigns were available.

Phase II should use the approach identified in Phase I to produce breadboard equivalents of combined functions using off-the-shelf components, and to produce the designs (but not necessarily the hardware) for proposed new IC hardware.

N91-326 TITLE: Exploitation of VHSIC Technology in F-14D

CATEGORY: Engineering Development

OBJECTIVE: Define F-14D architecture and software changes which will take advantage of enhanced capabilities inherent in XN-8 AN/AYK-14 processor modules; successful completion will define software / architecture changes which can yield higher throughput and increased tactical capability for F-14D aircraft.

DESCRIPTION: Very High Speed Integrated Circuit (VHSIC) technology has lead to enhanced performance XN-8 AN/AYK-14 processors, currently under test. By their design, XN-8 modules have greater memory and the potential for greater speed than existing AYK-14 modules. That potential, however, has yet to be realized in an actual application. Integration efforts to date have centered on VHSIC processors as "drop-in" replacements of existing processors. The contractor would be provided with detailed specifications of the current F-14D architecture and bus traffic, plus specifications for the XN-8 processors. The contractor should be familiar with MIL-Sill-1553 bus protocols.

Phase I would define an approach to distribute processing between XN-8 Mission Computer and back-up Mission Computer AYK-14 modules of the F-14D, and recommended key performance parameters.

Phase II would develop benchmark tests which could be used to compare existing F-14D systems with VHSIC based systems in those key performance parameters identified in Phase I. Ideally, this phase should be coupled with an actual demonstration; this would require Navy provided laboratory facilities and processors to be used in the comparison.

N91-327 TITLE: Dual Transponder For Ranging and Data Transmission

CATEGORY: Engineering Development

OBJECTIVE: Develop a dual frequency transponder to replace two existing units which are used by aircrews during fleet training exercises.

DESCRIPTION: Navy training and tactics development exercises employ tracking and data relay systems to provide exercise scenario control, range safety, data collection for exercise reconstruction and combat crew debrief. The Mobile Sea Range (MSR) system employs a relay, reporter, responder (R-cubed) transponder with a center frequency of 141 MHz, while land-based aircrew training ranges employ a Tactical Aircrew Combat Training System (TACTS) transponder with a frequency of 1840 MHz. These transponders may be housed in an external pod similar to an AIM-9L missile or installed internally to the applicable aircraft. Training requirements necessitates that MSR and TACTS aircrew training be conducted back-to-back without debrief. This requires the use of both transponders while training on the MSR and TACTS ranges. Limited external pod space and the need to reduce costs are the primary requirements for a single dual frequency transponder that can support the MSR and TACTS ranges.

Phase I: Design a dual frequency transponder with a target of 108 cubic inch volume excluding connectors and antennae. The 141 MHz section must have a peak power output of 200 watts and the 1840 MHz section must have a peak power output of 25 watts. The noise figure is to be no more than 3 dB. The design should entail card layout and manufacturing .I technology to be used.

Phase II: Develop and provide a breadboard to demonstrate the Phase I design. Develop a transponder prototype to validate the mechanical design and system performance requirements. Develop three (3) qualification units which will represent MIL quality components and manufacturing techniques. Perform in plant testing to validate the system performance requirements and provide support to the government on-site test program.

N91-328 TITLE: Data Relay System

CATEGORY: Engineering Development

OBJECTIVE: Develop a data communications system to provide a secure data relay for Global Positioning System (GPS) position, platform sensor, and weapons event data from a large number of fleet exercise participants over an extended open-ocean environment.

DESCRIPTION: The current Navy at-sea battle training system uses a position location and participant data relay system for real-time scenario control, range safety, and post exercise reconstruction. This system operates at 141 MHz to provide coverage over the operational area necessary for exercise "free play". Future at-sea battle training systems require enhanced participant position location using the GPS and increased data transmission rates. A secure data communications system operating at 141 MHz with a 4 MHz bandwidth in consonance with the characteristics of the approved frequency allocation must be developed to provide data relay for position location, on-board sensors, and weapon system data. The system must support training exercises in which up to 100 air and surface units will be instrumented for data relay. A design goal should be optimization of participant data handling capacity. One approach to be considered is the use of modules from existing Relay, Reporter, Responder (R- cubed) transponders.

Phase I: A paper design is required with supporting computer simulations which can be used to demonstrate communications system performance requirements. Transponder packaging to accommodate a GPS receiver should be also examined. The design should consider potential interference to and from narrow band Frequency Modulation Continuous Wave communications systems operating in the same band during the training exercise.

Phase II: A breadboard unit is to be developed and tested. A test bed using existing Navy R-cubed units .14 should be considered. An engineering development model (EDM) is to be implemented and tested. This EDM should include a master station and ten (10) transponders. Computer simulation should be used to demonstrate a fully stressed communications system.

N91-329 TITLE: Biodegradable Chaff

CATEGORY: Exploratory Development

OBJECTIVE: Provide a substitute material which is biodegradable for the current metalized-glass used for electromagnetic reflecting materials (chaff). If successful that material will replace the glass portion of the metalized-glass for use as chaff.

DESCRIPTION: Currently chaff is used by armed forces for confusing threat radar systems. The U.S. Navy uses metalized-glass cut to pre-determined lengths for this function. Current environmental impact studies have shown metalized-glass to be benign; however, due to chaffs persistence and the unpredictability of environmental standards it is appropriate to seek biodegradable alternatives.

During Phase I it is expected that the contractor will deliver: (1) a final report outlining the approach which will be undertaken to mass-produce the material, and (2) a quantity (2 to 4 lbs) of the material in 1" lengths by 1 mil thick for military testing. It is expected that this contract will require access to classified information upon awarding a Phase II contract. The Navy will assist in acquiring the needed facility clearance when required.

N91-330 TITLE: IR/RF Expendable

CATEGORY: Exploratory Development

OBJECTIVE: Provide an expendable device which will combine infrared (IR) and radio-frequency (RF) countermeasure d capabilities in a single expendable.

DESCRIPTION: Currently U.S. Navy aircraft use separate expendables for IR and RF threats. This drives a requirement to either identify the threat or use both types. In the first case this is done by an expensive warning system and in the latter case an k early expenditure of limited on-board assets. If one expendable could be devised for both threats with equal effectiveness, then both cost avoidance and increased effectiveness would result. The planning size constraint of the expendable is; 1-5/8" diameter by 10-1/2" in length. The IR/RF signatures sought are 1,000 watts/steradian in the 2-3 micron IR and 10 square meter of radar .cross-section in the 8-10 GR. spectrums.

During Phase I the contractor will be expected to evaluate alternatives and deliver a report outlining the concept chosen and their approach in implementing that concept to satisfy this requirement with sufficient data to demonstrate feasibility.

It is expected that this contract will require access to classified information upon awarding a Phase II contract. The Navy will assist in acquiring the needed facility clearance when required.

N91-331 TITLE: Single Channel Signal Processor on Minimal Number of Computer Cards

CATEGORY: Exploratory Development n

OBJECTIVE: Design single channel modular acoustic processor capable of performing all required processing and data storage for any sonobuoy type in any selected mode based on state-of-the-art hardware using a minimum number of computer cards.

DESCRIPTION: The Navy is looking for innovative ideas relative to design of a single channel modular acoustic processor capable of performing all processing functions and data storage for all types of sonobuoys.

Phase 1 of the study will define a processor to perform the following functions: (1) Hold and execute all processing and data control software -for input signal conditioning, beam forming, signal processing and display formatting.(2) Hold and format on demand all data required in the draft ASUTTA performance specification (includes 20 minutes of passive data, DIFAR (Orthogonal cardioids), or 6 pings of active data (ERAPS)). The ASUTTA spec is available at the SBIR office. (3) Have a reconfiguration time, between processing modes, of less than 2 seconds without impact on any other concurrent processing.

Phase 2 of the study will: (1) Identify the primary issues involved in developing the processor and evaluate alternatives and trade-offs in system design. (2) Provide an estimate of feasibility, capability and cost of any ASW aircraft acoustic processor upgrade using the modular processor. (3) Build and demonstrate a prototype processor. The system will be demonstrated using a fleet mission tape provided by the SBIR office.

N91-332 TITLE: Higher Harmonic Control Actuation and Electronic Control System for Navy H-60 Helicopters

CATEGORY: Advanced Development

OBJECTIVE: Design/develop a Higher Harmonic Control (HHC) actuation system and its control package which will allow for the transfer of 4P actuator loads from the fixed frame into 3P, 4P, and 5P in the rotating frame of a Navy H-60.

DESCRIPTION: Helicopter rotor motion amplitude and phase alteration with HHC can be used to reduce fuselage vibration, lower aircraft power required, and alter the helicopter acoustical signature. Using the filtering properties of a helicopter rotor, the higher harmonic content ((N -I)P, NP, and (N + 1)P) of the rotating vertical and inplane shears can be greatly suppressed through cancellation with the non-rotating vertical shears at NP.

The HHC system should incorporate high frequency hydraulic actuators which have no phase shift throughout the required frequency range and are adaptable to the Navy H-60's hydraulic system. The electronic control system should consist of an electronic control unit, a digital controller, and a control panel. The electronic control unit should interface the sensors with the digital controller or microcomputer. The control panel should provide an interface between the flight crew and the electronic control unit. Sensors are required to measure NP accelerations, rotor torque, and engine shaft pressure. Control of actuator amplitude and phase should be closed loop employing modem multi-input/multi-output state variable techniques for optimum response.

Phase I: Review previous HHC related work and develop preliminary design, using an innovative approach, for HHC actuation and control system and sensor package. Also, provide an initial estimate of performance increase using HHC on a Navy H-60 helicopter.

Phase II: Complete HHC system design, and develop and install the HHC system on an H-60 helicopter at the Naval Air Test Center (NATC). Provide an HHC failure analysis, a system simulation, and design and support a flight test program complete with sensor calibration and data reduction to show the effects of HHC on performance, acoustics and vibration.

N91-333 TITLE: Electrochromic Materials for Prevention of Cockpit Sunlight Infusion into Aircraft

CATEGORY: Exploratory Development

OBJECTIVE: To develop electrochromic materials that can prevent sunlight from washing out color multifunction displays (MFDs) and can also reduce the greenhouse effect in modem aircraft. Many of the new Navy aircraft such as the V-22 and F/A. I 18 utilize color MFDs which are easily washed out by strong sunlight penetrating the canopy. Current electrochromic materials do not meet all requirements needed to solve the problem.

DESCRIPTION: A method of reducing light entering the cockpit is to use electrochromic materials, preferably integrated into I the canopy of the aircraft, to control the amount of light falling on the displays. The major advantage of electrochromics is that j pilots can control the transmission of light into the cockpit for desired light levels. A number of the materials available come close to meeting the requirements for this type of application. Every material investigated to date fails at least one or more important parameter that prevents it from being suitable.

The purpose of this project is to find one or more new materials that would meet all of the major requirements. These requirements are: maximum transmission, 70% minimum (85% goal); maximum/minimum transmission ratio, 10 (100 goal); control voltage, less than 5 volts dc (less than 2 volts dc goal); fail safe, 0 volts dc (or shorted) for bleached; time constant, less than 5 seconds for 90% point each way (less than 1 second goal); temperature, operating range -10 degrees to 55 degrees C (-40 degrees to 70 degrees C goal); temperature, storage -55 degrees to 90 degrees C (-65 degrees to 100 degrees C goal). Material shall be long-term stable, and not deteriorate with ultraviolet radiation. In general, the material shall meet the requirements of MIL-E-5400.

Phase I should consist of identifying materials and selecting promising candidates which have the characteristics indicated above.

Phase II should use the materials identified in Phase I for testing to determine material characteristics. Three .I samples of each suitable material, 10 cm square (with 30 cm as a goal) shall be delivered to the government for testing.

N91-334 TITLE: Development of a More Universal Operational Effectiveness Analysis Computer Model

CATEGORY: Exploratory Development late.

OBJECTIVE: Investigate and demonstrate expanding an existing computer-based operations effectiveness model to analyze the acoustic spectrum of modern warfare from engagements to campaigns.

DESCRIPTION: Operations Analysis (OA) models have traditionally been developed and implemented independently by the j agencies or programs requiring specific platform unique analysis. As a result of processing limitations imposed by hardware, OA models have been scoped to a particular level of conflict in order to achieve fighter simulation fidelity. This limitation requires either a series of models, analyst assumptions or both to analyze weapon systems, strategies and tactics in context with other units or forces. Most OA computer models utilized by government agencies have not kept pace with weapon system developments nor are they readily expandable or exportable for use on evolving computer systems. This situation leaves government analysis low for organizations with a fragmented capability to simulate the many aspects of warfare scenarios.

This effort is designed to expand a modular, portable analysis tool designed for parallel processing into a selectable fidelity, full-spectrum model to serve as a "common denominator" among the specialized computer-based analysis at ion, facilities. It is intended to interact in parallel with related models for large-scale simulation as well as provide stand-alone excursion analysis for decision makers.

Phase I - Research existing models to identify the best candidate for consolidation and expansion. Develop software to demonstrate the degree of the model(s) growth potential.

Phase II - Develop, test and run generic software to model and analyze the operational effectiveness of consist strategic and tactical units in a total force context.

NAVAL SURFACE WARFARE CENTER

N91-335 TITLE: Aircraft & Cruise Missile Mission and Route Planning Using Near Real-Time Pattern Matching Techniques

CATEGORY: Exploratory Development

OBJECTIVE: Devise a concept for near real-time derivation of aircraft/cruise missile routes and mission plans using pattern test matching neural networks and supervised training vibration.

DESCRIPTION: A proof-of-concept is sought that demonstrates a new method for automating aircraft or cruise missile mission and route planning. The method should be non-algorithmic (e.g., connectionist models/artificial neural networks), and capable of " supervised or goal directed learning. The system should operate in three general modes: (1) "basic learning mode" where training can take from hours to days at a shore site; (2) in "fine tuning mode" where the nearly trained system is tuned (in ten minutes or less) to the tactical situation using scenario specific expert rules and constraints based on the latest intelligence/weather, plays etc; and, (3) in the "near real-time mode" in which the system, after fine tuning, can produce hundreds of coordinated U and F/A- aircraft/cruise missile strike plans in only a very few minutes.

In the basic learning mode the system should be able to train on very large sets of machine readable data specific to the target area (feature and terrain maps, weather, defense, etc.). Additionally basic learning modes would use standardized data sets (expertly planned route maps) for supervised training.

In the fine tuning mode the system must be able to continue training using a subnet to embed mission specific tactical rules for parallel implementation. These tactical rules may differ from mission to mission and may include such specific e come items as aircraft or cruise missile type, primary and secondary target designations, time-on-target coordination requirements, etc.

Delivery of a neural network simulation able to solve scaled representations of the problem, e.g. a top problem, is sought for Phase I.

Phase II will develop a hardware/software architecture for solving full scale problems and conclude with a demonstration.

N91-336 TITLE: Automated Aircraft & Cruise Missile Mission and Route Planning Using Parallel Constraint- Satisfaction Techniques

CATEGORY: Exploratory Development

OBJECTIVE: Devise a concept for: (1) near real-time derivation of aircraft/cruise missile route and mission plans using constraint-satisfaction techniques; and, (2) assigning initial values to input parameters in the cost functions.

DESCRIPTION: A proof-of-concept is sought that demonstrates a new method for automating aircraft or cruise missile mission and route planning. The method should emphasize massively parallel processing techniques (algorithmic processing on a shared memory MIMD machine or hierarchical non-algorithmic connectionist models/artificial neural networks). However, a key aspect of this effort, regardless of the method chosen for solving the optimization problem, will be the development of a technique for automatically developing good parameters for the cost functions (e.g., using neural subnets or a parameter set that is positive definite).

The system should operate in two sequential phases: (1) automatic cost function generation -based on generic weapon system constraints (rate of climb, rate of turn, range, etc.) and specific tactical constraints (weather, time-on-target, primary and secondary target types/locations); and, (2) automatic constraint-satisfaction optimization of mission and route plans - based on the number and location of TERCOM, feature maps, defense site location, etc.

Delivery of a parallel system able to solve scaled representations of the problem (e.g. a toy problem with 10 cost functions and fewer than 10 stable states) is sought for Phase I.

Phase II: develop a hardware/software architecture for solving full scale problems and conclude with a demonstration.

N91-337 TITLE: Real-Time Image Processing of LADAR Data for Object Target Classification

CATEGORY: Exploratory Development

OBJECTIVE: Demonstrate the integration of a self organizing hierarchical neural network into a connectionist model for image processing and object categorization and classification.

DESCRIPTION: A proof-of-concept is sought that builds upon the Boundary Contour System (BCS), CORT-X and ART-3 work of Carpenter, Grossberg, Mingolla, and Mehanian. Specifically, this is an effort to develop an integrated neural network capable of accepting LADAR returns (from a low flying aircraft or cruise missile sensor ranging stationary or slow moving objects on the ground, and then performing object boundary segmentation, invariant filtering, and pattern classification).

Phase I of this effort will develop an integrated hierarchical neural network similar to ART-3 with an input from a CORT-X like subnet. The effort should demonstrate non real-time classification of various objects based on government furnished LADAR data.

Phase II of this effort will extend the hierarchical network demonstrated in Phase I to near real-time operations and investigate the system as an adjunct to systems for aircraft (Pilot's Advisor) and for use in an advanced cruise missile or reconnaissance vehicle.

N91-338 TITLE: Connectionist Model for Automatic Target Recognition Based on the Theory of "Object Recognition by Components"

CATEGORY: Exploratory Development

OBJECTIVE: Devise a neural network based model for recognition of complex objects.

DESCRIPTION: A proof-of-concept is sought that demonstrates a multi-level connectionist model for automatic recognition of complex military objects based on: the representation of a complex object from a set of primitive objects; information about the relative spatial relationship between primitive objectives that make up the complex object; and, information about the "legitimate" relationships between primitive objects, complex objects, and the scene in a image. The output of this hierarchical connectionist model/neural network must be Position-Scale-Rotation-Invariant (PSRI) recognition of the complex object and classification (e.g. legitimate SAM site, some component objects of a SAM site, tank, tracked missile launcher, tracked APC, tracked SAM etc.)

Phase I will be a study to demonstrate a multi-level neural network that provides PSRI recognition of a simple geometric primitive and the PSRI identification of a complex object made from the primitives. The purpose of this phase is to demonstrate an orderly transition from an image based frame of reference (assumes low level processing to edges and/or contours) to an object based frame of reference.

Phase II studies will investigate the automatic recognition of complex objects in an object/scene based frame of reference.

N91-339 TITLE: Software Development Process Control

CATEGORY: Advanced Development

OBJECTIVE: Improve the software development process.

DESCRIPTION: An innovative approach is sought for applying statistical process control to a large, complex software development project in a Total Quality Management organization. This project, which may take years to complete and involves many people of diverse scientific disciplines, includes requirements definition, design, code, test, integration, and subsequent maintenance activities. MILSTD 2167 is generally followed. The methodology should include the ability to tract process status and product quality throughout the development cycle to assure management of schedule conformance as well as provide a means for continuously identifying areas for improvement. One approach might be a computer based tracking system for various software metrics that can be easily kept current and that will display trend lines of historical data and flag deviations that might imply schedule or technical risk. Each process phase might have different metrics. The system should be flexible enough to respond to directed requirement and schedule changes throughout the process. Other approaches might work equally well.

N91-340 TITLE: Shipboard Weapon System Crew Training

CATEGORY: Advanced Development

OBJECTIVE: Improve shipboard crew training.

DESCRIPTION: Innovative technologies and methodologies are sought for weapon control system operator training on board ship during routine deployments. No hardware constraints should be assumed. However, it is desired that the training be self paced, and performed without an instructor present. Other characteristics that should be considered are: real-time evaluation of the operator responses, HELP keys, integration with other associated systems, minimal training to use and total realism. Of particular importance is the ability to update the training material when the real system is changed because of maintenance action and upgrades. Bulletins describing workarounds or system anomalies should be easily embedded in the training at the appropriate place.

N91-341 TITLE: Molecular Computing For Automatic Target Recognition

CATEGORY: Research

OBJECTIVE: To construct a prototype computing device from organic materials that demonstrates stability and improved performance over conventional silicon and gallium arsenide based devices.

DESCRIPTION: Organic molecular materials whose functions and operations are controlled by physio-chemical and atomic electronic structure relationships offer a wide range of electronic, magnetic, and optical properties. Examples are optical switching via photoisomerization, signal transduction and transport, pattern recognition, self assembly and repair, and adaptability. Research is sought to understand molecular phenomenon and how to exploit it to design smaller, faster, cheaper and more efficient II computing devices. These devices should be applicable to automatic target recognition problems. Innate pattern recognition he capabilities of molecular materials, e.g. enzymes, could lead to new computing processes or architectures. These may be implemented in conventional semiconductor materials, bio-molecular materials or in a hybrid system.

Phase I should propose concepts for molecular electronic devices and pattern recognition techniques.

Phase II should conduct research, using the developed concepts, into highly connected and parallel systems for information processing in pattern recognition problems.

N91-342 TITLE: Next Generation of High Power Microwave Source

CATEGORY: Research

OBJECTIVE: Demonstrate a technology capable of generating "unlimited" microwave power.

DESCRIPTION: A large number of high power microwave sources with a fixed single frequency and controllable phase have numerous potential applications such as high-power radars and communication, and electronic defense warfare etc.. Combining groups of oscillators with controllable phase can bring the power up indefinitely to the level unattainable by a single one. A novel approach using magnetron arrays to produce such a unique microwave source is underway at Physics International with little theoretical effort. It is crucial to identify the locking condition and requirement for the phase between two mutually coupled high power relativistic magnetrons. The operation of relativistic magnetrons has been successfully simulated self-consistently by using two-dimensional electromagnetic particle-in-cell codes MASK and MAGIC. The analysis of phase-locking of dual magnetrons can be conducted by means of direct particle simulation of two magnetrons coupled by a transmission line. It is feasible to extend the analysis to the peer coupled case with an arbitrary number of devices. This research has some utility in the design of future experiments relative to the phase-locking of many microwave devices.

N91-343 TITLE: High Power Thermal Batteries for Sonobuoys

CATEGORY: Exploratory Development

OBJECTIVE: Develop a high power thermal battery for use in advanced sonobuoys. The battery must be packaged in as small and economical a package as possible and still produce a ten second, 35 kW pulse. Open circuit voltage should not exceed 350 V, and loaded voltage should not fall below 200 V.

DESCRIPTION: Thermal batteries are increasingly used in a broad spectrum of naval devices. Specifically, they are being considered for use in expendable, high power sonobuoys. While they offer excellent power density, they have not previously been optimized for extremely high power, medium duration single pulses. The technologies needed to attain maximum power density include the development of very thin electrodes and appropriate high conductivity molten salt electrolytes.

N91-344 TITLE: Instrumental Diagnostics for Hypersonic Fluid Mechanics Recognition

CATEGORY: Research

OBJECTIVE: To develop an instrumentation diagnostic to measure temperature and skin friction in the NA VSWC Hypervelocity Tunnel 9.

DESCRIPTION: A need exists for the development of two types of instrumentation diagnostics for the study of hypersonic fluid mechanics, especially in the NA VSWC Hypervelocity Tunnel 9 facility. The first diagnostic is a system which globally and non-intrusively measures the vibrational and rotational static temperature of the wind tunnel flow surrounding a hypersonic test model. The second is a measurement of local wall skin friction. Both diagnostics are paramount in the understanding of the physics of hypersonic flowfields and the validation of computational fluid dynamic codes. Both systems will enhance existing SBIR efforts and can also be extended to other-than-hypersonic fluid mechanic experimental applications.

The temperature measurement diagnostic will enhance the flowfield density measurements obtained from the holographic system currently being developed under SBIR funding. From simultaneous temperature and density measurements, other flowfield properties will be known. Therefore, an entire flowfield can be mapped and completely understood non-intrusively.

The skin friction diagnostic will determine the wall shear forces which are needed in the understanding of turbulence and model wall properties. Coupled with the current SBIR program which will enhance our IR camera (wall temperature and heat transfer measurements), this diagnostic will allow for the termination of fluid mechanic surface properties on an aerodynamic model.

Both systems must operate over the following Tunnel 9 environment range:
Mach: 8-14
Test Time: .25 -5 sec
Freestream: Pressure .001 psi to 14.7 psi
Density .00005 lbm/ft3 to sea level
Temperature 50 DegR to 400 DegR

N91-345 TITLE: Low Color Infrared Processor

CATEGORY: Exploratory Development

OBJECTIVE: Design a feasibility model of a simple, inexpensive signal processor using the NA VSWC developed two color array r to detect powered and un powered air targets in close proximity.

DESCRIPTION: A two-color infrared detector array was developed at NA VSWC White Oak by the Solid State Branch. A novel detector array would be an excellent candidate to detect both powered and unpowered jet aircraft and missiles due to the fact that a two color detection scheme mends itself to better target discrimination. Such a two color scheme would have direct i high application in proximity fusing for projectiles and missiles. The main objective of the Phase I SBIR is to design the algorithms, ling using the output of a two color array, to reliably detect a variety of targets in close proximity and then in Phase II to build the IS can signal processor as hard wired electronics and test it to determine its feasibility. The array output will be given to the contract.

In performing the task of designing and building the signal processor, research must first be done to determine the IR characteristics of targets previously described in a variety of environmental scenarios. Likewise, potential weapons on which the two color detector/processor might be used must be identified. For example, such added capability would be a welcomed t-addition to Navy gun fired projectiles. In order to keep the system simple and inexpensive, it is suggested that the scenario be short range detection, on the order of 100 feet or less, since the eventual objective will be to incorporate the two color system into a fuze and not a seeker, although it has extended possibilities in that area.

In designing and building hardware, special consideration must be given to manufacturability, failure mode analysis, eventual size, and Navy fuze safety requirements. The use of state-of-the-art electronics is suggested in order to keep small pace with changing technology and current trends. A microprocessor may be used for initial design, although determining the I 350 failure modes of microprocessors is difficult and, therefore, a custom array may be a better choice. Decisions such as these will be made during the course of the research and recommendations will be made with supporting analysis.

NAVAL AIR DEVELOPMENT CENTER

N91-346 TITLE: Multipurpose IR Optical Scanner

CATEGORY: Advanced Development

OBJECTIVE: To develop a multipurpose optical scanner for air ASW and surveillance.

DESCRIPTION: The Navy's infrared imaging equipment provides moderate to high spatial resolution of scenes and targets at low to moderate thermal sensitivity. However, some naval applications such as tactical oceanography and ASW require very high thermal sensitivities. Accordingly, new infrared line scan imaging systems are needed to provide simultaneously, high spatial resolution of targets and high thermal resolution of the scene. One of the key components needed for such a device is a UC fluid multipurpose dual function optical scanning system for use in multifunction infrared line scan imaging equipment. Such devices and components are not currently available. This development should proceed in two phases. Phase I is a study with the c test objective to define and design an optical scanner assembly including the scanner mirror, scanner motor and related position the sensing and control, collecting optics, and detector interface. This optical scanner assembly shall be capable of collecting infrared IIg SBIR radiation simultaneously in both high spatial resolution and high thermal sensitivity modes. Some key characteristics of this optical scanner assembly include: (1) f/number-approximately 2.0, for use with mercury cadmium telluride detectors, (2) active scanned scene angle -120 degree (60 degree each side of nadir), (3) reflecting optics comprising low distortion scanning optics and ,her collecting optics to produce an image on an infrared detector assembly (the reconfigurable IR detector assembly is being . developed in the FY-91 SBIR Topic No. N91-197), (4) rugged construction for airborne military equipment applications. It is and also highly desirable to add a Forward Looking InfraRed (FLIR) scanning mode to the optical system that would allow combining d heat a line scanner and FLIR into a single system. FLIR characteristics should be aimed at a medium to high resolution state of the dynamic art device.

The Phase I study would conclude with a design for the optical scanner assembly and associated interfaces including all required parameters, specification, ray traces and drawings needed to fabricate the device.
Phase II would be the fabrication of the Dual Function Optical System from the design package proposed in Phase I.

N91-347 TITLE: Long Wavelength Laser Detection System*

CATEGORY: Advanced Development

OBJECTIVE: Develop a low t Long Wavelength Laser Detection System that will provide a laser intelligence capability to Navy airborne platforms.

DESCRIPTION: Development of effective countermeasures to aircraft and thermal imaging systems being illuminated by long wavelength lasers requires detailed knowledge of the lasers being used. This threat is not clearly defined at this time. A need exists to equip existing infrared imaging systems with a system that can effectively discriminate lasers from non-laser sources and provide a measurement of wavelength, and discriminate pulsed from CW lasers. Measurement of pulse width, PRF, and an estimate of irradiance levels are desired capabilities. The wavelength regions of interest are both the 3-5 micrometer and 8-11 micrometer bands. The system should be capable of resolving the laser wavelength to within 0.5 micrometers. This system would allow correlation of recorded infrared imaging system imagery with the data stored by the laser detection system during an event when

the system is directly illuminated that occurs during surveillance operations. The sensing portion of the system must fit within the space available in the existing infrared imaging system turret and on the gimbals, and thus must be suitably small and lightweight. Drawings providing further information concerning the volume available inside the turret are available by contacting the SBIR office. The detector will utilize the present Germanium window used by the infrared imaging system. Data processing storage, display, and control will be located remotely inside the aircraft. The system is required to detect illumination levels down to 10-2 W/cm2. System Field of View is required to be 20 deg. by 20 deg.

Phase I will require the detailed system design.

Phase II will require the development of a prototype system that can be fully integrated into the infrared imaging system turret.

N91-348 TITLE: Vision Obscuring Device for Simulated Instrument Flight Training

CATEGORY: Engineering Development

OBJECTIVE: To develop a system to allow student naval aviators to fly training flights under simulated instrument meteorological conditions (IMC) from the front cockpit of a T -45 aircraft. This system would be produced for use in the Naval Air Training Command.

DESCRIPTION: Current in-flight IMC training systems use an opaque hood attached to the rear cockpit canopy and glare shield to obscure the student pilot's view of outside cues. An improved system would allow student training in the front cockpit, with the following advantages: (1) student in same cockpit on all flights, (2) cockpit optimization for student/instructor roles (instead front/rear identical), (3) use of head-up display (located in front cockpit only) as a primary attitude reference instrument, and (4 training for IMC-to-VMC (visual meteorological conditions) transition (obscuration removed, followed by student landing aircraft in VMC). This improved system would use a combination of a helmet visor and canopy/windscreen cover such that each would be relatively transparent, but when used in combination would obscure all outside cues. Previous studies have indicated that a combination of blue/amber or cross-polarized elements might be suitable. The system should be useable in all day and night lighting conditions, acceptable from a human factors standpoint, and compatible with existing aircrew flight equipment and aircraft escape systems.

Phase I should consist of a report documenting an analysis of available and possible systems, and the design concepts proposed for use in the T -45.

Phase II should consist of furnishing the government design documentation and laboratory test results with prototype suitable and qualified for flight testing.

NAVAL AIR ENGINEERING CENTER

N91-349 TITLE: Embedded Fiber Optic Sensors for Arresting Gear Cables

CATEGORY: Exploratory Development

OBJECTIVE: To investigate the use of embedded fiber optic sensors in arresting gear cables to monitor stress, strain, tension and impact and predict impending failures.

DESCRIPTION: Future arresting gear cable designs will be required to use alternative wire rope and core materials and construction methods to extend loading capacity and service life. Embedded fiber optic sensors have demonstrated the ability t monitor stress, strain and impact of the material that they are embedded in. This reveals the possibility to use embedded fiber optic sensors in arresting gear cable designs to monitor stress, strain, tension and impact as well as predicting, and therefore preventing, impending failures. A t savings would result because

cables would only be replaced when needed as opposed to the current method of replacing cables during regular intervals.

Phase I: Phase I should consist of a study outlining the approach and design methodology which would be used to develop embedded fiber optic sensors that can monitor arresting gear cable conditions in real-time. Phase I should include a survey of optical fiber core, cladding and buffer sizes, types and materials and a conclusion as to which types are best suited for this application. The design methodology should be supported with sufficient data to demonstrate feasibility.

Phase II: Phase II should use the results of Phase I to develop prototype cables with embedded fiber optic and sensors for testing and demonstration. The prototypes should demonstrate the ability to monitor stress, strain, tension, cable kinks 1 and impact in real-time and be able to predict failures before they occur.

Note: This is not an effort to develop new arresting gear cable materials, it is an investigation into embedded fiber optic sensors that can monitor the health of the cables.

N91-350 TITLE: Personal Computer (PC) Based Eddy Current Probe Characterization and Test Station

CATEGORY: Exploratory Development

OBJECTIVE: To fill the need for a system and equipment to test and characterize performance of eddy current probes.

DESCRIPTION: The eddy current industry is in need of a probe test/characterization station to perform quality assurance and in-service testing of eddy current probes. No system exists to perform standardized quality assurance on eddy current probes. The manufacture and test techniques for these probes is artistic in nature and is different at each manufacturer. Extreme variation exists among probes even when manufactured by the same companies. Recent studies conducted by the Air Force have indicated a seven-fold distribution of performance of probes intended to be equal. Standardization of test technique and equipment is needed to improve repeatability of probe performance and improve confidence of inspected aircraft parts.

Phase I: Study and experimentation is required to develop a test and characterization technique using simulated repeatable flaws which will test the probes at all frequencies. The technique needs to consider eddy current repeatable technique and equipment and needs to be useful with portable hardware and produce printed plots and data. The test system: Naval needs to be personal computer (PC) based and fully automated.

Phase II: The actual hardware shall be produced as an IBM PC based system in portable form for use and .J evaluation at Navy activities. The system shall be used on a large number of probes to confirm its ability to find problem probes. The PC itself should not be provided with the system.

NAVAL AIR PROPULSION CENTER

N91-351 TITLE: Advanced Ceramic Cutting Tools for Titanium AIIoys

CATEGORY: Advanced Development

OBJECTIVE: To investigate and develop ceramic cutting tools for use on titanium alloys.

DESCRIPTION: titanium alloys are used extensively in Navy aircraft in both airframe and turbine engine applications. While carbides have been used for machining titanium, they are less then optimum and contain cobalt (a strategic metal) as a binder. The program objective is to reduce dependency on cobalt imports as well as reducing the cost of machining titanium. In the case of machining titanium alloys, the cutting tool behavior is governed by its solubility and reactivity with titanium. The failure mechanism is not a wear type phenomenon.

The work plan should include: 1) powder processing; 2) billet consolidation parameters and evaluation (e.g. density, grain size, and homogeneity; 3) evaluation of hardness, fracture toughness, and interface reactions; 4) fabrication and mechanical properties testing and; 5) documentation of results with assessment of process scale-up.

Phase I: Investigate ceramic exclusive alternatives to carbide cutting tools. The successful completion of the Phase I program will provide a method of consolidation, test data to determine its feasibility as a titanium metal machining tool, and several tool inserts for the Navy to test.

Phase II: Evaluate ceramic cutting tool limiting due to the reactivity and solubility of titanium into the cutting tools.

N91-352 TITLE: Reducing the Toxicity of Beryllium

CATEGORY: Exploratory Development

OBJECTIVE: To reduce effects of beryllium toxicity so that it can be machined and manufactured for use by the military.

DESCRIPTION: Beryllium is currently being used in the aerospace industry to take advantage of its low density, high strength- to-weight and high stiffness-to-weight ratio and excellent thermal conductivity. However, its acceptance and application is limited due to the toxicity of the base alloy and its oxide. Airborne beryllium particles and its salts present a severe health hazard, if inhaled, and parts must be machined in specially equipped facilities. Current secure levels to beryllium dust are limited to approximately five micrograms per cubic meter. Proposals are requested that address: a. reducing toxicity of the material itself without reducing the beneficial properties or ," b. addressing the processing of finished material.

Phase I should address, identify and carry out any processing techniques (e.g. alloying or changing the size or shape of the beryllium powder) to reduce beryllium toxicity.

Phase II will perform manufacturing of parts in an industrial setting to prove the toxicity reduction to acceptable levels while maintaining the beneficial characteristics of the material.

N91-353 TITLE: Innovative. Lightweight. and Long Life Ignition Concepts for Low Pressure Diesel Engines

CATEGORY: Exploratory Development

OBJECTIVE: To develop a simple, lightweight, and long live ignition system capable of starting and maintaining combustion it low pressure (10:1 CR) diesel engines.

DESCRIPTION: The Navy is developing lightweight diesel engines for use in unmanned aerial vehicles (UAVs) which operate low compression ratio to minimize weight. For this reason, a source of energy is required in the combustion chamber to assist starting and maintaining combustion during low power operation and cold conditions. Conventional spark ignitions systems are Iii'" heavy and short lived under diesel conditions. Standard glow plugs are not capable of sustained operation at full power for 100E lengths of time. For these reasons the Navy wishes to develop a simple, reliable, lightweight, and innovative ignition system capable of starting and maintaining combustion in low pressure (10:1 CR) diesel engines. The system mean time between failures (MTBF) must exceed 300 engine hours except for components directly exposed to combustion. These components must operate without replacement for a minimum of 50 engine hours.

It is anticipated that investigation into candidate concepts would be divided into two phases. Phase I would generate conceptual designs which would be validated through theory and analytical assessment and/or testing.

Phase II would consist of fabrication of proof of concept designs and experimental verification of the approach.

N91-354 TITLE: Innovative. Lightweight. and Simple Fuel Filtration Concepts for Small Displacement Diesel Engine

CATEGORY: Exploratory Development

OBJECTIVE: To develop a simple lightweight fuel filtration system for use with internal combustion engines designed to:4 operate on a wide range of fuels.

DESCRIPTION: The navy is developing lightweight diesel engines for use in unmanned aerial vehicles (UAVs) which operate 0 wide variety of heavy fuels (JP-5, JP-8, and diesel). These engines use high-speed direct fuel injectors with close internal tolerances which cannot be subjected to any foreign particles in the fuel. For this reason, the navy would like to investigate sir lightweight filtering methods that would produce negligible or no pressure drop across the engine fuel line. The engines have output in the 25 to 100 hp range and have fuel flows in the 0.0 To 70.0 lb/hr Range (at standard conditions). The system must function with fuels operating in the -25f to 125f temperature range.

It is anticipated that investigation into candidate concepts would be divided into two phases. Phase I would generate conceptual designs, which would be validated through theory and analytical assessment and/or testing. Based on successful results in Phase I, Phase II would consist of fabrication of proof of concept designs and experimental verification of approach.

NAVAL AIR TEST CENTER

N91-355 TITLE: Portable Aircraft Flight Test Instrumentation System

CATEGORY: Engineering Development

OBJECTIVE: To develop a portable airborne flying qualities and performance (FQ&P) instrumentation package for remote aircraft testing.

DESCRIPTION: Flight-testing at the Naval Air Test Center (NATC) is usually conducted with highly instrumented aircraft. Certain type tests, like helicopter/ship at-sea Dynamic Interface (DI) testing, are usually conducted at remote sites with un-instrumented fleet helicopters. Without instrumentation only qualitative data can be recorded, which is not adequate for data extrapolation, analysis, or simulation. Portable, lightweight airborne FQ&P data packages, featuring quick and easy installation, calibration, and removal, would permit quantitative data to be recorded during DI testing. The instrumentation package should be designed to be compatible with the harsh helicopter vibration environment and aircraft/ship electromagnetic environment.

Provisions for mounting the instrumentation package to aircraft support structures should take the airframe crash requirements into account. The package measurements should include aircraft accelerations, rates, attitudes, control positions, power, airspeed, altitude, voice, and time/event correlation, with options for 3-D low airspeed and flight control system actuator positions. Compatibility with ship data packages measuring ship motion and ship air wake parameters is important. Options for miniaturized TM capability to transmit data from aircraft to ship should also be considered.

Phase I: Review existing options (such as MIL-1553 bus, flight control system, multifunction display, etc) for safely accessing flight test parameters in current Navy/Marine Corps rotorcraft. Design a portable airborne instrumentation system for rotorcraft FQ&P or DI testing.

Phase II: Build the portable airborne instrumentation system, in accordance with applicable MIL STDS, and demonstrate installation and calibration in a specified Navy rotorcraft at NATC. Also demonstrate installation in a fleet helicopter I m and support the instrumentation system during an at-sea DI test. Define any variations in installation required for using the system on other Navy/Marine Corps helicopters.

N91-356 TITLE: Instrumentation System to Measure Ship Motion/Air Wake

CATEGORY: Engineering Development

OBJECTIVE: Develop an instrumentation system to measure ship motion and ship air wake to support aircraft/ship testing.

DESCRIPTION: The portable system will be used aboard the ship being tested, and it should be compatible with ship power Id and ship electromagnetic environment. It should also be lightweight and air transportable for remote site aircraft/ship testing. It I should be able to record ship speed/direction, ship anemometer readings, ship motion (accelerations, rates, attitudes, displacements), ship air wake data (3-D steady and turbulence. at specific locations), vice, time, and video during aircraft/ship tests. It should be possible to perform comprehensive ship air wake/motion surveys using the basic system and air wake measuring sensors on the flight deck, during sip testing without an aircraft. Aircraft/ship tests will typically last 1-2 e, with.

Approximately 6 hours of flight testing per day. Large amounts of data processing and data storage capability are required. The instrumentation system software should be user friendly menu-driven, with built-in total system and single channel calibration and checks. The calibrations should account for ship motion at any sensor location with respect to ship center of gravity, center of touchdown spot, or other specified location. Options for presenting real-time aircraft operating limits and for accepting TM data from the aircraft should be considered.

Phase I: Review existing instrumentation systems and sensors used for measuring ship motion and ship on an air wake. Also review both rotary wing and fixed wing aircraft/ship test instrumentation requirements. Develop a preliminary instrumentation system design. Also identify required air wake sensors to support air wake measurements.

Phase II: Complete the instrumentation system design. Build the instrumentation system, in accordance with applicable MIL STDS, and acquire airwake-measuring sensors. Demonstrate system operation and checkout at the Naval Air Test Center (NATC). Also demonstrate system operation and checkout during an NATC helicopter/ship at-sea Dynamic I Interface (DI) test. Provide complete documentation and user instructions for the ship instrumentation system and associated sensors.

NAVAL TRAINING SYSTEMS CENTER

N91-357 TITLE: Knowledge-Based Intelligent Tutoring System (ITS) Development Tool for Tabletop Training Systems

CATEGORY: Engineering Development

OBJECTIVE: To design and develop a low-cost, intelligent, tabletop trainer development system. The system would enable rapid prototyping of 1TSs.

DESCRIPTION: Intelligent Tutoring Systems (lTSs) typically take a significant amount of time and resources to develop. Some of the components, such as those that manage the training session and student performance, could be predefined so that ITS development would take less effort. The tool itself should be based on expert system technology both for control over the development environment and for final ITS execution. Given such an ITS development tool on a low-cost, tabletop computer system, the course writer need only concentrate efforts on the specifics of the information to be learned by the student. As a result, development of tabletop trainers would require significantly fewer resources, enabling greater deployment of the technology.

Phase I: The offeror will perform a preliminary concept design with conformance to the specifications stated j above. The offeror will also show ability to construct a prototype of said device.

Phase II: The offeror will finalize display design and construct a prototype.

N91-358 TITLE: Gas Mask Sensor to Detect Whether Mask is Fully Sealed

CATEGORY: Advanced Development

OBJECTIVE: Develop a detection device for use with a gas mask to determine if the mask is fully sealed. The device is to be used in training exercises to enhance performance of the mask-donning task and provide objective feedback.

DESCRIPTION: The Desert Shield mission may expose Navy personnel to chemical attacks. The ability of personnel to don the gas mask quickly and effectively is basic to survival in a chemical environment. Although the protective mask is the single most crucial article of chemical defense equipment, there is no current training-effective shipboard method for mask donning drill. Mask training currently takes place during Recruit Training. The training consists of entering a tear gas chamber while wearing the sealed mask, breathing through the filter a few times, and then removing the mask so that the contrast with the protected state is appreciated. This method of training is not feasible for a shipboard environment. Also, research has indicated that the tear gas chamber exercise sometimes decreases confidence rather than promoting it. This occurs because many students are unable to completely seal their masks, but they do not report their failure for fear of having to repeat the exercise. Use of a sensor to indicate whether or not the mask is fully sealed would provide objective feedback to the mask wearer as well as to the instructor. The immediate and objective feedback provided would greatly potential the mask donning practice.

Phase I: The first phase will consist of identifying technologies for providing a mask sensor, and performing trade-off analyses to determine the most cost-effective method of implementation.

Phase II: In the second phase a mask sensor will be developed and experiments will be conducted with the gas mask to determine the training effectiveness of the device as a source of performance feedback.

NAVAL WEAPONS CENTER

N91-359 TITLE: Develop an Integrated Missile Power Supply and Roll Control System

CATEGORY: Exploratory Development

OBJECTIVE: The objective of this work is to develop an integrated electric power supply and roll attitude control system for a tactical missile. Innovative methods are sought to improve on the state of the art with power storage and/or generation technology that includes capability to generate missile roll damping forces. Such technology would improve on the use of missile volume by combining weapon power and roll attitude control into one package. This technology would apply to a movable nozzle-based thrust vector controlled missile or generic missile in which no inherit roll control is available. New technology or an innovative integration of existing techniques are sought that could apply to tactical air-launched missiles.

DESCRIPTION: An example approach envisioned for this research would be a suitable integration of an inertial energy storage system to provide an electric power generator and a bi-directional roll torque generator. Features such as minimum weight, low volume, low cost, long shelf-life, reliability, and a short mission duration are desirable. Target criteria (listed below) will be used as benchmarks to assess the degree of improvement over current technology: Maximum Envelope: Cylinder (seven inch max diameter, five inch max length) Minimum Specific Energy: 10 Kilo-Joules/pound Minimum Energy Density: 1.2 Kilo-Joules/cubic inch Minimum Delivered Energy: 210 Kilo-Joules Maximum Weight: 21 pounds r Power Generation Benchmarks: Bi-directional torque production: Maximum Startup time 60 Sec. maximum roll torque 200 inch-pounds Minimum operating life 60 Sec Minimum delivered Voltage 100 Volts Minimum Peak Power Drain 18.2 KW Minimum Continuous Power 3.5 KW. The roll torque production rate and duration is constrained by the total energy dedicated to roll control. The benchmark for total production is a minimum of 30% of the deliverable energy. The benchmark minimum torque production rate is that which can be achieved from a peak instantaneous energy use of 18.2 KW.

Phase I would include a study of feasibility, a technology and selection, a definition of approach and the process used to achieve expected results, and a prediction of expected performance.

Phase II should follow the approach outlined in Phase I to design, fabricate, test, and assess the performance of a prototype device. A prototype will also be delivered to the government for testing.

N91-360 TITLE: Multi-resolution Wavelet Image Tracking to be

CATEGORY: Exploratory Development

OBJECTIVE: This research will explore the uniqueness of multi-resolution, shock filters, wavelet transforms and other new don the algorithms to characterize artificial and natural features at scales, to separate noise from texture and then combine these in the most development of tracking or accurate target localization algorithms.

DESCRIPTION: Infrared or electro-optical imaging systems are prime examples of new sensor systems that produce vast amounts of data that greatly increase the computational burden while processing a particular image or image sequences. Target at the tracking and image identification from image sequences is traditionally achieved by optical flow computations or by linear template ire matching (e.g., matched filters). However, these are not always reliable in the presence of significant noise, blurring, and other of a quantities such as texture, occlusions, and dynamic changes. Multi-resolution wavelet transforms, shock capturing filters, essentially i to the conciliatory disconsolations are examples of new algorithms that can separate texture from noise, restore image degradations and extract local information about "targets". To realize the potential that these unique and innovative fast image-processing tools offer, their compatibility with imaging technologies must be tested.

Phase I: Phase I will be a study to determine the algorithms ability for target localization in a variety of the scenes and patterns.

Phase II: Phase II will combine the promising algorithms found in Phase II to produce new techniques to extract image information for evaluation in real-time target tracking algorithms.

N91-361 TITLE: High Voltage/High Density Capacitor

CATEGORY: Advanced Development

OBJECTIVE: The objective of this task is to develop a high energy, high-density capacitor for use with LASER initiation tem for a systems.

DESCRIPTION: Currently available capacitors are too large to be practical for use with LASER initiation systems in tactical Ible guided missiles due to space allocations for Ordnance components. High energy density capacitors are needed to make LASER)gy or an initiation systems practical for use in firing rocket motors and warhead explosive trains. The requirements for the capacitor are:

a) Capacitance = 20 uF +/- 10%(Design Goal) over the temperature range of -65 to + 165 degrees F
b) Breakdown voltage shall be 2.2kV minimum over the temperature range specified above storage
c) Working voltage shall be 2.0 kV WVDC minimum.
d) The desired geometry of the capacitor is a cylinder 1 inch in diameter by 1.2 long, however; other be used configurations of equivalent volume may be acceptable.
e) ESR shall be 400 milliohms maximum in the frequency range of 120 Hz to 40 kHz over the temperature range specified above.

N91-362 TITLE: Replacement Explosive for HNS-IV (HEXANITROSTILBANE)

CATEGORY: Advanced Development

OBJECTIVE: The objective of this task is to find a replacement explosive for HNS-IV which is the explosive used in Exploding Foil Initiators (EFIs). The EFI is sometimes referred to as the "Slapper" detonator and is used as the primary initiator in Safety-Arming devices that feature a non-interrupted explosive train.

DESCRIPTION: HNS-IV is expensive, difficult to produce, only one source is a qualified to produce the explosive for government use, and it is difficult to press and load. Alternate explosives must be formulated before the EFI can be considered a viable candidate for Department of Defense applications. The requirements for the explosive, in general terms, are:

a) A secondary or booster explosive, as defined in paragraph 4.3.1 of MIL-SW-1316C, must be used.
b) The energy required to initiate the explosive with an EFI shall be equal to or less than HNS-N.
c) The explosive shall retain its characteristics over the temperature range of -55 to + 165 degrees F.
d) The explosive must be capable of being loaded into detonators by means of pressing or by hot melt techniques.

N91-363 TITLE: Low Cost Magnetic Heading Reference

CATEGORY: Advanced Development

OBJECTIVE: To determine the feasibility in packaging and using the very low cost Hall Effect transducer in an orientation invariant magnetic compass for midcourse guidance applications.

DESCRIPTION: Breadboard hardware for a low cost magnetic compass with output accuracy of better than one-half degree of magnetic north has been demonstrated throughout three degree of freedom rotation. The breadboard was implemented with a very low cost Hall effect transducer as a replacement for high cost flux gate compass. A closed loop flux nulling technique was used to linearize the output and greatly reduce transducer errors. Current reversal signals processing of the Hall transducer output also greatly reduces the temperature error effect normally associated with Hall transducer. Accuracy of the overall closed loop system is primarily determined by two stable passive components, a coil and a resistor. The government will provide design disclosure.

PHASE I: Phase I would be a study to optimize the design to demonstrate the producibility of the low cost, Hall Effect transducer based, magnetic heading reference with the above demonstrated accuracy. Sufficient analytical data shall be provided to demonstrate feasibility and make well-grounded selections in design and packaging technology.

PHASE II: Phase II shall use the approved design packaging technology from Phase I to produce two magnetic heading reference systems using the above Hall Effect Transducer design disclosure.

N91-364 TITLE: Low Cost Multi-Spectral Sub-Sonic Radome

CATEGORY: Advanced Development

OBJECTIVE: To determine the feasibility of the manufacturing of a low cost, sub-sonic, optical quality, multi-spectral radome compatible with acceptable receipt of both visual light and radio frequencies. The radio frequencies will be from 2-18 GHz and received on a 4-arm spiral antenna.

DESCRIPTION: The enemy air defense threat to Navy air strike warfare forces has increased both in quality and quantity and include countermeasures that effectively neutralize radio frequency only sensors. The development of a low cost multi-spectral (EO/RF) sensor is being investigated and a low cost multi-spectral radome for sub-sonic vehicles would greatly enhance the successful completion of this effort.

PHASE I: Phase I would be a study examining different materials and fabrication techniques to meet the above requirements of a sub-sonic multi-spectral radome. Sufficient analytical data shall be provided to demonstrate feasibility and make well grounded selections of materials and fabrication techniques.

PHASE II: Phase II shall use the approved material and fabrication techniques from Phase I to produce three multi-spectral radomes and deliver them to the government for testing.

N91-365 TITLE: Electronic Nutation Damping of Free Gyro Seekers

CATEGORY: Exploratory Development

OBJECTIVE: Improve system performance of IR Seekers.

DESCRIPTION: Free gyro seekers like the Sidewinder have traditionally used complex mechanical dampers to reduce the oscillation of the seeker at the nutation frequency of the gyro. These mechanical designs are inherently j frequency dependent. Current designs can be improved if the gyro speed is higher and variable. This requires that the nutation damping be adjustable. Electronic damping may be possible over a range of gyro speeds. The objective of this initiative is to design and demonstrate electronic damping of a small free gyro for application to an IR seeker. The design parameters for the Multi-spectrum Guidance seeker will be provided for the initial design.
It is anticipated that this topic will require access to classified information upon awarding a Phase II contract. Interested applicants must posses or have the capability to obtain facility/personnel clearance up to and including the level of SECRET. The Naval Weapons Center SBIR Office can provide information on the Multi-spectrum Guidance Project.

Phase I: Study outlining the approach which will be undertaken to pursue requirements addressed above with sufficient data to demonstrate feasibility.

Phase II: Use the approach outlined in Phase I to design and demonstrate electronic damping of a small free :It gyro for application to an IR seeker.

N91-366 TITLE: Optimized Antennas for Multi-spectrum Guidance

CATEGORY: Exploratory Development

OBJECTIVE: Improve system performance of RF seekers with aperture blockage.

DESCRIPTION: Multi-spectrum seeker systems are being developed which will include a coaxial IR system mounted in the f radome of a gimbaled RF seeker. Presently the RF and IR seekers are developed independently and integrated into a single system. The RF antenna patterns are degraded by the presence of the IR blockage. Total system performance could be improved by designing the RF antenna for optimum average performance over all RF gimbal angles in the presence of IR seeker blockage. The objective of this initiative is the development and test of an optimized RF antenna in the presence of the IR output seeker blockage. The degradation in antenna gain and side lobes will be minimized as well as the magnitude of the bore sight d loop errors caused by the IR blockage.
It is anticipated that this topic will require access to classified information upon awarding a Phase II contract. Interested applicants must possess or have the capability to obtain facility/personnel clearance up to and including the level of low cost, SECRET. The Naval Weapons Center SBIR Office can provide information on the Multi-spectrum Guidance Project.

Phase I: Study outlining the approach which will be undertaken to pursue requirements addressed above with sufficient data to demonstrate feasibility.

Phase II: Use the approach outlined in Phase I to design and demonstrate the ability to apply the optimization techniques to the antenna used on the Multi-spectrum Guidance Project.

PACIFIC MISSILE TEST CENTER

N91-367 TITLE: Application of Mission Support Systems Technology to Navy Fighters

CATEGORY: Exploratory Development

OBJECTIVE: Demonstrate ground-based mission planning and software parameter tailoring for Navy fighter avionics software.

DESCRIPTION: Mission planning and mission support systems that have evolved to support Navy and Air Force Tactical Aircraft (TACAIR) have focused on characterizing the ground-based threat and scenario environments associated with air-to- the ground attack by manned aircraft or cruise missiles. Further, the Navy's designated core mission planning system for future use by all of TACAIR, the Tactical Aircraft Mission Planning System (TAMPS), was developed for stand alone mission planning and not the avionics/weapons employment missionization and subsequent mission loading to on board aircraft systems. Additionally, Navy fighters have not had the type of complex, software intensive systems and weapons that could be supported by a mission 1 planning and support system until the arrival of the dual role F/A-18, the F-14D, and the future Navy Advanced Tactical Fighter (NATF). These circumstances have left a void in mission planning research and development initiatives for the Navy fighter community. Adequate Support resources do not exist to help aircrew fully utilize the capabilities of their weapon systems in air-to- air combat. Advanced, complex weapon systems require mission support systems to achieve optimum system employment at the direction of aircrew while reducing their workload saturation problems. This effort is designed to provide proof of the unique mission Support concept for fighters, demonstrate the mission tailoring of existing Navy fighter avionics software parameters, serve as a first step for the development of an advanced fighter mission planning module to interface with TAMPS, and demonstrate risk reduction for a key function of the NATF program.

Phase I -Research existing tactical air mission support technology and determine the hardware, software and interface requirements necessary to plan air-to-air tactics for the current and next generation Navy fighter aircraft and the subsequently load/program those tailor able software parameters in the aircraft.

Phase II -Develop prototype hardware, software and interface to demonstrate air-to-air combat tactics adjustable. Planning and programming of Navy fighter avionics consistent with typical mission plans.