

NAVY

Proposal Submission

The responsibility for the implementation, administration and management of the Navy SBIR program is with the Office of the Assistant Secretary of the Navy (Research, Engineering and Systems). The Navy SBIR program manager is Dr. Carl E. Mueller. Inquiries of a general nature may be brought to the Navy SBIR program manager's attention and should be addressed to:

Office of Assistant Secretary of the Navy (RE&S)
Attn: Navy SBIR Program Manager
The Pentagon, Room 5E813
Washington, DC 20350-1000

The Navy has identified 263 technical topics to which R&D businesses may respond. A brief description of each topic is included along with the address of each originating office. This information is contained on the ensuing pages.

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

NAVY SMALL BUSINESS INNOVATION RESEARCH PROGRAM
Submitting Proposals on Navy Topics

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

Topics #N87-001 through #N87-009 and # N87-263

Mail/Hand carry Address

Office of Naval Research
800 North Quincy Street
BCT#1, Room 528
Attn: Code OCNR 11R, SBIR Program, Topic No.
Arlington, VA 22217-5000

Topics #N87-010 through #N87-022

Mail Address:

Office of Naval Technology
Attn: Code OCNR 20T
SBIR Program, Topic No.
Arlington, VA 22217-5000

Topics#N87-023 through #N87-029

Mail Address:

Commandant of the Marine Corps
Headquarters, U.S. Marine Corps
Attn: Code LBC-2 SBIR Program, Topic No.
Washington, D.C. 20380

Topics #N87-030 through N87-043

Mail Address:

Commander
Space and Naval Warfare Systems Command
Department of the Navy
Attn: SPAWAR 10D SBIR Program, Topic No.
Washington, D.C. 20363-5100

Topics #N87-044 through #N87-089

Mail Address:

Commander Naval Sea Systems Command
Department of the Navy
Attn: Code CET-5 SBIR Program, Topic No.
Washington, D.C. 20362

Topics #N87-090 through #N87-096

Mail Address:

Naval Supply Systems Command
Attn: Code PML-5505 SBIR Program, Topic No.
Washington, D.C. 20376-5000

Topics#N87-097

Mail Address:

Commanding Officer
Naval Medical Research & Development Command
Attn: Naval Medical Command, National Capital Region SBIR
Program, Topic No.
Bethesda, MD 20814-5044

Topics#N87-098 through #N87-115

Mail Address:

Headquarters, Naval Air Systems Command
Department of the Navy
Attn: Code AIR-9303D SBIR Program, Topic No.
Washington, D.C. 20361-3030

Topics #N87-116 through #N87-161

Mail Address:

Naval Surface Weapons Center
White Oak
Attn: Code S-02 SBIR Program, Topic No.
Silver Spring, MD 20910-5000

Topics#N87-162 through #N87-167

Mail Address:

Naval Surface Weapons Center
Attn: Code 512, SBIR Program
Dahlgren, VA 22448-5000

Topics#N87-168 through #N87-178

Mail Address:

Commander
Naval Weapons Center
Attn: Code 005 SBIR Program, Topic No.
China Lake, CA 93555

Topics#N87-179 through #N87-187

Mail Address:

Commanding Officer
Naval Weapons Support Center
Attn: Code 6053 SBIR Program, Topic No.
Crane, IN 47522

Topics#N87-188 through #N87-193

Mail Address:

Commander
Naval Air Development Center
Attn: Code 7012 SBIR Program, Topic No.
Warminster, PA 18974-5000

Topics#N87-194 through #N87-206

Mail Address:

Naval Underwater Systems Center
Commercial Acquisition Department, Building 11
Attn: Code 7012 SBIR Program, Topic No.
Newport, R.I. 02841-5047

Topics#N87-207 through #N87-212

Mail Address:

Commanding Officer
Naval Air Engineering Center
Attn: Code 9013R SBIR Program, Topic No.
Lakehurst, NJ 08733-5000

Topics#N87-213 through #N87-215

Mail Address:

Commander
Pacific Missile Test Center
Attn: Code 3141 ABIR Program, Topic No
Point Mugu, CA 93042-5000

Topics#N87-216 through #N87-219

Mail Address:

Naval Training Systems Center
Attn: Code 6 (SBIR), Topic No
Orlando, FL 32813-7100

Topics#N87-220 through #N87-222

Mail Address:

Commanding Officer
Navy Personnel Research and Development Command
Bldg. 329
Attn: Code 21B (SBIR), Topic No.
San Diego, CA 92152

Topics#N87-223 through #N87-225

Mail Address:

Commanding Officer
Naval Civil Engineering Laboratory
Attn: Code L038-SBIR Program, Topic No.
Port Hueneme, CA

Topics#N87-226 through #N87-232

Mail Address:

Commanding Officer
Naval Air Propulsion Center
Attn: Code PEIA – SBIR Program, Topic No
P.O. Box 7176
Trenton, NJ 08628-0176

Topics#N87-233 through #N87-239

Mail Address:

Commanding Officer
Naval Ocean System Center
Attn: Code 0141 – SBIR Program, Topic No
San Diego, CA 93555

Topics#N87-240 through #N87-249

Mail Address:

Commander
David Taylor Naval Ship
Research & Development Center
Attn: Code 003 – SBIR Program. Topic No.
Bethesda, MD 20084

Topics#N87-250 through #N87-251

Mail Address:

Commanding Officer
Naval Avionics Center
6000 East 21st Street
Attn: Code 801, SBIR Program, Topic No
Indianapolis, IN 46219-2189

Topics#N87-252 through #N87-262

Mail Address:

Commander
Naval Air Test Center
Attn: Code CT-24, SBIR Program, Topic No.
Patuxent River, MD 20670-5304

N87-001 TITLE: Eye Movement Instrumentation For Dynamic Skills

CATEGORY: Exploratory Development

DESCRIPTION: A need exists for an automated eye-movement recording and analysis system that would be minimally disruptive to a person engaged in the performance of a task involving whole body motion, such as the control of aircraft landing on a carrier or the performance of an instructor in the classroom. This system must include a capability to record both eye-movements and scene being viewed in such a way that the information can be correlated with a reasonable degree of precision. It should provide capability for automated superposition of eye movements on a video-display of the scene and for recording of that information, as well as for digital recording of data in a form readily usable for standard methods of eye-movement data analysis. Techniques for easily entering information about the location of objects in the video scene should also be provided, such as automated encoding of the location of a light pen. Automated techniques for tracking the location of an object once it has been designated in the video scene would also be highly desirable. To the maximum extent possible, the system should be constructed from standard components that are commercially available, and software should be written in a standard, widely available language. Provide that a sufficiently convincing design concept is presented and expected costs are not excessive, proposals that include prototype construction will be considered and given preference.

N87-002 TITLE: Marine Instrumentation Systems

CATEGORY: Research

DESCRIPTION: Develop innovative techniques for remotely mapping the temporal evolution of three-dimensional coherent structures (e.g., turbulence cells: wave signatures: vortical motion: Langmuir circulation; bubble clouds and plankton patches), providing scalar and vector fields with precision and spatial/temporal resolution adequate to test dynamical hypothesis. Required are unmanned systems or system components designed to acquire reliable, long-term measurements at sea. Modular elements with standardized interfaces include:

Innovative sensors for state and action variables within the ocean and atmosphere boundary layer;
Programmable, adaptive, low power, control and mass storage devices;
Telemetry transmitters, both acoustic and electromagnetic; and autonomous surface and/or subsurface platforms, either fixed position, free drifting, or navigable.

N87-003 TITLE: Red Blood Cell Substitutes

CATEGORY: Exploratory Development

DESCRIPTION: A need exists to increase the supply of biomedical materials capable of delivering oxygen to tissues for combat casualty care and for national emergencies. Approaches currently being developed by the Navy include: 1)enzymatic modification of natural red cells to remove A and B blood type determinants, converting them to Type O or universal donor blood cells, and 2) synthesis of artificial red cells using liposome-encapsulated hemoglobin. Modifications of or alternatives to these biomedical materials are being sought that deliver oxygen efficiently, evade clearance by the reticuloendothelial system and which fail to activate clotting systems.

N87-004 TITLE: Immunopharmacology

CATEGORY: Research

DESCRIPTION: A need exists for pharmacologic agents that can activate immune defenses against microorganisms, especially viruses. Agents that activate either non-specific or specific immunity are of interest, but immune stimulants that protect against a wide variety of infections non-specifically are of special importance to military medicine. Both prophylactic and therapeutic pharmaceuticals are of interest. Suitable pharmaceuticals must

be potentially safe for human use, economical to produce, convenient to use, and enhance resistance to or recovery from infectious agents.

N87-005 TITLE: Spatial Statistics

CATEGORY: Research

DESCRIPTION: Data about phenomena unfolding in space and time are now collected in large amounts, often continuously by automated systems, in disciplines and technologies as diverse as in radar imaging, geology, oceanography, and remote sensing. The common distinguishing feature of these data is the typical existence of patterns which express the underlying interactions between entities observed in space. The purpose of spatial statistics is to uncover the patterns in data about spatiotemporal Phenomena. The proposed research includes:

A comprehensive approach to modeling and inference for space-time processes
Model-free strategies to assess the variability of statistics of spatial data.
Robust inferential procedures for spatial point processes.
Graphical methods to reveal complex structures in multidimensional data.

N87-006 TITLE: Miniature Capillary Pumped Heat Transfer Component

CATEGORY: Exploratory Development

DESCRIPTION: Several classes of new electronic devices would perform much better if waste heat could be removed from them efficiently at moderate operating temperatures, high density digital circuits and concentrator solar cells being two examples. For some applications such as high concentration ratio photovoltaics, heat removal is an enabling technology. What is needed is a component of low weight subtending a very small volume which can remove up to 50 watts/cm² at near room temperature without requiring a pump. Standard heat pipes are far too bulky and heavy for many applications, and most standard designs don't perform well near room temperature anyway. Hopefully the techniques used in silicon microcircuit fabrication could be employed to produce numerous closely spaced grooves through which a liquid heat transfer fluid might flow by capillary action evaporating to absorb the waste heat, thus forming an array of miniature capillary pumped loops. The advantages of forming such an array in a silicon substrate are considerable, since material incompatibilities between waste heat rejection components and active electronic devices are eliminated at the outset.

N87-007 TITLE: Environmentally Stable Fluoropolymers

CATEGORY: Research

DESCRIPTION: The overall goal of this work will be to understand structure property relationships in fluoropolymers with regard to how composition and morphology determine processability and acoustic propagation velocities. Fluoropolymers have long been known to exhibit high environmental stability combined with low surface energy (e.g., ice release coatings). In addition, recent results have shown that certain fluoropolymers can exhibit very low acoustic propagation velocities. A problem with many attractive fluoropolymers is their intractability toward processing. Teflon for example is impossible to melt or solution process. What is sought then is novel polymer chemistry aimed primarily at glassy or thermoset polymers (though other sorts are not necessarily excluded) which will have processability in casting or molding. This will be coupled with physical characterization so as to determine pertinent structure property relationships. The results of this work will have great impact in the area of advanced naval materials for underwater acoustic applications such as sonar domes.

N87-008 TITLE: Processes For Producing Multicomponent Ultrafine Microstructures

CATEGORY: Research

DESCRIPTION: There is increasing interest in materials having multi-component ultrafine microstructures (i.e., a microstructural scale of 1 to 100 nm) and therefore useful mechanical, magnetic or optical properties. Processes are needed which can produce microstructures comprising two or more phases, with emphasis on metals and ceramics, which cannot be produced by solidifying the corresponding liquid. Fully dense materials having a granular or filamentary, vs. laminar, microstructure are of primary interest. Examples include ultrafine composites containing particulate tougheners/strengtheners, ultrafine metal granules embedded in a low conductivity matrix, cermets with bicontinuous phases, and unusual combination of ceramics. The objective of this research is to explore the capabilities of processes which can produce such materials, in particular by understanding the mechanisms which determine the resultant microstructure as a function of process parameters.

N87-009 TITLE: Turbulent Vortex Flows Due to Unsteady Body Motion

CATEGORY: Research

DESCRIPTION: Computational and Experimental work directed towards understanding the flow physics involved in vortex motions generated by unsteady body motion is desired. Purely laminar flows are not of interest. Analytical efforts should have the three dimensional Reynolds Averaged Navier Stokes equations as the lower order model acceptable. The role of turbulent models in such calculations is of extreme interest. Comparison with existing cases for code verification should be considered part of the work. Experimental work that deals with developing instrumentation to obtain quantitative information for such flows is acceptable. However, priority will be placed on efforts that offer quantitative information for such flows and how control devices might be used to control unwanted events in unsteady flows. The flow regimes of interest range from low speed to supersonic.

N87-010 TITLE: Improved Ordnance Life-Cycle Affordability

CATEGORY: Exploratory Development

DESCRIPTION: The objective of this project is to quantify how technology developments can improve ordnance life-cycle affordability in an extended time-frame (POM + 15yr). Based on projected ordnance technology advancements forthcoming, this effort will investigate and develop an ordnance life-cycle affordability model flexible enough to accommodate both inventory affordability and the future capability degradation of the most modern ordnance in that inventory due to advancing threats and end of service life. It is recognized that precise definition of ordnance degradation is complex and difficult. This effort will build on existing older-models which have derived such ordnance degradation factors.

N87-011 TITLE: Composite Materials As Electronic Device Substrates

CATEGORY: Exploratory Development

DESCRIPTION: Electronic devices generate large quantities of heat which produces thermal expansion mis-match problems resulting in bond-line failures and significantly reduced device lifetimes. Recent advances in composite materials offer the opportunity to exploit their potential as thermally stable heat sink substrates for the heat-producing microchips. Composite matrices (carbon, metal, ceramics and organics) reinforced with fibers (graphite, silicon, carbide, aluminum oxide, etc.) can be combined to produce a substrate tailorable to the specific heat sink and thermal expansion requirements of a wide variety of electronic devices. The objective of the proposed effort should be the design of selected composite systems and the demonstration of their utility as thermal expansion-matched heat sinks for electronic devices. The bidder should have background in composite materials and electronic devices. As an alternative, a teaming arrangement between composite materials and electronic device companies should be considered.

N87-012 TITLE: Micron Scale Lithography On Concave Surfaces

CATEGORY: Exploratory Development

DESCRIPTION: The development of micron scale lithography is needed for several Navy cathode applications: (a) very low cost integral cathode/heater/grid structures for expendable TWTs, (b) micron scale porosity for high brightness millimeter wave controlled porosity dispenser cathodes, and (c) integral shadow and control grids for such cathodes. These cathodes range in diameter from a few millimeters to several centimeters and have various spherical radii of curvatures of a few X the diameter. Optical lithography has not been useful here because of short depth of focus; but masked ion beam, X-ray, or e-beam lithography may be possible. Patterning of 2-5 micron slots on 20-30 micron centers with 100-200 micron lengths is needed in mm-size fields which do not have to be accurately stitched (Pattern-transfer by means of ion milling or reactive ion milling is envisioned, in mask materials in which erosion is low).

N87-013 TITLE: Development Of Diver Monitoring Equipment

CATEGORY: Exploratory Development

DESCRIPTION: Divers and combat swimmers continually conduct operations in hostile environments during which physiological limits are approached and on occasion, exceeded. There is a critical need to monitor physiological variables while a diver or combat swimmer is free to move about conducting normal underwater tasks. The physiological variables of interest include heart rate, heat flow, temperature, electromyogram, and respiratory rate. The equipment would be used to monitor the above variables on as many as six divers from a distance of up to two miles. The transmission of the data should involve wireless methods and it is desirable that the data from each diver can be stored for transmission when signaled by the investigator. The envisioned development effort will produce a prototype device for use in the study of diver physiology. The Navy is keenly interested in diver and combat swimmer physiology under variety of conditions and this device will allow the appropriate studies to be made.

N87-014 TITLE: Modeling Of Shipboard Electric Power Distribution System

CATEGORY: Exploratory Development

DESCRIPTION: The objective of this work is to develop an approach to mathematically model the steady-state and transient behavior of a shipboard electrical power distribution system. Such a model would include multiple engine-generators, cabling, distribution breakers at three (3) levels and multiple loads. Loads would include linear, non linear and pulsed types. The output of the work should be a computer model useable by the Navy to analyze the behavior of shipboard distribution systems. The level of detail should be sufficient to include both 60Hz and 400Hz harmonics. The availability of such a model would allow trouble shooting distribution system problems without elaborate experimental measurements, better design of system modifications and new systems, and provide the means to assess the impact of new technology and equipment on the distribution system.

N87-015 TITLE: Electrical Fault Current Limiter

CATEGORY: Exploratory Development

DESCRIPTION: Develop small, low cost device(s) to limit current into a short circuit under fault conditions. Such a device would exhibit very low voltage drop under fault conditions. Such a device would exhibit very low voltage drop under normal conditions, react nearly instantaneously to an over current, and be self healing, i.e., revert to the normal state when the fault is removed. Fault current limiters can be used to reduce the effect of faults in one portion of a distribution system on the unaffected portions, thus maintaining power continuity to vital loads. Further, the short circuit current carrying and interrupting ratings of breakers could be reduced, resulting in smaller breakers and/or the ability to parallel multiple power sources without increasing breaker ratings. Devices with normal state

current ratings in the range of 15 to 5000 Amperes are of interest. Small size and low cost are mandatory for practical application.

N87-016 TITLE: Machinery System Noise Model

CATEGORY: Exploratory Development

DESCRIPTION: The objective of this project is to develop computer software for comparative analysis of torsional vibrations in main propulsion drive trains for Navy ships. Successful software development would provide a tool for conducting comparative evaluations of the noise (on a relative basis) of alternative machinery systems. This would permit machinery noise to be considered on an equal level with other performance characteristics such as size, weight, and efficiency when conducting comparative evaluations of alternative machinery systems for future ship applications. The user should be able to specify the amplitude, frequency and point of application of the torques which excite the system. The primary outputs generated by the software will be the ratios of the oscillation amplitudes at any junction in the system to exciting torque amplitude as a function of frequency.

N87-017 TITLE: Power Amplification For Underwater Electroacoustic Transducers

CATEGORY: Exploratory Development

DESCRIPTION: Design, develop and demonstrate a compact, highly efficient (greater than 60% power conversion) power amplifier that will self tune over a bandwidth of at least one octave about a resonant frequency of an underwater electroacoustic transducer. At the selectable "tuned" frequency, the system must efficiently produce a high-fidelity and high-power acoustic signal. Available electric battery power would be in the 1-1.5 KW range with output underwater acoustic levels in the 190-210 db re 1 uPa range. Nominal frequencies considered should be 0.5-200 kHz.

N87-018 TITLE: Mine Warfare Tactical Theory And Planning Methodology

CATEGORY: Exploratory Development

DESCRIPTION: Development of minefield and mine countermeasure theory and related analytical models which can treat the entire stockpile-to-target sequence and be used to evaluate complex multiport and campaign level scenarios. Near term application of this improved methodology will allow more realistic predictions of the effectiveness of various minefield designs; permit more efficient utilization of available mining assets; provide a capability to accurately determine stockpile requirements; and realistically compare the attributes of new mine design concepts.

N87-019 TITLE: Detection of Non-Metallic Objects

CATEGORY: Exploratory Development

DESCRIPTION: There is a requirement for developing a capability to locate small, non-metallic objects on the surface or shallowly buried, both on land and/or in the surf zone. It is further required that the chosen technology be effective in a variety of soils and under all weather conditions. Also desired, but not required, is the capability of incorporating the resulting design into a man portable configuration.

N87-020 TITLE: All Metals Locator

CATEGORY: Exploratory Development

DESCRIPTION: The Navy requires an active all-metals locator for detecting and locating ordnance with metal components. The locator should be a hand-held, one-man operable device for both surface and underwater use to 300 feet depth. It should have the following capabilities and characteristics:

Detection Range: 1-inch by ¼ inch brass ion at 20-inches minimum.

Operational Weight: 15 pounds maximum

Underwater operational Depth: 300 feet

Operational Time: 8 hours

Operating Temperature Range: 125F to –30F

Power Supply Type: available batteries.

The locator would need to be rugged and reliable in all field scenarios requiring disposal of explosive ordnance.

N87-021 TITLE: Enhanced Undersea Warheads

CATEGORY: Exploratory Development

DESCRIPTION: Warhead concepts capable of producing enhanced damage to ships and submarines for weight and volume limited undersea weapons systems are needed. These concepts include, but are not limited to, explosive compositions having increased output, focused blast warheads where the stock wave energy is concentrated in the direction of the target, shaped charge warheads incorporating new metals or bimetals and/or liner shaper, long rod penetrators, explosively formed formed projectiles, etc. For each concept, analytic tools such as finite element codes should be conducted to validate these analytic results. The end product should be a warhead concept whose feasibility has been demonstrated on a preliminary basis.

N87-022 TITLE: Innovative Methods For Submarine Detection

CATEGORY: Exploratory Development

DESCRIPTION: Develop innovative methods of submarine detection using advanced techniques. One of the key factors in maintaining sea control, in the event of a conflict, is our Navy's ability to detect and defeat hostile submarines. This task solicits innovative proposals to accomplish the detection part of this effort. Respondees should examine emerging technologies for potential application to submarine detection systems, develop system concepts, and recommend those seeming to offer the highest for further development. Factors of cost, feasibility, sweep rate, and reliability of detection should receive careful consideration in the development of proposed concepts. The ability of proposed systems to operate under a variety of weather and oceanographic conditions as well as their ability to localize a potential submarine target to a small area will also be considered in the selection of concepts. Especially promising concepts will be considered for further development.

N87-023 TITLE: Variable Speed Compatible Refueling Drogue For Air Refueling Fixed/Rotor Wing Aircraft

CATEGORY: Exploratory Development

DESCRIPTION: At present, the mission of refueling both fixed wing and helicopter aircraft cannot be accomplished without air equipment change to the refueling pods. This is due to the design of the high speed drogue that will not support the weight of the refueling hose at the lower speeds required for the helicopter refueling. The challenge is to develop a drogue that will support the 80 foot refueling hose at airspeeds between 105 KIAS and 250 KIAS. The goal of this study should result in the development of a design proposal of a flight worthy engineering development model of a variable speed compatible aerial refueling drogue.

N87-024 TITLE: Communications Skills For Base and Station Communications-Electronics Officers (CEO's)

CATEGORY: Management and Support

DESCRIPTION: Base and station communications skills are not the same as tactical skills, yet the Marine Corps provides little or no special training to officers or senior staff NCO's assigned to billets as base or station CEO officers. Required communications and related functions and skills need to be identified, qualified, and recommendations made to implement an effective training program.

N87-025 TITLE: Translation of Jams Software From "C" Language To Ada Language

CATEGORY: Engineering Development

DESCRIPTION: JINTACCS Automated Message System presently is written in the computer language "C". Due to the now available ADA compilers and DOD direction, conversion requires the translation of approximately 500,00 bytes of code.

N87-026 TITLE: Fibre Optic Cable Recovery System

CATEGORY: Exploratory Development

DESCRIPTION: Both the teleoperated vehicle (TOV) and the airborne remotely operated device (AROD) anticipate the employment of fibre optic cable over considerable distances both in training and in combat operations. Marine Corps units require the means to recover deployed fibreoptic cable expeditiously to relieve logistic aspects of TOV/AROD operations and to limit the expense of both training and combat operations. As a design point, the system need; the capability to recover fibre optic cable at a rate of 15 km/hr (higher rate if terrain permits) on one spool without damage to the fibre optic cable. The purpose of the system is to recover the fibre optic cable for subsequent respooling. The system needs to be mountable on a HMMWV, to require no more than two Marines, to be powered by HMMWV sources and to be simple in design for field maintainability. The task is a three-phase undertaking in which the Phase I is a feasibility study. Phase 2 is the fabrication effort derived from the consideration of Phase I. Phase 3 is the demonstration validation of the recovery system design.

N87-027 TITLE: Tactical Warfare Simulation Evaluation Analysis System (TWSEAS)/Aviation Systems Interface

CATEGORY: Advanced Development

DESCRIPTION: Produce a report indicating the most effective means of interfacing the TWSEAS with the current and projected Marine Air Command and Control Systems (MACCS) at the Marine Amphibious Brigade and Force levels. Complicating this problem is the fact that the MACCS are already large automated. The goal of this interface is to provide exercise information to the wing command elements which will allow them to participate in integrated exercises with the other elements of the Marine Amphibious Brigade and Marine Amphibious Force.

The TWESAS is a computer assist, real time tactical exercise control system which can monitor actual events as they occur in field exercises and as reported by umpires using digital communications links. In the command post exercise where only the player's command post is real, TWSEAS simulates the battlefield environment, reports the actions of all simulated units and calculates/reports all combat damage as a result of actions of forces on both sides of the engagement. Combat information must reach the player's command post in a manner which is the same as, or at least very close to, that which is present during actual battle.

The MACCS environment contains numerous automated systems with new versions currently being developed. These systems include the Advanced Tactical Air Command Center, The aviation portion of the Tactical Combat

Operations System, and the Tactical Air Operations Module. The training target elements in the MACCS are not air controllers, but rather, the command staffs. This effort should include an analysis of the most beneficial point(s) of interface to exercise the MACCS command elements. Factors such as the amount and type of required information, and appropriate transfer points shall be included. As a follow-on effort, Interface Design Specifications could be prepared for the specific interfaces defined in the initial effort. These specifications shall be in accordance with Military Standard 2167 (or current version thereof).

N87-028 TITLE: Tactical Warfare Simulation Evaluation Analysis System/Marine Integrated Fire And Air Support System Interface

CATEGORY: Advanced Development

DESCRIPTION: Produce an Interface design Specification, in accordance with Military Standard 2167 (or current version thereof), and an operational concept of employment for the interfacing of the Tactical Warfare Simulation Evaluation (TWSEAS) and the Marine Integrated Fire and Air Support System (MIFASS).

The TWSEAS is a computer assisted, real time tactical exercise control system which can monitor actual events as they occur in field exercises (FEX) and as reported by umpires using digital communications links. In the command post exercise (CPX) where only the player's command post is real, TWSEAS simulates the battlefield environment, reports the actions of all simulated units and calculates/reports all combat damage as a result of actions of forces on both sides of the engagement. In order to be successful, combat information must reach the player's command post in a manner which is the same as, or at least very close to, that which is present during actual battle. The TWSEAS must interact with the player's command and control systems. In the future, this command and control environment will include MIFASS. MIFASS will be a command and control system which will integrate artillery, mortars, naval gunfire and air support with the unit scheme of maneuver. Since supporting arms actions form a large part of the combat exercise environment, there is a clear need for the TWSEAS and MIFASS to interface. This effort shall include the software and hardware issues involved in the interface as well as an analysis of the level on interface required supported by the operational and training requirements present during an integrated (i.e., combined FEX/CPX) exercise involving Marine Air integrated (i.e., combined FEX/CPX) exercise involving Marine Air Ground Task Forces at all three levels of command (Marine Amphibious Unit, Brigade, and Force). These requirements include the need to present various information to the exercising staff via these command and control systems as well as the need to create a realistic environment through the simulation of the player's real command and control systems.

N87-029 TITLE: Mechanical Differential Steer Drive Unit For Amphibious Tracked Vehicles

CATEGORY: Engineering Development

DESCRIPTION: The current hydrostatic steer unit and transmission assembly for the AAV7A1 have experienced a high failure rate in testing and operational use. A mechanical steer drive unit has potential for drastically reducing failure rate, initial procurement cost, as well as overall life cycle costs. Additionally, reliability, availability, and maintainability and vehicle performance could be appreciably improved. Adapt existing designs (commercially available differentials, gears, transfer cases, etc.) into a mechanical steer drive unit and control system that would allow for assembly and installation into an Assault Amphibian Vehicle 7A1 (AAV7A1)

N87-030 TITLE: Frequency Stabilization in Pulled Laser Waveforms

CATEGORY: Advanced Development

DESCRIPTION: A significant problem in developing a pulsed coherent laser system is the control and minimization of frequency jitter (intra-and inter-pulse) in pulsed waveforms. Current approaches involve the development of ultra stable Master Oscillators and utilization of Power Amplification (MOPA) stages. While effective, this approach leads to large and relative inefficient laser transmitters. An innovative approach is needed to

allow the utilization of smaller, less complicated and more efficient laser sources which can still maintain critical levels of frequency stability. In general, this technique must be applicable in a system producing high repetition frequencies must be applicable in a system producing high repetition frequencies (PRFs) and peak power.

A potential solution to this problem would be the measurement of frequency instabilities and modification of the frequency content of a pulse prior to the transmission. An approach based on modifying successive pulses would not be satisfactory, since from pulse to pulse there is little correlation in intra-pulse frequency jitter. In particular, the frequency stability required is so severe that even CW systems require intricate design and fabrication procedures to achieve it. Proposed approaches will have to describe the process, determine the level of frequency stability, and determine what power level can be achieved.

N87-031 TITLE: Broadband Acoustic Characterization

CATEGORY: Advanced Development

DESCRIPTION: Further improvement in detectability of broadband underwater acoustic radiated energy depends upon more detailed characterization of that energy and application of sophisticated signal processing techniques to capitalize upon particular features for detection, classification and localization. This task involves processing of real acoustic data with utilization of innovative software tools to parameterize the broadband signature characteristics by quantifying spectral, correlation, statistical or other applicable methodology products. This detailed characterization can be utilized in further, carry-on tasks to develop algorithms for detection and classification and to identify possible sources of the broadband energy.

N87-032 TITLE: Automated Broadband Detectability

CATEGORY: Exploratory Development

DESCRIPTION: Utilize characterizations and parameterizations of broadband underwater acoustic radiated energy and real target characteristic maneuvers to develop innovative approaches to target detection tracking and classification. Both the target signature and the target dynamics should be accounted for to produce automatic operator alerts, measure parameters useful for multiple hypothesis classification group sorting and associate sporadic contacts with multiple acoustic contacts.

N87-033 TITLE: High Power Microwave Antenna Development

CATEGORY: Exploratory Development

DESCRIPTION: New high power microwave source devices under development require an associated development of antenna technology. The high power microwave antenna performance characteristics required include the ability to project gig watts of effective radiated power with superior gain and side lobes which are down 80 db from beam main lobe intensity. A modified phased-array design is thought to represent the best compromise solution for the conflicting performance requirements. The Phase I Small Business Innovative Research effort needed is a preliminary design calculation based upon first principles and innovative fabrication concepts.

N87-034 TITLE: Submarine Communication In Direct Support Of a Battle Group

CATEGORY: Advanced Development

DESCRIPTION: There is a need for covert means for a submerged submarine in direct support of a Battle Group to communicate with the Battle Group Commander or other members of the Battle Group. The objectives(s) of this task are to provide a reasonably covert means of communication between a submerged submarine and members of a Battle Group (Battle Group Commander/Composite Warfare Commander). As a minimum, the communication

system should: have an availability of 0.90; be reasonably covert; impose a minimum restriction to submarine operations and tactics; to the maximum extent possible, utilize equipment which is presently on board surface ships and submarines; NOT require the submarine to surface, or expose radar antennas above the surface to communicate; obtain a minimum communication range of 10 nautical miles, at a signal-to-noise ratio of 10db, data rate of 100 bits per second with an error-to-noise ratio of 10 db, data rate of 100 bits per second with an error rate not greater than ten to the minus four. The end result of this task will be: A literature search and requirements analysis; a communication system technical analysis and risk assessment; and a system definition.

N87-035 TITLE: Data Compression For Naval Messages (And/EDM)

CATEGORY: Advanced Development

DESCRIPTION: Data compression can be applied to naval record message systems to increase their throughput and efficiency. This task will investigate the cost and benefits to be derived from the application of data compression techniques to a target naval record message processing system specified by the Navy. Analysis will be performed to identify viable compression techniques and to quantify the resulting increases in system throughput. Implementation requirements, such as the need for new compression equipment and/or the use of existing processing and storage capabilities to support compression functions, will be considered. Candidate compression techniques to be investigated include both reversible and non-reversible and semantic dependent and independent techniques. Examples are null suppression, bit mapping, run length encoding and that broad class of statistical methods represented by Huffman encoding. Chaining (sequential application of different techniques) will also be considered. Compression ratios of the order of 2:1 resulting in approximately a doubling of system throughput) will be sought with no degradation in system error performance. A follow-on task will establish the performance of the candidate compression technique(s) through benchmark testing. Compression performance test results will provide the basis for subsequent preparation test results will provide the basis for subsequent preparation of program plans and system specifications for the implementation of data compression within a naval message system.

N87-036 TITLE: Low Cost Pointing And Tracking System For Optical Communications

CATEGORY: Advanced Development

DESCRIPTION: Free space optical communications could become an important mode of information transfer between ships that are e within line of sight. Optical communications emitters and detectors have become readily available at low cost as have many other critical components. These devices can support the very high data rates needed for modern naval sensors and command and control. However, subsystems for the pointing and tracking of these optical signals continue to be difficult to build due to the high precision required of the mechanical gimbals. Their costs dominate the overall cost for free space optical communications. What is needed are innovative approaches to pointing and tracking including control system theory, the mechanical assemblies, and the means for their economical production. Microprocessors, for example, could be used to implement a complex algorithm that would be used with a simple mechanical assembly with loose tolerances to provide accurate tracking and pointing. Production of an accurate pointing tracking system would be significantly easier because of the loose tolerances on the mechanical assembly and low cost of microprocessor electronics. Other innovative approaches could prove to be even more attractive. Proposals should focus on the potential of low cost and ease of production along with the innovative aspects.

N87-037 TITLE: Tactical Packet Transmission

CATEGORY: Advanced Development

DESCRIPTION: The large number of systems desiring access to the HF, increasing volume of traffic from those users presently using the channels and the need for faster communication with the community lead to a severe problem in the use of very limited assets. The traditional method has been to "add another circuit" however, the spectrum is presently so crowded that this is not a satisfactory solution. The use of packet transmission schemes for

the transmission of data and voice is not only feasible, but appears to be practical. The task is to document the circuits required for the Atlantic Fleet and then develop approaches to allow an evaluation of the implementation problems.

N87-038 TITLE: Adaptive Techniques To improve HF Communications

CATEGORY: Advanced Development

DESCRIPTION: The use of High Frequency radio to transfer command and control information in the battle force is expected to continue for the foreseeable future. The use of adaptive techniques to improve the performance of HF in a noisy environment appears to have potential. The task is to explore the threats to HF communications and propose solutions. The solutions must be evaluated in terms of cost, size, implementability and benefit. A follow-on effort, if desirable, will be to brass board a system and develop system specifications.

N87-039 TITLE: Development of Covert Communications Applique

CATEGORY: Advanced Development

DESCRIPTION: Develop an appliqué to lower the detectability of existing VHF or UHF radios so that they can be used for special communications from ship to ship or other operations requiring limited range communications. Obvious techniques such as power reduction and signal spreading techniques will be considered. Innovative methods for low cost implementations should be considered. Radios to be considered should include: WSC-3, PRC-117, and ARC-182.

N87-040 TITLE: Arctic Meteor Burst Communications

CATEGORY: Advanced Development

DESCRIPTION: Increased Soviet submarine threat levels in the Arctic (both strategic and tactical) have driven a corresponding U.S. emphasis for increased Arctic operational capabilities. U.S. Submarines must be capable of communications with beyond line of sight (BLOS) shore stations while remaining below the ice layer. Furthermore, a report back capability must be developed which is independent which is dependent which is independent of satellites (due to their vulnerability), resistant to nuclear ionospheric effects, difficult to jam or intercept, and has high throughput. Meteor burst communications offer such an alternative. The objective of this effort will be to develop an ice penetrating expendable meteor burst buoy. Coordination with current effort to develop ice penetrating techniques is mandatory. The first phase of this effort will consist of a review of current and buoy design. The second phase, if desirable, will consist of refining buoy design to ensure power, frequency (30-100 MHz) and size requirements are met. A prototype buoy will then be built and tested in conjunction with a schedule ice exercise.

N87-041 TITLE: Software Programmer Productivity

CATEGORY: Advanced Development

DESCRIPTION: The Defense Department urgently needs ways of increasing the productivity of individual computer programmer in an effort to reduce the sizable costs of software intensive programs. Practically all major procurements nowadays require a large investment in applications programming and the general level of industrial productivity in this area is quite low ...1 to 5 lines of code per day per programmer on a gross average. Dramatic increases in productivity would permit faster development which would quickly recoup the research investment. Furthermore, it would permit larger sized programs to be undertaken with obvious application to the Strategic Defense Initiative as well as Navy Command and Control Programs. All technical approaches to increasing productivity will be entertained.

N87-042 TITLE: Software Development Measures Of Performance

CATEGORY: Advanced Development

DESCRIPTION: The Defense Department urgently needs ways of measuring progress of software development in software intensive systems. Although reasonably analytic methods are available to Navy and Defense contractors today, they often consist of "score keeping" of software modules undergoing design, coding, integration, and test. Is there a way, for instance, of measuring the complexity of modules or entire systems with a view toward accurate cost and schedule data before the fact, and tracking the effort accurately during the development? A survey of available methods is not what is expected. Original work, building on today's state-of-the-art is required.

N87-043 TITLE: Low Cost Electronic Warfare Systems For Remote Operated Vehicles

CATEGORY: Advanced Development

DESCRIPTION: The U.S. Navy has needs for Compact, low cost electronic warfare systems to be carried by remote operated vehicles. These will be used for surveillance and for countering threat surveillance, missile attacks and data links. Design work is required for electronic counter measure techniques and frequency set-on generators integrated with a microprocessor controller that will provide autonomous and remotely cued countermeasure responses coordinated with the tactical deployment of the remote operated vehicle.

N87-044 TITLE: Torpedo Mk 46 Exercise Configuration Recovery Subsystem

CATEGORY: Engineering Development

DESCRIPTION: The torpedo Mk 46 exercise weapon is recoverable at end of run through a system of lead weights which are released at a predetermined depth. The loss of the lead weights then makes the weapon positively buoyant; it rises to the surface and is recovered. The current design employs explosive bolts (NALC DN61) which are fired at the specified depth and which then release the lead weights (approximately 70 lbs). Although generally satisfactory, this method has been the source of several problems. The explosive bolt has proved difficult for several contractors to make and without them, the Fleet exercise program can be curtailed. Secondly, once the bolts fire and release the lead weights, residual bolt body must effectively seal the torpedo exercise head against seawater contamination at great depths. Contaminant of the exercise head can result in loss of that expensive component. What is needed is an alternate method to release the lead weights that does not require the use of other expendables such as explosive bolts and which is simple, reliable, and effective.

N87-045 TITLE: Broadband Transducer/Amplifier Techniques

CATEGORY: Advanced Development

DESCRIPTION: Tuning techniques are required to permit efficient excitation of a broadband, high power sonar projector over a minimum octave frequency band around the mechanical resonance of the transducer. The amplifier types that may be used to excite the transducer would be either of a switch mode or linear variety. Techniques involving the phenomenon of negative capacitance and/or variable tuning are candidates for investigation.

N87-046 TITLE: Improved Maintenance Aids

CATEGORY: Engineering Development

DESCRIPTION: Current maintenance practices onboard ship involved tech manuals and maintenance/repair cards which are bulky to carry around, not easy to follow and at times difficult to keep up to date. This solicitation is for a small demonstration hardware system using the latest technology in storage, graphics, interactive displays and voice

to “automate” a small and selected set of current maintenance aids. The can prompt or lead the troubleshooter through the procedures without referencing current documentation.

N87-047 TITLE: ASW Search Planning

CATEGORY: Advanced Development

DESCRIPTION: Develop search planning methods for optimizing asymmetrical detection performance (i.e., detection performance which is non uniform in azimuth due to beam dependent noise and (or) propagation loss). Apply these to sonar performance prediction/lineup and search planning methodology.

N87-048 TITLE: Flexible Fusion Splices For Optical Fiber

CATEGORY: Engineering Development

DESCRIPTION: A need exists for a technique to achieve flexible fusion splices of optical fibers in the field. This technique will be critical to the practical utilization of optical fiber sensor technology in an operational environment. The resulting spliced and coated fiber should have nearly the same physical characteristics as the fiber on either side of the splice. Bend radius and hermeticity would be two parameters of concern.

N87-049 TITLE: Environmentally Stable Single mode Fiber Optic Couplers

CATEGORY: Engineering Development

DESCRIPTION: Environmentally stable, single mode fiber optic couplers are critical components for virtually every fiber optic sensor and transmission system. There is a need to develop fabrication techniques for low cost, high volume production of these components. Particular attention should be given to the potential for automation and the application to polarization preserving fibers.

N87-050 TITLE: Shallow Water Sonar System

CATEGORY: Advanced Development

DESCRIPTION: There is a need for a shallow water sonar system (shallow water 40 – 1000 fathoms). System will be used on small ships so it should be 15K yds. Or more consistently. System should be able to detect, classify, localize and prosecute the threat without other sensor assistance.

N87-051 TITLE: Pigtailed Single mode laser Diodes

CATEGORY: Engineering Development

DESCRIPTION: Pigtailed laser diodes are critical components for all fiber optic sensor systems. There is a compelling need to develop fabrication techniques for pigtailed single mode laser diodes, particularly towards achieving automated fabrication processes for low cost, volume production. Manually pigtailed single mode laser diodes are available from a limited number of suppliers, but fabrication techniques are costly, time consuming and have a low yield rate.

N87-052 TITLE: Fine Metal Reinforcements For Ceramic Composites

CATEGORY: Exploratory Development

DESCRIPTION: With the advent of ceramic matrix composites there is a need for various types of reinforcements. One of the combinations of matrix and reinforcement that has received little attention but offers great potential payoff is the metal reinforced composite. To be most effective at producing high strength as well as high toughness composites, submicron and metal powders and metal wires are required. The development of submicron diameter serial metal powders and whiskers will enable a new class of composites to be developed. This aluminum and molybdenum. Using the above technology fabricate appropriate parts of a steam turbine engine. After laboratory analysis, parts will be exercised on torpedo test vehicle. Parts include turbine nozzle plate and gears.

N87-053 TITLE: Field Theoretical Model Of Acoustic Propagation With Rough Boundaries

CATEGORY: Research

DESCRIPTION: A model for the propagation of acoustic waves through a medium with rough boundaries (surface, or bottom, or both) is needed. The emphasis is on alternative to conventional ray tracing techniques. A prototype test case would be one where source and receiver are under-ice and in shallow and low frequency acoustic wave is propagating. The output should be an analytical description of acoustic field at the receiver for all combinations of ranges and depths. Innovative approaches to characterizing the interaction with the rough surface(s) are also appropriate.

N87-054 TITLE: Piezoelectrical/Magnetostrictive Sonar Transducer

CATEGORY: Advanced Development

DESCRIPTION: An underwater sonar transducer is required which combines the advantages of a magnetostrictive and electrostrictive/piezoelectric transducer as described in U.S. Patent 4,443,731 (Butler and Clark Hybrid Piezoelectric and Magnetostrictive Acoustic Wave Transducer). Specifically a transducer is needed which has minimal need for electrical tuning and is physically configured for pressure cancellation in the acoustic medium. Utilization of the lanthanide series magnetostrictive material Terfenol-D will optimize transducer performance.

N87-055 TITLE: Low Cost Acoustic Sensor Technology

CATEGORY: Advanced Development

DESCRIPTION: Effective deployment of acoustic detection systems will in the longer term be dependent on the development of low-cost acoustic sensor technology. Several current approaches to low cost sensors have been based on the use of optical fibers and Polyvinylidene fluoride (PVDF) wire. While these materials could potentially provide the needed low-cost acoustic sensors, laboratory investigations have revealed serious problems related to high acceleration response in the materials. Current efforts to develop these sensors further are hampered by inadequate understanding of the response of such sensors to vibrational excitation. This procurement is for the development of analytical models that relate sensor output to mechanical excitation input in terms of the elastic and optical or piezoelectric properties of the sensor. With such models sensor performance might be optimized to minimize acceleration response. Sensor optimization should include not only overall sensor geometry but also optimal selection of sensor and laboratory evaluation of their respective vibration response is desired. Appropriate methods for mounting the candidate sensors in various types of acoustic arrays should also be considered.

N87-056 TITLE: Low Cost Telemetry

CATEGORY: Advanced Development

DESCRIPTION: There is need to substantially reduce the cost of current acoustic and non-acoustic data telemetry system in arrays. These are one or two dimensional arrays with large numbers of elements, each with a significant

bandwidth. A telemetry system is required which can receive data from each sensor and process it to give the required information such as beam forming. Preferably each sensor will be passive or very low power and capable of a large (80db) dynamic range. Sensors may also be of mixed types such as acoustic and non-acoustic. The proposal shall describe the innovative, preferable non-digital, telemetry system to be used, estimated it's cost and describe how the data will be processed.

N87-057 TITLE: Implementing Incremental Delays For Hydrophone Position Corrections to Fixed Delay Beam formers

CATEGORY: Advanced Development

DESCRIPTION: Current beam formers of interest assume a known and fixed hydrophone geometry. This is not always the case. An important case of interest is when the hydrophone positions are known but changing with time. Enabling a beam former to respond to hydrophone time trajectories is a new capability. A significant problem in using this new information to compensate for beam former degradation due to the changing geometry is the need to change the fundamental shipboard signal processing architecture. This procurement is for the development of a prototype architecture. This procurement is for the development of a processing architecture. This procurement is for the development of a prototype stand-alone device which would supply incremental delays in response to array geometry changes so that the hydrophone time series, which go to the central beam former, "appear" to be coming from undistorted geometry. This cannot be done exactly because the perturbed time delays are a function of a steered direction as well as the perturbed geometry. However compensation within sectors of the steering space of primary interest might be possible.

N87-058 TITLE: Artic Ice Thickness Measurement

CATEGORY: Exploratory Development

DESCRIPTION: Develop a method for measurement of the thickness of arctic ice from either the surface or from under the ice using laser technology. The goal is to be able to measure the thickness of arctic ice in the range of 6 inches to 100 feet, with an accuracy of 10%

N87-059 TITLE: Acoustic Reverberation And Background Monitoring

CATEGORY: Advanced Development

DESCRIPTION: Develop modifications to the AN/WLR-9 intercept receiver to permit real time monitoring of the reverberation and background noise fields utilizing the system's SPL (sound pressure level) measurement capability.

N87-060 TITLE: Low Frequency Underwater Sound Calibration Source

CATEGORY: Exploratory Development

DESCRIPTION: A low frequency, non-explosive, sonar projector is required to perform acoustic calibrations at sea. Specifically a highly efficient projector capable of the one watt acoustic output at a mechanical resonance below 500 Hz I needed with physical dimensions such that it may be installed in a cylindrical shell with a diameter not exceeding three and one half inches and a length not to exceed 18 inches.

N87-061 TITLE: Very-Low-Frequency, High Power Sonar Projector

CATEGORY: Exploratory Development

DESCRIPTION: High Power, non-explosive, broadband acoustic sources are needed to implement proposed active surveillance systems concepts. Specifically, a flexural type sonar transducer excited electrodynamically using high efficiency magnets is required to produce a source level in the range of 190 db to 230 db re micro Pascal/Hz over the frequency range of 5 Hz to 40 Hz. To demonstrate feasibility and establish a technology base, a scaled model transducer will be initially designed and built.

N87-062 TITLE: Microbend Optical Sensor For Gear-tooth-Root Pressure Measurement

CATEGORY: Advanced Development

DESCRIPTION: Develop a Fiber Optical Microbend Probe for Torpedo Gear testing. High speed gears in torpedoes are one of the major components of this noise is believed to result from the Hydrodynamic pumping action of the meshing teeth. Experiment determination pumping action of the meshing teeth. Experimental determination of this noise sources requires the measurement of the dynamic pressure at the root. This measurement of the dynamic pressure at the root. This measurement requires a very small, fast response probe with a large dynamic range. Such a device is not commercially available. An attractively simple fiber-optic pressure sensor is the microbend-attenuation device. This works by an increase in the attenuation coefficient of a multimode fiber by the imposition of millimeter scale bends, from a corrugated cover sheet. The potential advantages of this type of device include: simple signal conditioning (light amplitude measurement) easy light coupling (multimode-fiber); as well as small size, fast response and large dynamic range.

N87-063 TITLE: Acoustic of Neoprene Transducer Windows

CATEGORY: Advanced Development

DESCRIPTION: Study and test the effects of composition of neoprene such as type of carbon black used etc., on the acoustic of torpedo transducer windows. Properties to be evaluated include power absorption, shear, hardness, beam pattern effects etc. A neoprene having understood and controlled composition is critical to the acoustic performance of a torpedo transducer.

N87-064 TITLE: Modeling Effects of Tribochemical Processes

CATEGORY: Exploratory Development

DESCRIPTION: Mathematical models of tribochemical processes are required are required to account for the chemical processes that may be critical in determining wear lifetimes, and design limits for loads and speeds. They may also be needed in determining the rate at which lubricants (or species forming the component's environment that react to produce a lubricant) must be added to reach a steady or quasisteady state that avoids lubrication distress and ensures reaching design lifetimes. Innovative approaches to the development of the database and the modeling guide such designs are required. In the first phase of this effort it is anticipated that modeling approaches will be developed and "proof-of-principle" calculations carried out. In addition concepts are to be developed for acquiring the experimental data base required to verify the models and ensure the utility of the predictions for the design engineer. Of particular interest are the following situations: (1) chemical reactions of a ceramic (or hard coated) surface with species in its environment to form a solid lubricant; (2) improving prediction of wear for metals with boundary lubrication.

N87-065 TITLE: More Effective Navigation Model For Interdiction Of Evasive Targets

CATEGORY: Exploratory Development

DESCRIPTION: Well known and widely used navigation laws (e.g., proportional, bearing rider and pursuit guidance) are not highly effective in interdiction of targets executing evasive or large volume search maneuvers,

particularly if high turn rates are used. Develop and demonstrate by computer simulation a more effective navigation law to cope with such targets. Assume the target is a modern high performance torpedo, having appropriate dynamic characteristics.

N87-066 TITLE: Three Dimensional Underwater Acoustic Intensity Measurement System

CATEGORY: Advanced Development

DESCRIPTION: The objective of this SBIR is the design, fabrication and evaluation of a compact underwater acoustic measurement system that can be used to more completely characterize the nature and sources of both radiated noise and scattered acoustic fields produced by submerged vehicles like submarines and torpedoes. A small, probe-type array of eight or more hydrophone elements is required. These elements are to be configured in such a way that the acoustic Pressure, p , and particle velocity, v , can be measured simultaneously in three orthogonal directions. Determining these two field quantities allows one to numerically compute the corresponding complex intensity ($I=pv$) and/or the complex specific acoustic impedance ($Z=p/v$) at any point in the field; even the field nears the radiating or scattering surface. The sources and paths of acoustic energy can be identified by having the probe scan the acoustic field produced by the vibrating submerged structure. The ability of the probe to simultaneously monitor the three-dimensional components of an acoustic field suggests that transient noise sources and responses can be determined. It is envisioned that the probe system will also include a separate projector element that will provide a control source for in-situ calibration and orientation of the array. Over the last few years the feasibility of a two or four element probe technique has been established for one-and two dimensional air-borne radiated noise diagnostics (e.g., 1-), however similar applications for underwater acoustic structures is relatively new (e.g. 6-8). In addition, no known system possesses the feature of the proposed system: simultaneously three dimensional measurements, transient analysis, and in-sit calibration and orientation capabilities. A few of the technical issues needed to be addressed include the size and shape of the array, the signal processing and calibration procedures, the influence of environmental and flow noise on performance.

N87-067 TITLE: Compact Underwater Buoyancy System For Expendable Sonobuoys

CATEGORY: Advanced Development

DESCRIPTION: Improved nondestructive evaluation methods, for testing the integrity of rubber-to-metal bonds in sonar transducers are needed. Current techniques are ultrasonic, holographic, visual or mechanical methods none of which are consistently reliable and universally applicable to the numerous assortments of joint configurations found in sonar transducers. The goal of this effort is to develop a cost effective non-transducers. The of this effort is to develop for testing the integrity of rubber-to-metal bonds on production units. New methods are needed which will be inexpensive, reliable and easy to use by operators having little or no training. Portability for use in field testing is also a desirable attribute. Proposed methods should be capable of detecting debonds in which the rubber and metal remain in intimate contact. In addition the methods should as a minimum detect debonds at corner joints and within the annulus formed by the transducer shroud and head mass assembly.

N87-068 TITLE: Improved Transducer Production Testing For Rubber-To-Metal Bonded Joints

CATEGORY: Advanced Development

DESCRIPTION: Improved nondestructive evaluation methods, for testing the integrity of rubber-to-metal bonds in sonar transducers is needed. Current techniques use ultrasonic, holographic, visual or mechanical methods none of which are consistently reliable and universally applicable to numerous assortment of joint configurations found in sonar transducers. The goal of this effort is to develop a cost effective nondestructive evaluation method for testing the integrity of rubber-to-metal bonds on production units. New methods are needed which will be inexpensive, reliable and easy to use by operators having little or no training. Portability for use in field testing is also a desirable attribute. Proposed methods should be capable of detecting debonds in which the rubber and metal remain in

intimate contact. In addition the methods should, as a minimum, detect debonds at corner joints and within the annulus formed by the transducer shroud and head mass assembly.

N87-069 TITLE: Standard Backplane Busses For Navy Tactical Hardware

CATEGORY: Advanced Development

DESCRIPTION: The use of an “open architecture” (the use of a standard well-defined backplane) for some commercial computers (e.g. the Apple has enabled hundreds of third party vendors to build boards for these machines and for VARs (value-added resellers) to apply these machines to a host of special applications. Furthermore, these standard-backplane processors can be easily linked via LANs (Local Area Networks) because LAN bus-access cards have been built for these standard backplanes. The Navy could more easily interconnect tactical processors, displays, etc. If they used a common standard backplane to which LANs would interface. Furthermore, the Navy could competitively procure memory boards, I/O boards CPU boards, etc. if they all worked with a standard backplane. The objective of this task is to define an innovative solution to the problem of standardization of backplanes within USN tactical computers, displays and other equipments.

N87-070 TITLE: Non-procedure Languages For Rapid System Prototyping

CATEGORY: Advanced Development

DESCRIPTION: The successful development of large, complex computer systems depends on a detailed analysis of user needs and requirements analysis phase can result in product deficiencies which can be very expensive to correct. Modern, non-procedural languages could be used to allow the rapid development of a prototype of the proposed system based on the user development of a prototype of the proposed system based on the user requirements, This prototype can provide a system model for user review and study. It will allow the early identification and correction of errors in requirements definition and help assure a better product. In addition, the prototype could serve to support automated design and development. The possible application of non-procedural languages to system prototyping will be studied with particular emphasis on problem orientation and on the consequent limitation(s) on flexibility, and an architecture for this concept developed.

N87-071 TITLE: Radar Cross Section Of Targets – Dynamic Behavior

CATEGORY: Advanced Development

DESCRIPTION: One of the major challenges facing naval weapon systems in the 1990's is to defend against attacking missiles (primarily) which have radar cross-sections considerably reduced from values regarded as typical today. The Navy deals with requirements rather simply expressed as a single value and based on first-order reflection from the vehicle itself. It is important to gain greater understanding of total cross-section (or of the “radar observables”) of such targets while in flight; both the effects of the violently displaced medium and the effects of vehicle effluents must be considered, with cause and effect separations of the two. The object is to gain an understanding of lower bounds on radar cross-sections and, further, to develop radar waveform and signal processing methods to favor the dominant reflection mode whatever its nature. The Phase I effort requires literature search and own generation of a framework for accounting quantitatively for the several possible effects (body, medium disturbance, effluents), and some exhibit of radar characteristics likely to enhance detection (carrier frequency, resolution cell size, Doppler processing), and will propose experimentation in such phenomena (as in medium-variable wind tunnels, for example) and in radar techniques appropriate (whether at own facility or in cooperation with others, government or industry for Phase II accomplishment.

N87-072 TITLE: Use of Millimeters Wave Technology in Naval Shipborne Radar Applications

CATEGORY: Advanced Development

DESCRIPTION: Among the many challenges facing radars in the 1990/s in their support of shipboard weaponry are some in which the characteristics normally associated with millimeter wave radar would seem well-suited to meet. For example, wavelengths of 10mm and shorter permit quite narrow beams from modestly sized antennas; this permits in turn low elevation tracking in the presence of multipath (sea surface reflection), less off-set jamming, interference and clutter sources. Other generally accepted challenges in naval radar are the smaller cross-section targets, one's own desire to hide one's signal, the desire to classify targets by high resolution (multi-dimensional) signals and processing, and exploitation of the particular propagation characteristics of the medium. The use of millimeter wave radar is not itself unknown in the free-world military. The object of this work is to associate the 1990's needs of shipborne radar with the properties of millimeter wave radar (particularly as seen in maturing systems elsewhere), and to present (relative to U.S. Navy's present and projected radar systems) complementary features, subsystems or companion systems that could become parts of our improved systems or new development of the early 1990's. A Phase I report will require review of these requirements, of our present systems and plans, of millimeter state of the art and equipment availability, the accomplishment of some performance and sizing calculations, and recommendations for Phase II pursuit involving experimentation and demonstration.

N87-073 TITLE: Critical Strain Energy Density As A Fracture Mechanics Criterion

CATEGORY: Advanced Development

DESCRIPTION: For elastic-plastic fracture of ductile metals, several fracture mechanics criteria have been proposed. One of these, the method of critical strain energy density has the advantage of being able to evaluate the non linear case of mixed-mode elastic-plastic fracture. An argument for this method is that the critical strain energy density can be determined from a true stress-strain test, and other fracture tests are unnecessary. This initiative is intended to evaluate that hypothesis. Comparison of various steels, including Ordinary Strength (OS), Higher Strength (HS), HSLA-80 and HY-80 alloys will be made to establish a correlation between the strain energy determined from a true stress-strain tensile test and fracture evaluated by other parameters, including J1C and Charpy V-notch.

N87-074 TITLE: Computer Program to predict Fatigue Crack Growth

CATEGORY: Advanced Development

DESCRIPTION: The objective is to identify existing fatigue crack growth computer programs which can accurately predict growth in submarine hull structural details. The lack of analytical methods to predict fatigue crack growth in submarine hull structures have lead to a reliance on large scale model tests when developing and certifying new hull materials and suspected overly conservative surveillance procedures. A validated analytical method would provide is a tool for assessing current surveillance procedures and possibly eliminate the need for large scale fatigue model tests. This effort will consist of surveying existing programs and selecting those surface discontinuities in structures subjected to variable amplitude applied compressive loading and residual welding stresses. The selected programs will then be used to analyze a number benchmark experimental cases to determine each programs accuracy.

N87-075 TITLE: Composites For Auxiliary Machinery Components And Equipment

CATEGORY: Advanced Development

DESCRIPTION: Composites offer potential advantages which are not only limited to initial cost and weight savings but also include corrosion resistance, design adaptability and multifunctionlity which will reduce acquisition and maintenance costs of future Naval machinery components. Weight savings of at least 20-30% can be realized by replacing metals with FRP's in machinery-related applications such as: (1) shafts, (2) intake ducting, and (3) housings for electrical systems (e.g., generators, motor housings, panels, enclosures). Where required, a hybrid concept can be utilized; e.g., a composite shell containing an insulated high temperature metallic liner for application for exhaust ducts. In addition, in applications where corrosion resistance, as well as weight reduction is

of concern (e.g., fuel: sanitary and ballast tanks), FRP's provide an attractive alternate to metal for areas that have historically been difficult to preserve due to near-impossible surface preparation/access situations. Composite selection, fabrication techniques and property characterization compatible with application, should be addressed. Issues such as fire, smoke & toxicity must be considered.

N87-076 TITLE: Detection Of Antifoulants In Aqueous Media

CATEGORY: Advanced Development

DESCRIPTION: Anti-fouling paints for boats and ships are designed to release toxins onto the surrounding seawater to hinder the adherence and growth of bacteria, diatoms and slime films on the hull. These films are believed to increase the hydrodynamic drag factor, and adhering mollusk and arthropods can actually damage the paint film on the ship. Tributyltin compounds have been demonstrated to be very effectively biocides. Novel analytical methods to detect and determine the concentration of parent biocide and related oxidation or degradation products are sought to better evaluate the risks, if any, to nontarget organisms.

N87-077 TITLE: Fire Resistant Barriers For Composites

CATEGORY: Advanced Development

DESCRIPTION: Various studies have shown that demands to reduce weight and improve specific structural characteristics of Naval Ships can often be met through the use of organic matrix composites. However, one major obstacle remaining in the way, which limits use of composites on Naval ships is the combustible nature of the polymeric component of the composite. A potential solution is the use of fire resistant barriers for composites. This barrier can be an outer skin of a composite, either mechanically bonded or integrally fabricated to the polymeric material. Metallic or ceramic materials may be considered. However, such barrier must have minimal weight impact and be able to be conformal to a variety of geometrics. Methods of attachment will need to be addressed as well as fire performance of the barrier material including effect on composite properties after fire testing.

N87-078 TITLE: Noise Control Bibliography

CATEGORY: Management Support

DESCRIPTION: Develop an annotated bibliography of open noise control literature according to topics such as:

Machinery quieting
Measurement and analysis techniques
Acoustical materials
Effects of noise on people

Sources to be used should include references to contemporary papers in Acoustics (supplement to Journal of Acoustical Society of America) Engineering Index, Applied Sciences & Technology Index, and Reader's Guide to Periodical Literature.

Bibliography should begin in 1975.

Bibliography should include brief (50 words or less) synopsis of indexed

N87-079 TITLE: Flowmeter Technology

CATEGORY: Exploratory Development

DESCRIPTION: New flowmeter technology is required to accurately measure the mass of fuel transferred during open sea re-fueling operations. Flow rates in excess of 1000 gallons per minute are required with a desired accuracies of 1%. This investigation should evaluate the available technology and determine the feasibility of new flowmeter technologies. The flow meter must function under extreme environmental conditions and present no explosion hazard.

N87-080 TITLE: Miniature Magnetic Sensor

CATEGORY: Exploratory Development

DESCRIPTION: Show feasibility for developing a miniature single axis magnetic sensor capable of detecting field changes in 1 nanotesla in a background field of 20 perstedts, with a bandwidth of DC to 100Hz. The sensor shall operate at room temperature with a stability and drift of 1 nanotesla per hour. The sensor element shall not be more than 10 cm² in volume (not including electronics).

N87-081 TITLE: Improved Fracture Resistance Of Gas Turbine Ceramics

CATEGORY: Research

DESCRIPTION: Basic investigation into the fracture initiation of ceramics could provide useful information needed to extend the life of ceramics in gas turbine engines. This effort should determine if it is the microns in gas turbine engines. This effort should determine if it is the presence of latent flaws or impurities which initiate cracks in ceramics and identify the nature of those flaws if possible. Almost any representative ceramic can be used provided it has application in the gas turbine engine hot section. The effort would involve identifying a material, obtaining samples initiating fractures in such a way that the fracture surfaces can be studied to determine the source of the fracture initiation and writing a report.

N87-082 TITLE: Ceramics Structures For Diesel Engines

CATEGORY: Advanced Development

DESCRIPTION: A significant problem in the application of ceramic materials to diesel engines concerns integrity of ceramic to metal structures. Cylinder liners and heads, valves and pistons might display increased life, lower friction, and better engine performance if a reliable method of joining were available. The disparity in thermal coefficients of expansion is a principal problem. Composites of ceramics and metals, and fabrication methods to reduce their disparity should be investigated. Test pieces should be joined and thermal cycled under simulated conditions, and a report made comparing present techniques to test samples reflected.

N87-083 TITLE: Development Of low Cost RPV Sensor And Communications Payloads

CATEGORY: Advanced Development

DESCRIPTION: Conduct development and test of low cost sensor and communication payloads for expandable Remote Piloted Vehicles (RPV's) for over the Horizon (OTH) target and reconnaissance roles. The feasibility of launch and retrieval is being developed in current R&D programs, however, the amount of R&D being accomplished for RPV payloads is limited. Without payload development, RPV applications to the Navy's Surface Ship Continuing Concept Formulation (CONFORM) Programs ship designs are not credible.

N87-084 TITLE: Millimeter Radar Non-Contact Ranging

CATEGORY: Advanced Development

DESCRIPTION: Simple and effective non-contact ranging sensors are needed for use on mobile robotic platforms for purposes of obstacle avoidance, vehicle navigation, and discrete object detection. Conventional radar systems have been used since World War II to determine range to targets and other objects, but are traditionally complex, expensive, and lack the resolution needed for the short range applications required of robotic systems. Millimeters wave radar may provide a cost-effective solution as a non-contact ranging sensor for mobile robots. Proposals should stress low cost, low power consumption, and should quantify the expected range and bearing resolution of the resultant system.

N87-085 TITLE: Ship Motion Effects

CATEGORY: Exploratory Development

DESCRIPTION: Throughout history the environment aboard ship has present a challenge to those designing equipment which must function in concert with the pitch, roll and yaw of a vessel at sea. Numerous potential shipboard robotic systems are being studied in attempts to improve safety, increase productivity, and reduce manning. This effort requires the investigation of effects of ship motion on robot dynamics and equipment life, and to develop specific solutions to any such identified problems so as to minimize performance and service life degradation.

N87-086 TITLE: Torpedo MK 48 Adcap Thermal Battery

CATEGORY: Engineering Development

DESCRIPTION: The Torpedo MK 48 ADCAP utilizes a thermal battery to provide electrical power to the torpedo during its transition from external power to load assumption by the internal torpedo alternator. This battery is functional between the application of the fire signal and the time the torpedo alternator assumes all internal loads (approximately 10 seconds). Once activated the battery load life is ten seconds. Once the firing key has been closed the thermal battery must be considered activated. If a misfire occurs the torpedo must be considered a dud weapon and backhauled for thermal battery replacement. An alternate transition power supply is therefore required that will allow more than one firing attempt for the weapon. The alternate must be of the same form, fit and function as the existing thermal battery.

N87-087 TITLE: Advanced Power Sources For Naval Mines

CATEGORY: Advanced Development

DESCRIPTION: Power/energy dense, safe batteries with long shelf lives are required for Naval mines. This effort seeks to develop a new mine battery to meet these demanding requirements that is also economical to produce

N87-088 TITLE: Naval Minefield Computer Modeling

CATEGORY: Advanced Development

DESCRIPTION: Computers are used to simulate the behavior of Naval mines and minefields. The results of these simulations are used to set inventory objectives or to determine which characteristics of Naval mines need improvement. New modeling methods are needed to refine estimates of minefield performance with varying targets and countermeasures.

N87-089 TITLE: Rapid Mine Surveillance in Shallow Water

CATEGORY: Advanced Development

DESCRIPTION: Surface forces can not conduct over-the-beach operations through mined shallow water. Mine clearance in shallow water is very difficult. One means of reducing the threat from mines would be to be able to survey a hostile coastal area rapidly for mines and then select for the operations an area where there was a low density of mines. This effort seeks to identify and verify the type of sensors which could be used to rapidly locate submerged and partially buried mines in coastal environment to depths of 30 feet or more. The rate of coverage needed is such that an aircraft platform would be required for the sensor.

N87-090 TITLE: Voice Actuated/Phonetic Recognition Microcomputer Input Device

CATEGORY: Advanced Development

DESCRIPTION: The Navy requires a small device with the ability to translate voice input into data which can be read by a computer. It is needed for many inquiry-driven, transaction-oriented applications. A vocal phonetic recognition device could be used to augment bar code reading devices or other forms of source data automation technology already planned or in existence. The device must be able to translate enough Phonetic characters to be equivalent to at least 50 spoken numbers, alphabetic letters, and control words, i.e., dot, dash, commas, etc. The device must provide some type of feedback, either audible or visual to the user so that translation can be verified and confidence in must not be affected by background noise associated with shipboard and/or warehouse operation. Finally, the device must be capable of being programmed to format translated data, must be compatible with a variety of common protocols, and be able to connect via RS-232 type interface ports with a large range of microcomputer hardware and mainframe peripheral devices.

N87-091 TITLE: Electric Power Supply And Pump-Motor Assembly

CATEGORY: Advanced Development

DESCRIPTION: A compact efficient, electric power supply and pump-motor assembly is required to provide chilled water to a portable personal cooling system. The power to the pump-motor assembly to allow for 6 hours of operation Recharging of the power supply should be designed to provide approximately 200 lbs/hr flow of water at 20 psig. Minimization of size and weight are primary considerations for both the power supply and pump-motor assembly. The power supply shall be capable of being recharged at least 100 cycles.

N87-092 TITLE: Flame Retardant Coated Fabric For Hazardous Chemical Handler's Protective Clothing

CATEGORY: Advanced Development

DESCRIPTION: The Navy has a need for a liquid/vapor impermeable, flame retardant material for use in the manufacture of hazardous chemical handler's protective clothing. Desired properties include self-extinguishing, no melt-drip, impermeable to all known hazardous chemicals (liquid and vapor form), unaffected by all classes of petroleum oil and lubricating products, flexible at temperatures from -40F to 120F, and posses a tear strength of 8lbs. (min) warp and filling.

N87-093 TITLE: Alternative Buoyant, Flame Retardant Materials For Clothing Applications

CATEGORY: Advanced Development

DESCRIPTION: The Navy has a need for hire retardant buoyant insulating materials other than closed cell foams for use in cold weather clothing. The materials should be self-extinguishing upon exposure to flame hydrophobic

when submerged in water and have the potential to be incorporated into a garment to provide insulation and positive buoyancy, while still providing some degree of air permeability.

N87-094 TITLE: Telemetry System For Measurement Of Body Temperatures

CATEGORY: Advanced Development

DESCRIPTION: A need exist for an untethered, compact, portable telemetry system for measurement of body temperatures, including both skin and core temperatures. The system is capable of telemetering temperatures for a distance of up to one-quarter mile in an unobstructed area. It should be portable and adaptable for both field and laboratory use and should be lightweight, as it would be carried on the person. The receiver should be portable but will be located in a fixed area. As a minimum, the system should be capable of measuring three skin sites and one core site simultaneously. Preferably, core temperature should be measured internally in a location other than the rectum. However, the selected site should show good correlation with measurement of esophageal or rectal temperature. The range for the core temperature measurements should be 33-40C for the skin temperature measurement, 9-40C. The digital readout should be accurate to 0.1C.

N87-095 TITLE: Standard Generalized Markup Language (SGML) Integrated Software Package

CATEGORY: Advanced Development

DESCRIPTION: The Navy requires a Standard Generalized Markup Language (SMGL) Parser. It will enable automated printing and publishing of electronically composed documents received via telecommunications. Current commercial automated publishing systems are unsuitable because they are geared to an in-house environment and would necessitate rekeying of data received electronically from the multitude of word processors used through out Navy. The Navy Publications and Printing Service Management Office (NPPSMO) already has contracted for the selection of a small subset of SGML tags and supporting document type definitions to utilize gencodes for manual coding by the publishing customer. It is expected this language will serve as a preliminary publishing guideline with evolution to content tagging since SGML's use has recently been approved by the International Standards Organization tagging, this project will develop an integrated package of software to eliminate manual insertion codes for existing documents. The software is to automatically invoke a syntax-directed editor for new documents and validate the SGML tags and document type definitions through a parser. There should be a loose coupling between the various components of the integrated software with any hardware or vendor software. Total decoupling between the syntax-directed editor and the automated program to tag existing documents are required. The integrated package should be developed in "C" be designed to operate on micro and mini based processors, handle a wide variety of document formats, end comply with ANSI standard X3.64-1979, subj: "Additional Controls for Use with American National Standard Code for Information Interchange" (FIPS PUB86). The validating parser shall have the capability to detect whether a document is correct or incorrect according to the rules of SMGL and the associated document type definitions, and should be able to output fully qualified generic identifiers as well as a fully tagged document (removing minimization).

N87-096 TITLE: Non-metallic (Self Curing) Toe Protection for Footwear

CATEGORY: Engineering Development

DESCRIPTION: The Navy requires a light, self curing compression resistant, safety toe box capable of resisting a compression force in excess of 2500 pounds and an impact of 75 foot pounds as per ANSI Z41.1 1983 standard. This non-metallic toe would replace the prevailing steel safety toe which is the standard of the footwear industry.

N87-097 TITLE: Miniature Transducer For Measuring Respiratory Rate, Volume, And Oxygen And Carbon Dioxide Concentration

CATEGORY: Engineering Development

DESCRIPTION: The development of miniature transducers, compatible with a naval aviator's oxygen mask, to measure respiratory rate, volume, and oxygen and carbon dioxide concentration with sufficient response time to calculate uptake (V_{O2}) and production (V_{CO2}) during flight is essential for quantifying metabolic work during various flight maneuvers in operational environments. The Naval Aerospace Medical Research Laboratory (NAMRL) is soon to acquire a solid-state recording device that is capable of recording numerous physiological and environmental parameters during flight. Any transducers used in conjunction with this device must be able to convert Physiological readings into analog signals that can be automatically recorded on a solid-state device. Oxygen and carbon dioxide transducer that are small enough to fit inside an oxygen mask and are not affected by environmental extremes (e.g., G-forces, barometric pressure changes, and vibration) are not currently available.

N87-098 TITLE: Observability Of Rotorcraft Due to Electrostatic Charging

CATEGORY: Exploratory Development

DESCRIPTION: Evaluate the susceptibility of rotorcraft to detection, tracking and targeting by enemy forces resulting from buildup of electrostatic charge on the aircraft. Determine variation in susceptibility with ground plane characteristics, atmospheric characteristics, and conditions controllable by the crew (such as altitude, airspeed, etc.). This effort will be pursued with a view to possible follow-on work in these areas: Explore possible means of countering any significant susceptibility discovered; Evaluate threat to other types of aircraft and applicability of countermeasures; Explore exploitability of the effects for own force observation of enemy aircraft.

N87-099 TITLE: Development Of innovative Computer Applications For Navy Aircraft/Ship Interface Equipment

CATEGORY: Management and Support

DESCRIPTION: Develop innovative approaches and new techniques utilizing installed hardware and software for logistical, budgetary, and program management applications in the area of navy shipboard and shore based launch and recovery, and aircraft interface equipment. Desired is a relational database management system able to communicate via 2400 band modem in a wide area remote network linking diverse Navy Agencies utilizing current knowledge gained from informational systems applied/expert technology areas. Specifically, support is required for equipment ILS effort, government furnished property inventory management, engineering change proposal and ship alteration material tracking, internal and external budgetary spreadsheets and documents, and generation of applicable reports. Consideration must be given to internal data control, electronic mail and quality assurances issues. Generic to this effort will be the conducting of a requirement definition analysis/study, development of a master/overview plan concept feasibility demonstration through the development and building of a working software prototype and supporting technical documentation. Project objective would be to achieve more effective cost control, enhance the quality of inventory management and tracking, and improve the accuracy of long range planning. Additionally, a data repository will be established from which information and knowledge can be organized to assist management in making more timely and accurate decisions.

N87-100 TITLE: Knowledge Base For Fault Symptom Relationship In Helicopters

CATEGORY: Exploratory Development

DESCRIPTION: Develop structural relationships between failure modes and observable symptoms for use in real time monitoring of helicopter propulsion system components and airframes. Current knowledge includes a number of one-to-one relationships such as 1/rev vibration caused by tail rotor drive shaft unbalance, but does not

adequately address other, less common signals such as two per rev, gear rotational sideboards, etc., which are thought to accompany early failure conditions.

N87-101 TITLE: On-Board Real Time Monitoring of Helicopter Condition

CATEGORY: Advanced Development

DESCRIPTION: Existing helicopter propulsion system vibration monitoring techniques involve measurement of a few single-point readings, usually on the ground. Advanced aircraft now employ considerable on-board computer power, some of which might be applied to intermittent acquisition of key vibration signal components, and a comprehensive analysis of these signals to determine changes in propulsion system condition. Required is an analysis of the practicality of utilizing on-board computers for the purpose of housing expert systems having considerable inherent understanding of the propulsion components.

N87-102 TITLE: Automated Ultrasonic Scan Data Formatting And Storage

CATEGORY: Advanced Development

DESCRIPTION: Developed software and hardware to provide compatibility among all computer base large area automated ultrasonic scanning equipment within DoD and DoD contractors. This software will format and store automated Ultrasonic data on multitrack magnetic tape or other appropriate medium. A hardware and software specification for incorporation into all future RFQ's and weapons systems contracts which require automated ultrasonic scan inspections will be written. This specification will also identify appropriate retrofit measures to bring existing DOD and DOD contractors automated ultrasonic equipment into conformance. This specification will require compatibility among DOD and DOD contractors facilities, thus allowing transfer of automated ultrasonic scan data.

N87-103 TITLE: VHSIC Technology Introduction

CATEGORY: Exploratory Development

DESCRIPTION: Identify, describe, and examine a range of potential VHSIC technology applications for Combat Identification System (CIS) programs. This study should present the expected technical and manufacturing risks and benefits associated with each application. Additionally a plan of action and milestones will be developed for each potential application to facilitate informed management action. This effort will enable the CIS programs to identify and characterize significant benefits and risk areas associated with this emerging technology.

N87-104 TITLE: Fiber Optic Crossbar Switches

CATEGORY: Advanced Development

DESCRIPTION: Techniques and devices for multiple (n x u) part crossbar switching of optical communications signals are required. Rapid switching and full duplex operation are requirements as well as the ability to meet severe military environments.

N87-105 TITLE: Artificial Intelligence Processing Capability

CATEGORY: Advanced Development

DESCRIPTION: Develop an artificial intelligence signal integration technique which improves target classification capabilities using data provided by outputs from "ARTIS", "OPUS" MK XV and infrared sensor sources. The

objective is to fuse sensor data in such a manner that a target can be classified quickly and accurately when a minimum of data from sensors is arrayed against known target characteristics.

N87-106 TITLE: EHF Flush Mounted Conformal Array For Aircraft Command& Communication Systems

CATEGORY: Exploratory Development

DESCRIPTION: Conduct a feasibility study of a dual frequency millimeter band conformal array antenna system to provide in excess of upper hemispherical coverage from an aircraft platform to a satellite. The array must be capable of transmitting greater than 100W at 44Ghz and receiving at 20GHz. It shall provide at least 40 d.B.I. gain in both bands and be circularly polarized. Bandwidth is less than five percent of the transmitted or receiver frequency. The array must be steerable and must be capable of locking on to a received signal from a satellite.

N87-107 TITLE: Trailing Wire Antenna Icing

CATEGORY: Exploratory Development

DESCRIPTION: Develop description and modeling of icing buildup on thin (.16 inch diameter) wire of long (20,000 ft) length deployed from slow moving aircraft. The objectives are to conditions and provide recommendations on methods to protect the antenna from ice buildup. The slow moving aircraft is defined as 170-180 knots true airspeed maneuvering in continuous 30 degree angle of bank turn. Consideration should be given where aircraft is in straight and level flight also. Altitude if the aircraft is assumed to be 17,000 to 27000 foot.

N87-108 TITLE: High Conductivity Electrical Cables With Improved Cooling

CATEGORY: Advanced Development

DESCRIPTION: A need exists for electrical cables which can conduct high currents without excessive heat build-up. Existing cable designs use metallic conductors (aluminum, cooper) which overheat before the system reaches it's maximum potential. Advanced composite materials may show an advantage for this application. Design concepts must emphasize high current densities and an insulation approach that will permit open ocean use.

N87-109 TITLE: Real-Time Radar Techniques For Electronic Countermeasures Signal Discrimination

CATEGORY: Advanced Development

DESCRIPTION: Complex ECM (Electronic Countermeasures) environments are effective against Radar systems with conventional ECM signal detection and recognition techniques. The basic purpose of this effort will be to develop a single pulse Radar ECCM (Electronic Counter-Countermeasures) technique to discriminate ECM deception and transponder signals from target returns. The system analysis should include basic Radar ECCM system concept development, theoretical analysis, effectiveness against generic ECM repeater techniques, and effectiveness against ECM transponder techniques. Also, the expected tactical performance payoffs for U.S. Navy applications should be considered.

N87-110 TITLE: Theoretical Characterization of Radar Traveling Wave Tube Amplifier Modulation-On-Pulse Signatures

CATEGORY: Exploratory Development

DESCRIPTION: Pulsed waveforms have modulation-on-pulse (MOP) signatures, which may be useful information sources for advanced Electronic Warfare systems. These MOP signature may be utilized for Electronic Support Measures classification and identification purposes. Theoretical analysis and quantification of MOP signatures for modern radar systems has been completed. The objective of this work is to perform theoretical MOP analysis of pulsed radar systems employing TWT amplifiers. MOP signatures will be theoretical quantified with source mechanisms and potential use in advanced EW systems from theoretically quantified with source mechanisms and potential use in advanced EW systems from theoretical and real-world perspectives.

N87-111 TITLE: Reliability Testing Of Sealed Electronic Component Packages

CATEGORY: Engineering Development

DESCRIPTION: An optical correlation method has been developed to test the integrity of sealed microelectronic packages on a one by one basis. This new method is based on an optical correlation techniques using a low-power laser. The only substantial problem remaining to produce a viable work station version. The extension of the method to determine leak location and the nature of the leak is feasible with further study. The method is described in the article "Detecting Non-uniformity In Small Weld and Solder Seams using Optical Correlation and Electronic Processing" in Applied Optics, (Vol. 20, p. 3605), 15 Oct 1981.

N87-112 TITLE: Passive Non-Cooperative Target Recognition (PNCTR)

CATEGORY: Advanced Development

DESCRIPTION: Analyze and define the role and requirements for PNCTR and associated Technologies in the support of Combat Identification Systems Development. The analysis is to include allocation of PNCTR capabilities in combination with Q & A, and active NCTR in the Combat Identification System (CIS) Architecture. Define the role of PNCTR in proving classifications and confidence levels which will permit changes in the rules of engagement based in the CIS at the platform level. Examine the available technologies, their degree of application capability risks. Include projected time frame in which a mature capability can be achieved at the platform level.

N87-113 TITLE: Infrared Clutter Rejection Signal Processing

CATEGORY: Advanced Development

DESCRIPTION: Investigate algorithms and clutter rejection signal processing to improve clutter rejection performance infrared Search and Tracks Sets (IRSTs).

N87-114 TITLE: Multi-Wave Band IR Focal Plane Arrays

CATEGORY: Exploratory Development

DESCRIPTION: Investigate the feasibility of fabricating Infrared Focal Plane Arrays (FPA's) through use of materials, structures, cryogenic temperature or other design features that are usable over multiple wave length bands. The bands of interest are between 2-14 micrometers or subsets thereof.

N87-115 TITLE: Radar And Electronic Warfare Systems Information Sharing And Power Management

CATEGORY: Advanced Development

DESCRIPTION: Investigate the possibilities of sharing information between airborne radar and Electronic Warfare (EW) Systems aboard an aircraft for the purpose of target identification and targeting. Investigate radar and EW power management techniques.

N87-116 TITLE: Corrosion Protective Marine Paint Systems

CATEGORY: Advanced Development

DESCRIPTION: Corrosion protective marine Paint systems are needed that are compatible with Volatile Organic Compound (VOC) emission regulations* and air quality standards* for FBM applications. *(e.g., San Francisco Bay Area Air Quality Board) New state, local, etc. environmental regulations/standards will prevent the use of many existing marine paint systems presently applicable for FBM equipment. Replacement systems are needed.

N87-117 TITLE: New Corrosion Evaluation Techniques (Electrochemical)

CATEGORY: Advanced Development

DESCRIPTION: Requirements for corrosion testing include long term immersion tests. If a proven correlation between the electrochemical behaviors can be found for particular materials (e.g., ferralium), then the long term tests maybe replaced by quick polarization measurements.

N87-118 TITLE: Methods Of Relating Dynamic Elastomer Properties To Lab Scale Tests

CATEGORY: Advanced Development

DESCRIPTION: A correlation method to compare the dynamic characteristics of “Engineering Elastomers” (e.g. shock pads, launch seals) to simple laboratory scale tests such as – dynamic mechanical analyzer, etc. – is needed. Such correlation technique could provide valuable data for use in dynamic math models of the “Engineered Elastomer.” Successful analytical tools – math model – would design technique presently used.

N87-119 TITLE: Advanced Surface Cladding Of Metals

CATEGORY: Advanced Development

DESCRIPTION: Develop laser cladding methods for titanium and turbine blade alloys. Use a variety of properly selected cladding materials based on wears resistance and corrosion improvement. Analyze for dilution and chemistry. Perform wear teats and environmental resistance evaluation.

N87-120 TITLE: Development of Metallic Surfaces With A Very High Light Absorption Capability

CATEGORY: Advanced Development

DESCRIPTION: Stellar inertial guidance requires stars images to be detected with a high probability of acquisition. Stray light reflected from the sunshield or other surfaces in the light path to the detector creates background noise which reduces the signal to noise ratio and hence the probability of acquisition. There is a need for the development of a new, very non-reflective and very durable surface which will not allow stray light from the sun, moon, earth, or plume to scatter off its surface into the stellar detector.

N87-121 TITLE: Improved Inspection Techniques

CATEGORY: Advanced Development

DESCRIPTION: High Z metallic material is a spray deposited on the inside of guidance Packages for some design applications. It is important for these applications that the coating be continuous and without holes. Inspection of this process is slow and cumbersome by conventional techniques to insure a reliable product. It would be to great assistance to the guidance manufacturer if a rapid, reliable inspection technique could be developed. It is generally desired to detect holes on the order of .001" diameter.

N87-122 TITLE: Evaluation of Functions Represented By Grid Points

CATEGORY: Advanced Development

DESCRIPTION: A future guidance system might have to derive gravity from a set of values stored on a three dimensional grid of points around the trajectory. The optimum approach requires a tradeoff between the interrelation function, the number and regularity of the grid points, the computer filing system, speed, and memory. Another guidance application would be the derivation of a map in map matching guidance. What is desired is a generalized algorithm and associated techniques which would allow specialization of the algorithm for a particular application to yield an efficient computer program.

N87-123 TITLE: Reduction of Consolidation Stresses In Ceramic Reinforced Metal Matrix Composites

CATEGORY: Exploratory Development

DESCRIPTION: Metal matrix composites exhibit consolidation stresses as the metal matrix and ceramic reinforcement are allowed to cool to room temperature (near the matrix liquidus). There is a concern for how this room temperature (or equipment usage temperature) stress condition will affect micro-creep behavior of the composite. Questions that need answering include:

- (a) Is there some acceptable or even desirable level of residual stress in the matrix
- (b) Are there techniques (Plastic yielding for example that can be used to modify the amount of residual stress in the matrix?; and
- (c) Can predictive schemes be developed to accurately Predict residual stress levels in metal matrix composite systems of interest

N87-124 TITLE: Graphite Reinforced magnesium As An Alumina Matching Low Coefficient of Thermal Expansion (CTE) Material

CATEGORY: Exploratory Development

DESCRIPTION: Commercial 6061 is commonly used as the support structure material for alumina chip carriers in many electronic packaging designs. The bond between the aluminum (CTE=13 ppm' degrees F) and the alumina (CTE=3 ppm/degrees F) requires a carefully designed adhesive lap shear joint. A metal/matrix composite (magnesium with graphite reinforcement) has been suggested as a solution to the aluminum-alumina bond problem. Depending on the volume fraction of graphite used (25 to 40 volume percent) the composite CTE is predicted to be from about 6 to 3 ppm/degrees F. Additionally the composite density will only be about 67% of aluminum. The graphite is expected to make machining possible with conventional tools. The objective of this effort would be to demonstrate the fabrication of one or more volume fractions of this material and to get experimental data on CTE, density, strength and machinability.

N87-125 TITLE: Hard Real Time Software Design Methodology

CATEGORY: Exploratory Development

DESCRIPTION: Current practice in designing hard real-time systems leave little provision for guaranteeing stringent timing specifications will be met. These software development concepts are not suitable for systems which must function in the hard real-time environment. The objective of this effort is to develop a methodology which is a basis for mechanizing the design and maintenance of software which operates in the hard real-time environment.

N87-126 TITLE: Diagnostic Test Methodology For Large Real Time System

CATEGORY: Exploratory Development

DESCRIPTION: Review state-of-the-art methodologies for automated development of diagnostic test cases. Distributed systems present a difficult problem to the diagnostics designer which may be best solved through an automated methodology. Proposals are invited which address equipment and/or system diagnostic applications for both on-line and off-line diagnostics.

N87-127 TITLE: Pascal To ADA Cross Compiler

CATEGORY: Exploratory Development

DESCRIPTION: Investigate feasibility of and define constraints and limitations for development of a software system to translate PASCAL programs to ADA. The Compiler will be capable of generating code for two unique target computers, one for software development; the other for tactical military deployment.

N87-128 TITLE: Real Time Software Requirements Automation

CATEGORY: Exploratory Development

DESCRIPTION: Software revisions to operational systems must be made to react to changes in system requirements. This on-going maintenance effort accounts for an ever increasing portion of the system's life cycle cost. Cost reductions and increased accuracy have been applied to new developments; similar savings may be realized for maintenance of existing systems. Investigate and report on feasibility of utilizing an automated requirements development tool to translate existing computer software requirements into an automated form. This effort will determine the cost/benefit tradeoff of automating existing software requirements in order to reduce the ever-increasing life-cycle cost of maintaining operational systems. Proposals should address: (a) methodologies available for automating software requirements; (b) implementation of a specific methodology, and (c) cost/benefit analysis of maintenance dollars saved to methodology cost.

N87-129 TITLE: Characterization Studies Of High Energy Density Batteries

CATEGORY: Exploratory Development

DESCRIPTION: Conduct characterization studies of advanced electro-chemical systems such as lithium/poly-carbon monofluoride for application in long-life deep ocean devices. The chemistry should be elucidated in terms of safe applications and deployment from submarine, aircraft and surface ship platforms.

N87-130 TITLE: Infrared Sea Background Modeling and Model Validation

CATEGORY: Exploratory Development

DESCRIPTION: The prediction of Navy Electro-optic Infrared System Performance is hampered by the lack of accurate models which predict infrared sea background radiance (3- 5 μ m 8-12 μ m). Models currently exist (e.g. LOWTRAN) which predict downwelling sky radiance but these must be combined with a complementary model which predicts how the sea surface reflects the sky radiance. A unified model combining existing sky radiance models with a surface reflectance prediction in terms of weather and sea conditions is sought. A plan to validate the model experimentally in Phase II is required. Equipment necessary to obtain data may be obtained commercially or designed using commercial components.

N87-131 TITLE: Multi-Color Infrared Sensor Linear Arrays

CATEGORY: Exploratory Development

DESCRIPTION: A need exists in a variety of military applications for low cost, multicolor, infrared sensor linear arrays. Proposals to produce photovoltaic, backside illuminated arrays using epitaxial PbS_xSe_{1-x} grown on BaF₂ substrates will be considered. These arrays should be based on Schottky barrier devices, and should take advantage of the insulating nature of the BaF₂ substrate for possible multilayer metallization and interconnect structures. Initial objectives should include the fabrication of a 64 element two-color array, 32 elements of each color, with 10 mil center to center spacing. All 64 elements should be in line, not staggered, and the colors (A and B) should alternate along the line, ABABA.... Longer range objectives should include three and four color linear photovoltaic arrays and appropriate read out schemes.

N87-132 TITLE: Precision Optical Tracking For Short Range Engagement

CATEGORY: Advanced Development

DESCRIPTION: Electro-optical Systems have been proposed as adjunct sensors for radar-based fire control systems. The electro-optical systems should provide increased tracking capability in multipath, jamming and low observable conditions. This project is to develop and demonstrate a prototype system that will be useful in the surface local area defense role. The prototype system will use infrared thermal sensors and automatic video acquisition and tracking systems.

N87-133 TITLE: Infrared Transmissometer

CATEGORY: Advanced Development

DESCRIPTION: Infrared systems such as optical trackers, seekers and fuses are limited by optical transmission through the atmosphere. This project is to develop and demonstrate a low cost infrared transmissometer. The transmissometer should cover the optical Land from one micron to 14 microns. Algorithm which correlates weather data such as sea state, wind, rain, humidity and temperature shall also be developed.

N87-134 TITLE: Long Haul Fiber Optic Link For Navy Ranges

CATEGORY: Advanced Development

DESCRIPTION: Long Haul, point-to-point fiber optic communication is being applied to various communication needs. A prototype fiber link is needed to provide a digital data path for remote in-water data gathering. Under this project, one or more models will be developed to establish cost effective performance standards for Navy Ranges. These performance standards will include delivery of power to the in-water systems, maximum data rates, and reliability. Present (and planned) systems will be taken into account. The model will permit specific features to be studied in detail. A small scale prototype will be built and tested.

N87-135 TITLE: Non-Destructive Testing By Imaging With Penetrating Radiation

CATEGORY: Advanced Development

DESCRIPTION: A need exists to develop a large area high resolution sensor with diameters in the range of 20 to 25 inches, which provides a video type signal output and is able to perform in a snap-shot mode of operation. Exposure and read-out must be managed from the same position so that it is not necessary to transport the sensor from the place of exposure to a read-out station. Device read-out can be either an electron or a laser beam. Priority should be placed on exposure of objects with 1 to 10 MeV x-ray radiation, with consideration for subsequent potential application to lower energy radiation and to neutrons.

N87-136 TITLE: Development Of High Density Chemically Vapor Deposited Composite Materials

CATEGORY: Advanced Development

DESCRIPTION: Higher operating temperatures, and the performance in advanced air breathing propulsion systems are primarily limited by material capabilities. Carbon/carbon composites show good potential for propulsion system applications due to high temperature to high-temperature strength, but must be protected from oxidation. Carbon/ceramic composites offer the capability of combining the structural capability of carbon fiber with the oxidation-resistance of ceramics. Carbon/carbide and carbon/diboride composites are currently being investigated for advanced propulsion systems. One approach to the development of such carbon/ceramic materials is by chemical vapor infiltration technology. A current drawback with chemical vapor infiltrated materials is the relative low (85% theoretical) densities in thick section (over 0.25 inch) parts. The need currently exists for identification of suitable fiber architectures, innovative processing conditions, etc., which can yield high density, thick section components (over 0.25 inch) produced by CVI techniques. Fabrication advances can be via the production of plates or cylinders.

N87-137 TITLE: Fabrication Of Carbon/Ceramic Composites For High Temperature Leading Edges On hypersonic Ramjets

CATEGORY: Exploratory Development

DESCRIPTION: The need currently exists for the materials suitable for leading edge applications in advanced hypersonic ramjets concepts. Leading edge materials require high strength, oxidation resistance, toughness, and erosion resistance up to 4000F, the ability to be constructed with relatively sharp leading edges (i.e., 0.030 inch leading edge radius). Small diameter, high strength carbon fiber currently exists from which leading edges could be constructed utilizing appropriate fiber architectures. One approach to the protection of carbon/carbon composites is the use of alternative ceramic compounds in the matrix, yielding carbon/ceramic composites. Candidate matrix ceramics include, but are not limited to, diboride compounds and diboride composites. The material system fabrication could be demonstrated through the fabrication of 0.25 inch thick flat plates for mechanical characterization and additional plates demonstrating a 0.030 inch leading edge radius.

N87-138 TITLE: User Interactive Software For Holographic Interferometry

CATEGORY: Advanced Development

DESCRIPTION: A need exists for automating data reduction methods used in holographic interferometry. Laser holography offers a method by which entire density flow fields can be measured experimentally about models used in wind tunnel tests. Because the entire flow field can be recorded instantly (less than one microsecond), holographic interferometry is a very promising method of investigating rapidly changing flow fields. The photographic recording of laser holograms is well understood, but the data reduction methods, although understood, have proven extremely tedious and labor intensive. The need for automated data reduction algorithms is paramount. These software routines must be carried out on a very fast computer with large amounts of memory.

(many mega bytes). The software must be user friendly, fast, yet, sufficiently automated to analyze a wide variety of holographic interferograms. The software for the image processing should utilize both contrast and spatial techniques.

N87-139 TITLE: High Optical Quality Photorefractive Single Crystals

CATEGORY: Research

DESCRIPTION: A need exists to understand precisely which material parameters directly effect the production of phase conjugation and four wave mixing in photorefractive crystals. The goal of this effort is to grow large (greater than 2 cm X 2cm X 2cm) high optical quality photorefractive single crystals of barium titanate, potassium tantalum niobate, barium strontium niobate, Potassium niobate, and strontium titanate. Both pure (i.e., intrinsic or undoped) crystals and also crystals doped with controlled amounts of impurities such as iron and/or manganese and/or rare earth ions are required in order to compare the effects which these elements have on phase conjugation efficiency

N87-140 TITLE: Investigations Toward A nonvolatile, Ferroelectric Random Access Memory

CATEGORY: Research

DESCRIPTION: A nonvolatile random access memory (RAM) with viable performance and economic parameters could be constructed if a suitable ferroelectric material were substituted for the dielectric in the capacitors of a Dynamic RAM. The ferroelectric materials should be easily deposited, sputtered, or otherwise controllably grown and have properties compatible with subsequent MOS processing. The material should switch at a volt or less and in 20 sec or less using a 2 volt drive. A defect-free thin film which retains its polarity and does not fatigue or break down with 3.5 volt drive is required. During the research phase of this program it is sufficient to fabricate small capacitors to demonstrate the ferroelectric properties rather than construct a modified DRAM. The proposal should identify at least two materials likely to fulfill the requirements along with reasons supporting the choice of materials. The end result of this phase of the work will be a demonstration of and report on the switching speeds and hysteresis curves of the chosen materials.

N87-141 TITLE: Synthetic Techniques For Cloud/Sea Infrared radiance Maps

CATEGORY: Exploratory Development

DESCRIPTION: Background cloud clutter represents the principal performance limitation of Infrared Search and Track (IRST) sensors operating from ship borne platforms. The goal of this work is a computer model to generate cloud and sea radiance maps to be compared with and validated by the experimental data base being acquired by the Navy's Background Measurement and Analysis program (BMAP).

N87-142 TITLE: Reliable Real-Time System Development

CATEGORY: Advanced Development

DESCRIPTION: Reliability and time constraints are critical issues in the design of real-time tactical systems. The purpose of this effort is to develop or extend formal specifications language and automated system requirements design and analysis tools to include the concept of time and reliability for such systems. Time and reliability should be treated as top level parameters throughout both design and analysis activities. The specification language and the toolset should operate at multiple levels from top level requirements specifications detailed system design. It should be able to make trade-offs analysis for scheduling processes on a given machine description under normal and highly stressed conditions at all levels.

N87-143 TITLE: Development Of a Combatant/squadron Level Automation System for Management Of Readiness, Operations, And Maintenance

CATEGORY: Management and Support

DESCRIPTION: The Navy has on going a great deal of effort developing and applying fleet experience data collection and information feedback systems. Software applications which make use of modern computer technology offer an opportunity to satisfy both combatant/squadron and higher fleet and support commands information needs and objectives with much greater efficiency at greatly reduced manpower and cost expenditures. There is a need to make use of such software and computer technology at the combatant/squadron level to assist in mission essential equipment configuration management, readiness determination, and logistic element forecasting, as well as concurrently satisfying basic maintenance and material management information feedback needs.

N87-144 TITLE: Optical Signal Processing

CATEGORY: Advanced Development

DESCRIPTION: High speed signal processing for intelligent weapons can be achieved through the use of optical computer systems. Optical processor concepts that can interpret target information in real-time are solicited.

N87-145 TITLE: High Density Power Sources For Robots

CATEGORY: Advanced Development

DESCRIPTION: One of the major barriers to continuous autonomous operation of mobile robots is performance of available power sources. Lightweight, long-term stable power sources, which tolerate environmental extremes (e.g. high/low temperature, humidity, shock), are required for the operation of robot control electronics. In addition, bursts of power for mobility heavy lifting, and other mechanical functions are often required. High density power sources that can provide these capabilities over long periods of time with minimal maintenance are of great interest. Advanced power systems, including hybrid concepts that integrate available power sources, should be investigated to meet the needs for long-term, low level robotic operation with surge capabilities for high-power demands.

N87-146 TITLE: Parts-On-Demand Manufacturing Work Cell

CATEGORY: Engineering Development

DESCRIPTION: A requirement exists for a highly automated, parts-on-demand manufacturing capability able to produce small number's (1 to 200) of critical military electronic and mechanical components as required, rather than relying on large inventories of spare parts to meet operational requirements. Concepts employing extensive use of highly flexible automation to reduce manpower requirements and increase quality and reliability should be explored.

N87-147 TITLE: Real Time, 3-D Computer Vision

CATEGORY: Advanced Development

DESCRIPTION: Passive machine-vision is required for use in robots, autonomous systems, manufacturing, and other military applications. Systems that can provide near real-time (video frame rates) image understanding, including ranging and classification of objects in 3-D space are of particular interest.

N87-148 TITLE: Advanced General Purpose Controller

CATEGORY: Advanced Development

DESCRIPTION: Develop an advanced, compact, microprocessor based, multipurpose controller for real time sensory understanding and adaptive control of weapons, robots, factory automation and other control applications. The concept should employ a highly distributed, hierarchical architecture to enhance performance and flexibility. Investigations should include software/hardware architecture, software design methodologies, interface designs, protocols, bus architecture, microprocessor selection, high level languages, programming aids, packaging and other design parameters.

N87-149 TITLE: Application of Robotics Technology To Performance Of Hazardous Tasks At Maintenance Facilities

CATEGORY: Engineering Development

DESCRIPTION: Robotics technology is revolutionizing manufacturing in almost every major industry. There is a similar potential for the use of robotics technology to perform hazardous or labor intensive tasks at depot and intermediate level maintenance facilities. Applications include but are not limited to such areas as painting, plating, cleaning, corrosion treatment, tire repair, and battery servicing.

N87-150 TITLE: Development Of Inexpensive VCR Training

CATEGORY: Management and Support

DESCRIPTION: Most training and information films and video tapes used by the Navy are produced by professional film and TV production people using expensive equipment and traditional production methods. Video Cassette Recorders and Television Cameras have recently become very reliable, easy to use, and are relatively inexpensive. There is a need to use this technology to develop training. Information, and instruction modules that could be very useful in enhancing a wide range of different training programs and for providing operational instructions for the performance of complex tasks.

N87-151 TITLE: Shipping Container Design And Labeling Improvement

CATEGORY: Engineering Development

DESCRIPTION: There have been many improvements in packaging, handling, and labeling methodologies which have not been utilized by the Navy. There exists a great deal of inefficiency, confusion, duplication and many errors in the present system. There is a need to develop an efficient system of labeling and to improve and standardize the packaging and handling of components, subsystems and systems.

N87-152 TITLE: New Technology Test And Measurement Systems

CATEGORY: Advanced Development

DESCRIPTION: Recent trends in automatic testing technology together with higher levels of circuit integration are leading to more compact and efficient Automatic Test Equipment (ATE) for board and assembly level test and fault isolation. ATE system architectures incorporating complex analog, digital and RF stimulus and measurement functions in integrated bus structures offer advantages in performance, size, power consumption, and life cycle costs. There is a need for development of ATE systems incorporating integrated instrument functions, robotics and advanced flexible automation that would perform equally well in the factory, repair depot or field environment.

N87-153 TITLE: Naval System Issues For Charge Particle Beams

CATEGORY: Engineering Development

DESCRIPTION: The trust of this research would be to take existing and planned CPB weapon components and address system issues such as radiation effects on ship and personnel, logistics, EMP and noise

N87-154 TITLE: Real Time Dynamic Analyzer For quality Control Of Rubber Products

CATEGORY: Advanced Development

DESCRIPTION: Development of a meaningful, fast, accurate and precise dynamic mechanical testing apparatus and procedure for characterizing rubber products to meet the Navy's acoustic requirements. The procedures and apparatus must provide for dynamic mechanical property evaluations of new, high performance rubber formulations (R&D environment) as well as for real time quality control materials evaluation in a manufacturing environment.

N87-155 TITLE: Corrosion Testing Of Metal Matrix Composites In Hostile Environments

CATEGORY: Exploratory Development

DESCRIPTION: Proposals are sought for practical methods for characterizing the corrosion behavior of metal matrix composites in marine environments. For example, the validity of advanced potential controlled methods used in the characterization of the pitting behavior of metal matrix composites may be incorporated in the study to determine their effectiveness in inhibiting corrosion.

N87-156 TITLE: Improved Methods For The Synthesis Of Dysfunctional Fluoroalcohols

CATEGORY: Research

DESCRIPTION: Fluorodiols are building blocks for a variety fluorinated polymers with potential uses as coating materials and binder components for plastic-bonded explosives and propellants. To permit tailoring of polymer properties, new types of fluorodiols are needed. In addition, efficient methods for the synthesis of new as well as known fluorodiols are needed to enable their manufacture at reasonable costs. Examples of fluorodiols which are of interest for above applications have the following general structure:



Structural variation of these prototypes might include branching and the presence of hereto atoms in the backbone or side chain.

N87-157 TITLE: Synthesis Process For BIS(Dinitropropyl) Formal/Dinitrobutyl Dinitropropyl Formal Plasticizer (BDNF/DNBPF)

CATEGORY: Exploratory Development

DESCRIPTION: The title mixed plasticizer has many properties very similar to the nitroplasticizer BDNPF/A. However, BDNRF/DNBPF is more thermally and chemically stable, which should result in improved shelf-life and compatibility with energetic ingredients. In addition, BDNRF/DNBPF is potentially less extensive than BDNPF/A. A practical synthesis method for the plasticizer mixture must be demonstrated based on existing chemical reactions: A3:1 mixture of 2,2-dinitropropanol and 2,2-dinitrobutanol is prepared from a mixture of the mononitroalkanes via an oxidative nitration or chlorination/ter Meer process. The mixture of nitro-alcohols is then reacted with formaldehyde/sulfuric acid to produce the desired formal mixture in one step

N87-158 TITLE: Software Engineering Environment For Parallel And Distributed Systems

CATEGORY: Advanced Development

DESCRIPTION: The future generations of Navy Combat Systems will be based on parallel and distributed processing architectures. System design and in particular, software design and programming for these environments will be orders of magnitude more difficult than anything we face now. The purpose of this effort is to assess current capabilities and to design a software engineering environment for the development of parallel and disturbed real-time software. The environment should cover functions from requirements, functional decomposition to program design and automatic code generation. Language study should include Ada, and the software environment should be as automated as possible.

N87-159 TITLE: Integrated System For Numeric And Symbolic Computations

CATEGORY: Advanced Development

DESCRIPTION: It is clear that the next generation of tactical systems will include heavy requirements for both numerical and symbolic computing. However, these computing functions must reside in a single system. The purpose of this effort is to study the integration of numeric and symbolic functions into a single system, and the requirements of such a system. Included in the study should be the requirements of a development system and the language issue, such as whether Ada can be used as a single language and how well it will satisfy all the computing functions.

N87-160 TITLE: High Performance Optical Image Processor

CATEGORY: Exploratory Development

DESCRIPTION: Currently available image processors are limited by the size, complexity, speed and power requirements of conventional digital computers. Image understanding systems are required to perform target detection, location, and classification in real time through the use of optical elements that manipulate signals, images and other target information. Concepts employing optical sensing, holographic correlation, image enhancement, feature extraction, multisensor fusion and similar optical techniques will be considered.

N87-161 TITLE: Conductivity Meter For Graphite Epoxy

CATEGORY: Advanced Development

DESCRIPTION: Fiber reinforced polymer matrix composites such as graphite epoxy are being used to an increasing extent in structures ranging from aircraft to computer housing. The electrical conductivity of these materials determines both the electrical shielding they provide and applicability of electromagnetic nondestructive inspection techniques. The materials are usually in the form of flat plates in which the conductivity is anisotropic. A device is needed which will measure the conductivity of the plates as a function of orientation relative to the fiber direction. Special problems are presented by the difficulty in achieving good electrical contact and by the low conductivity of the materials (less than 0.1 of the International Annealed Copper Standard). The device should measure the conductivity over a large cross-section relative to the cross-section of the fiber toes. It must measure the conductivity from DC to 6Mhz and the accuracy of the device must be demonstrated.

N87-162 TITLE: Automation Engagement Planning

CATEGORY: Exploratory Development

DESCRIPTION: A major opportunity for technology insertion exists in the area of multi-ship, multi-target cruise missile engagement planning. Current Anti-Surface Warfare (aSUW) systems support engagement planning generally at the single slavo level. Yet ASUW depends for its effectiveness on the ability of the striking force to produce a coordinated attack. This productive area for advanced mathematic studies.

N87-163 TITLE: Unwanted Radar Waveform Modulation

CATEGORY: Advanced Development

DESCRIPTION: Radar systems are characterized by waveform characteristics. Generally, the waveform characteristics of a specific radar are the same from radar set to radar set. However, it is known that unwanted modulation on pulse due to differences in operating environments, component aging, and other reasons, results in unique waveform characteristics within the same type of equipment. Methods are sought that eliminate unwanted modulation or permit it to be changed in a controlled way. All types of radars should be considered.

N87-164 TITLE: Multipath Modeling

CATEGORY: Exploratory Development

DESCRIPTION: Shipboard radars are subject to tracking errors resulting from multipath effects off the water. Simulations of radar tracking low flying missiles require models of these effects in all sea states. Innovative approaches to modeling radar multipath tracking errors are sought. Of particular interest is X-band and Ka-band radars.

N87-165 TITLE: Software Development Productivity

CATEGORY: Exploratory Development

DESCRIPTION: Software development productivity can be affected by the mean by which the developer interacts with the computer, e.g., typing in text. Methods are sought for alleviating this man/machine bottleneck by means of voice input. An example might be voice recognition to provide the textual input for a diagrammatic language.

N87-166 TITLE: Generalized Fire Control System Design

CATEGORY: Advanced Development

DESCRIPTION: Fire control systems for ground missile weapon systems in general perform similar types of functions. Most existing fire control systems (or weapon control systems) have been developed as a unique set of equipment and software to solve very specific problems. It is felt that a generalized approach to fire control system design should be possible that would result in a uniform design applicable to any new start.

N87-167 TITLE: Attributed Based Track Correlation/Classification

CATEGORY: Exploratory Development

DESCRIPTION: The problem of surface contact correlation consists of two major steps: deciding which contacts should be grouped together as a single real vehicle and producing smoothed state estimates for the result an track. While the latter problem has been worked extensively, the former problem of correlation, particularly based on full use of attribute information, has not been fully developed. The area of attribute-based correlation/classification may be a good expert system application.

N87-168 TITLE: Coding Of Color TV Signals For Encryption

CATEGORY: Advanced Development

DESCRIPTION: Color TV signals conforming to the NISC standard are transmitted for telemetry purposes throughout test ranges in two major application areas: all to ground and ground-to ground. It is required for national security reasons that these signals be encoded to permit transmission by digital means rather than by conventional analog techniques. Compression of an imaging video into possibly as high as a 50N/S binary digit stream; also, of limited motion and/or reduced resolution imaging video into a 10Mb/s binary digit stream to be compatible with data processing and security equipment is of interest. The purpose of this task is to investigate alternative techniques to perform this coding process. The key technical objective is the maintenance of the maximum possible, subjective image quality over the range of transmitted bit rates.

N87-169 TITLE: Low Cost Accelerometers

CATEGORY: Advanced Development

DESCRIPTION: With few exceptions, inertial sensor manufacturers are striving toward lower and lower cost gyros and succeeding. Very shortly, the gyro will be cheaper than the accelerometer. This is not acceptable since accelerometers are relatively simpler devices. Because the accelerometers a technically less demanding device, it really does not take the resources of a large aerospace company to develop a low cost accelerometer should be consistent with missile midcourse guidance requirements. Accelerometer bias should be between 200 and 800 micro-g's, scale factor error should be between 200 and 500 PPM, and the dynamic range should be +25 g's to + 50 g's. One accelerometer is not expected to cover this entire performance regime. Power consumption and size should be consistent with solid state technical approaches. The projected cost of the device should be less than 500 including electronics.

N87-170 TITLE: Acceleration Driven Energy Interruptor

CATEGORY: Advanced Development

DESCRIPTION: The purpose of this effort is to develop an acceleration driven electrical energy interruptor such as a normally open switch or transformer to be used on a safety-arming (S-A) device in a guided missile. The purpose of the energy interruptor is to insure that the guided missile has traveled a safe distance from the launch platform, i.e. a ship or an aircraft, prior to allowing the transfer of energy from the guided missile battery to the firing circuits in the S-A device. Specifically, two energy interruptors will prevent the flow of electrical energy to the explosive initiator firing circuits until the missile has reached a safe distance from the launcher in accordance with paragraph 4.3.3 b. of MIL-STD-1316C. The interruptors will be capable of passing a direct current of from 100 to 300 milliamperes for two seconds. The system will function after being subjected to the standard military environment such as five foot drop, temperature, and humidity cycling, shipboard and transportation vibration and extreme temperature storage. The interruptors shall not exceed 1.5 inches diameter or 3 inches length.

N87-171 TITLE: Near Net Shape Sapphire Domes

CATEGORY: Advanced Development

DESCRIPTION: Sapphire is ideally suited for missile domes due to its high optical quality, high transmission, and low residual stress. However, manufacturing costs are very high, prohibiting utilization of sapphire on missile systems. The objective of this work task is to developed techniques to manufacture full scale, near net shape, single-crystal sapphire domes. Limited small scale sapphire crystals have been produced by the industry. There is now requirement to develop the techniques necessary to grow low cost sapphire crystals to a scale usable on missile systems and at rates compatible with production requirements. Present processes for providing full-scale sapphire domes include growing a solid boule then scooping, grinding, polishing the sapphire to the final shape This is a very

expensive process. In fact, the costs are high enough that no U.S. missile programs are using sapphire domes, which limits the capabilities of the missile. Industry has been investigating methods of growing near net shape sapphire crystals. Their limited efforts give strong indications that these processes could be scaled up to provide low cost sapphire domes at high production rates. These methods need to be defined in detail, and the feasibility of the full-scale processes to be demonstrated.

N87-172 TITLE: Processing Improvements in Chemical Vapor Deposited Zinc Sulfide And Zinc Selenide IR Window And Dome Materials

CATEGORY: Exploratory Development

DESCRIPTION: The development of missile domes and imaging devices for the 10-14 μ m region is complicated by a lack of availability of suitable window materials. The most commonly used long wave length material is germanium, however, aerodynamic heating in high speed missile applications cause serious degradation of its infrared transparency. Materials with larger electronic band gaps than germanium, such as zinc sulfide and selenide are optically stable at higher temperatures, but are generally soft and subject to erosion damage by impacting high velocity particles such as rain drops or sand. Efforts to improve the resistance of these materials to the erosion effects of impacting particles by the control grain size, ion implantation, or the applications of hard coatings has not been successful because of the persistence of particle induced surface crack initiation and the propagation of fractures into the material. The fractures, in turn, reduce the transparency as well as the fracture strength of the material. The objective of this work is to improve the mechanical and optical stability in CVD zinc sulfide and zinc selenide in a rain erosion environment through improvements in material processing parameters. Surface flaws and microstructure of CVD ZnS and ZnSe material that are critical to crack initiation and propagation in a rain erosion environment will be identified. Then, process modifications to improve the microstructure and surface finishing techniques to reduce the surface flaws will be investigated. Improvements in material quality and surface finishing will be validated by rain erosion tests and appropriate optical and mechanical property measurements.

N87-173 TITLE: High temperature Turbine For Missile Power Generation Applications

CATEGORY: Advanced Development

DESCRIPTION: Design and fabricate a turbine wheel for missile power generation applications. The operating gas temperature range of interest is 2500F – 3500F. The turbine should be capable of operating with air as the operating gas. The construction should be of a ceramic or composite material. The operating life is 100 hrs at a design speed of 100,000 rpm. The turbine efficiency should be 50% or higher to minimize the mass flow rate requirements. The shaft power output of interest is 12 KW nominal. The turbine size should be 8 inches in diameter or less. Testing could be done by the monitoring activity

N87-174 TITLE: Tuned Tactical Rocket Motor Cases For Insensitive Munitions

CATEGORY: Advanced Development

DESCRIPTION: Develop rocket motor cases that resist hazardous reactions (any response greater than burning) more effectively than current designs when subjected to the stimuli specified for the Navy's insensitive munitions (fast (fire) cook off, slow cook off, bullet and fragment impact, and sympathetic reaction). Reaction severity may be reduced to burning by relieving confinement prior to violent explosion or pressure rupture of the case. Strip Laminate cases and composite case have demonstrated good pressure relief in both bullet impact and fast cook off tests. For the class 1.1 propellants that resist all but prompt detonations, it may be possible to design a motor case that can reduce the shock level transmitted to the contained propellant in a fragment impact or sympathetic detonation scenario. The case would be tuned by design to have at least the fast cook off and bullet impact mitigation behavior of strip laminate and composite cases, but in addition it would be designed to attenuate the input shock levels from high velocity fragments. The physical, and perhaps chemical, behavior of the case materials may have to be carefully adjusted to fairly specific fragment velocities and sizes depending on the threat scenario and the

specific propellant involved. The “tuning” may involve sandwiching layers of different materials. It may involve using metal layers and composite/fiber layers that are fabricated with specific build-in compression or tension. It may involve the use of materials that absorb energy (endothermic). Material acoustic properties would be important, as would interactions with liners, internal insulation, and with the propellant. Case design may involve combinations of these and other concepts. The work should involve development of a design methodology for “tuned” rocket cases that uses applicable dynamic finite element design tools. Also important will be high rate mechanical property measurements to determine design variables and subscale test methods for assessing different design approaches.

N87-175 TITLE: Variables Flow Gas Generator

CATEGORY: Advanced Development

DESCRIPTION: Design and fabricate a variable flow solid propellant gas generator. The flow should be variable over a range of 0.01 lbm/s to 0.1 lbm/s. The output as temperature will be 2500F at a pressure between 1000-1200 psia. The output gases will be used to power turbo machinery and is required to be clean burning and non-erosive. The burn time will be 1-2 minutes. Testing could be done by the monitoring activity.

N87-176 TITLE: Rapid Prototyping For Real-Time Embedded Computers

CATEGORY: Advanced Development

DESCRIPTION: Detailed requirements for the development of real-time embedded computer systems found in avionics, missiles, and fuses are generally not available for much of the system when the design process must be initiated. There is a need for a mechanism to develop parts of the system that are high risk and least understood early in the design phase so that both users and developers can learn and refine the requirements. The objective of this work is to develop methods for prototyping real time embedded computer systems with only high level requirements as inputs. The methods must assist both users and developers in characterizing their systems and interactively changing the system to determine impacts to operational use. Automation of these methods should be considered, and could be lost on either super micro or minicomputers

N87-177 TITLE: Linear Measure Sensor In Dynamic/Hostile Environments

CATEGORY: Exploratory Development

DESCRIPTION: In dynamic environment of SLBM traveling out of a launch tube accurate, sensors to measure the relative small clearance between a point on the missile and a point on the launch tube is needed. Sensors can be mounted on the moving missile (e.g., missile skirt area) and/or on the stationary launch tube (e.g., tube missile area). Sensors must not physically alter launch environment and affect measurements. Sensors are to measure in real time the changing clearance (linear distance) between the tube wall and the traveling missile reference surface. Desired range of linear measurement is 1.625 + 1.00 inches with a +2% accuracy requirement. Time coded continuous reading sensor data is desired for “in-tube” launch trajectory studies. Large temperature gradient and pressure fluctuations as well as gases must be considered in launch event/environment.

N87-178 TITLE: Metallic Materials Technique Correlation Or Charpy Izod Impact Energy Correlation

CATEGORY: Advanced Development

DESCRIPTION: In metallic materials development, a number of testing techniques are available. A correlation between two particular methods – charpy impact and Izod impact energy – results (particular, stainless steels) would be useful. Present correlations between charpy and Izod results contradict each other and do not take material chemistry/microstructure/properties into account. Considering the difference in loading (cantilever vs. bending) and

possible correlation differences as a function of materials and/or different strength levels of a given material, an empirical method to obtain correlation may provide more rewarding than a theoretical one.

N87-179 TITLE: Software Model Development For Matrix Composite Material Evaluation

CATEGORY: Advanced Development

DESCRIPTION: Understanding the physics of metal matrix and organic matrix composites has increased rapidly in recent years, as the application of such new materials has increased. To improve further the development or application of such matrix composites, software development based on knowledge obtained to date would be useful; in particular a fracture criteria analytical model for both organic matrix and metal matrix composites.

N87-180 TITLE: The Physics Of Metal Matrix Composites

CATEGORY: Advanced Development

DESCRIPTION: The use of metal matrix composites in advanced missiles and guidance systems in particular is at the introductory level at this point in time. If a concentrated development program were undertaken to improve our understanding of the physical properties of these materials, its application in areas where stability, strength, and low weight are of critical importance could be made more quickly and without unexpected risk.

N87-181 TITLE: Passive Variable Resistance Techniques

CATEGORY: Advanced Development

DESCRIPTION: Thermal stability and the absence of large thermal gradients are key design elements in maintaining accuracy through improved stability of critical alignments and also aid improved performance of the inertial components. A technique whereby the thermal resistance across a heat flow path can vary as a function of the heat flux present would result in improved thermal stability in critical areas. In particular, the development of a compact passive variable thermal resistance device would represent a unique advance in thermal design.

N87-182 TITLE: Polyimide Quartz Multilayer Board

CATEGORY: Advanced Development

DESCRIPTION: Ceramic integrated circuit packages have a thermal mismatch when mounted on the standard epoxy fiberglass multi-layer board. If a polyimide quartz multi-layer board could be developed, it would provide a much closer thermal expansion match with the ceramic package. This would result in improved reliability and longer life for the electronic package.

N87-183 TITLE: Hermetic Packaging Equivalent

CATEGORY: Engineering Development

DESCRIPTION: Develop methods and standards to provide protection to Integrated Circuits(IC) equivalent to those provided by hermetic cavity enclosures (i.e. 38510 hermetic parts) without enclosing the IC in a cavity. Traditional packages are creating many problems as electronic systems shrink using new technology. Many alternatives known collectively as "Chip-On-Board" technologies have been suggested, but none have demonstrated the ability systems. The work should start by addressing the question of relevance of current 38570 hermeticity tests to a part not in a sealed cavity. Beyond the environmental protection of the IC, mechanical protection of the IC (handling problems),

manufacturability, and repair ability should be addressed. New standards and test methods for non-cavity “packages” should be proposed.

N87-184 TITLE: Large Scale Integrated (LSI) Circuit Evaluation With Election Beams

CATEGORY: Exploratory Development

DESCRIPTION: Conduct an assessment of the differences and the significance of the differences between photon and electron beam excitation of LSI circuits. The following electrical parameters (magnitude and time varying response) must be considered in the study: VoH VoL Icc. In addition the thermomechanical response shall also be considered.

N87-185 TITLE: 54 Series Advanced CMOS Replacement Of 54 Series Bipolar Devices

CATEGORY: Engineering Development

DESCRIPTION: Integrated Circuits of the 54 Land H Series are now obsolete and the 54 and 54, S types will soon follow. Military experience with the newer HC, HCT, and ACT types is minimal with respect to there and quality in high speed applications. How will these devices perform as replacements for the slower speed bipolar devices? Assessment will require test and evaluation of the new part types under Mil-Spec test conditions, an their performance substitutes for the obsolete parts.

N87-186 TITLE: Radiation Hardening

CATEGORY: Engineering Development

DESCRIPTION: Approaches are required for fabrication of power transistors which are hardened to neutron radiation. Novel ideas are needed for neutron radiation hardening of bipolar, DMOS or gallium arsenide power transistors for operation after exposure to neutron fluences of $3E14 \text{ N}^2\text{CM}^2$. This development program will define hardening approaches, develop manufacturing techniques, produce sample transistors, and perform radiation testing as proof of concept.

N87-187 TITLE: Development Of Ferroelectric Memory

CATEGORY: Engineering Development

DESCRIPTION: It has been reported (computer Design, March 1983 that the ferroelectric thin film such as KNO_3 may be used for non volatile, and inherently radiation hardened memory fabrication. The Projection is 160 MB/in², @.001/BIT. Furthermore, neutron hardness well over 10^{14} , advantage over current non-volatile MNOS technology is that ferroelectric memory is known to have an endurance cycle of better than 10^{10} read/write cycles compared to 10^6 10^7 cycles of current MNOS technology: potential offerer will construct 1KB memory and study trade-off in endurance and radiation hardness problem.

N87-188 TITLE: Internally Focused Random Arrays

CATEGORY: Exploratory Development

DESCRIPTION: Develop innovative acoustic techniques such as two-dimensional adaptive beam forming or coherent frequency diversity which will allow focusing and scanning within and outside an array, thereby rejecting interfering noise sources (a major detriment to acoustic sensors today). The objectives are to: (a) provide future array systems with the unique capability of reducing their side lobes well beyond existing levels (on the order of 30

dB) and greatly enhancing the acoustic sensor's capability to discriminate against noisy targets on or off main beam axis; (b) define the processing load and update time required to achieve this amount of suppression; and (c) establish the number of sensors and array gain achievable commensurate with the derived approaches. Since the technique does not require a specific frequency bandwidth combination, it has extraordinarily great potential for implementation into all methods of signal processing.

N87-189 TITLE: Emergency Blade Removal From A Helicopter

CATEGORY: Engineering Development

DESCRIPTION: Develop a methodology and prepare a generic design to remove the helicopter rotor blades from an aircraft in a flight emergency so that a parachute system may then be used to recover the inhabited fuselage. A significant problem associated with severance or removal of the blades is that they may become a free flying hazard to other aircraft flying in formation or in its vicinity. Analyze the system safety of the design against inadvertent actuation because of component failure, sneak circuits, EMI, etc.

N87-190 TITLE: Expendable Glider

CATEGORY: Advanced Development

DESCRIPTION: Design a device which can be attached to a small free fall cylinder to cause it to glide. The device should be contained in a package 4.5 inches in diameter by 1 inch high. It must deploy after ejection from an aircraft flying at 200 knots. It must be capable of carrying a payload which is 4.5 inches in diameter by 6 inches high weighing up to 3 pounds. The device should orient its glide angle in excess of 45 from verticle is desired. The device must be expandable and inexpensive (\$1-2 in 500,000 quantities).

N87-191 TITLE: Flight Control Actuator Electronics Cooling

CATEGORY: Exploratory Development

DESCRIPTION: Develop innovative approaches and new techniques to provide cooling for electronic assemblies mounted on the bodies of flight control hydraulic actuators. The objective is to make it feasible to incorporate loop closure and redundancy management electronics on or within the flight control actuator, thereby reducing wire count between the actuators and flight control computers. Anticipated actuator case ambient temperatures may be as high as 300F. A highly reliable cooling method will be needed to operate flight critical electronics in this environment.

N87-192 TITLE: Sonobuoy Cables Of high Strength Spectra Materials

CATEGORY: Advanced Development

DESCRIPTION: Since sonobuoy cables must have strength and small diameter, many are presently constructed with a high strength member of Kevlar. The high strength polyethylene materials Spectra 900 Spectra 1000 have reported higher strength and lower weight than Kevlar. Evaluation of Spectra materials for sonobuoy cables requires the design, fabrication, and testing of cable samples in comparison to comparable Kevlar designs. A commonly used sonobuoy cable consists of a cooper core (7strands of AWG36) insulated with 10-mil thick Surlyn for water integrity; around this is the strength member, an 8-end braid of 1000 denier Kevlar 29 with cordage finish. The diameter of this cable is 0.058-inch maximum, and its breakthrough is 325 lb minimum in lengths of 17,000 ft. It is desirable to investigate a smaller diameter cable with equivalent break strength and a stronger cable with the same diameter. Both braided and served constructions should be considered. Minimum lengths 10,000 feet should be fabricated and tested at various sections along the cable length. Testing should include stress-strain, break strength (straight tension and over pins of 1-inch and 2-inch diameter), cyclic tension to break at 100 lb +50 lb (straight and

over 1-inch and 2-inch diameter pins), and cycles over a sheave of 1-inch and 2-inch diameter at 100 lb tension. Data should be in a form useful or the design of an improved sonobuoy cable using Spectra material.

N87-193 TITLE: Methodology For Predicting Canopy Fracturing Patterns During Ejection

CATEGORY: Advanced Development

DESCRIPTION: The objective is to develop an inexpensive and effective methodology for determining the optimized placement of detonating cord to predictably weaken and fracture an aircraft canopy for penetration by an ejection seat during crewmember emergency escape. Develop a finite element model to represent an aircraft canopy at the location where the ejection seat canopy breakers normally contact the structure during an ejection. The resulting stress pattern will identify the canopy areas that are potentially suitable for canopy fracturing using mild detonating cord. Exercise the model with mild detonating cord located at the weakened areas identified initially. Determine breakout pattern.

N87-194 TITLE: Low frequency Underwater Sound Calibration Source

CATEGORY: Advanced Development

DESCRIPTION: A low frequency non-explosive, sonar projector is required to perform acoustic calibrations at sea. Specifically a highly efficient projector capable of one watt acoustic output at a mechanical resonance below 500 Hz is needed with physical dimensions such that it may be installed in a cylindrical shell with a diameter not exceeding three and one half inches and a length not to exceed 18 inches.

N87-195 TITLE: Split Transformer Performance Modeling

CATEGORY: Exploratory Development

DESCRIPTION: Develop a model to predict the performance of a split transformer in a conducting seawater environment. Parameters that need be modeled include: size, materials, separation distance and amount of "disorientation", seawater conductivity, power transmitted, operating frequency, etc. The effects of the conducting seawater need to be quantified, e.g., electromagnetic field shape and eddy or other current within the seawater that dissipate the energy being transmitted.

N87-196 TITLE: Short Range Communication

CATEGORY: Advanced Development

DESCRIPTION: There is a need to develop a short range (,1000 yards), bi-directional communication system for undersea applications. The "transmitter/receiver" must be able to operate with various sound velocity profiles, water conditions and depths, surface and bottom conditions, etc. The method, approximate size, and energy level requirements need to be quantified.

N87-197 TITLE: Electromagnetic Launcher Brush Rail Interface

CATEGORY: Engineering Development

DESCRIPTION: This task is the investigation of the problems associated with the electro-magnetic launcher brush-rail interface in a conducting medium. Problems to be investigated include corrosion, wear, and electrochemical reactions due to the high current densities achieved at launch. End products include materials selection and brush design to minimize or eliminate specified problems.

N87-198 TITLE: Transient Electromagnetic Field Prediction Of An Electromagnetic Launcher

CATEGORY: Exploratory Development

DESCRIPTION: Develop an analytical prediction scheme which will predict the distribution and strength of the electromagnetic field produced by a submarine electromagnetic launcher system in a conductive fluid, such as seawater. This numerical analysis will also have the ability to predict the shielding capacity of the material and geometries used in an electromagnetic launcher. All computer programming prepared must be compatible with a VAX 11/780 computer and the source code must be a deliverable on the contract.

N87-199 TITLE: Three-Dimensional Transient Flow Prediction

CATEGORY: Exploratory Development

DESCRIPTION: Development a computer code capable of accurately predicting incompressible transient turbulent flow fields using the finite volume technique. The code should be applicable to three dimensional internal and external flow problems and be in the form of generalized curvilinear coordinates to include Cartesian, cylindrical, and spherical space. The algorithm should be capable of performing both fully elliptic and elliptic-parabolic analyses. As a minimum, the turbulence model should be the two-equation K-E development. Detailed documentation of the complete code development should be provided including comparisons to available (in the literature) experimentation. The code is to be compatible with a VAX 11/780 Computer and the source code must be provided.

N87-200 TITLE: High Speed Particle Trajectory Measurement

CATEGORY: Advanced Development

DESCRIPTION: Laminar flow offers significant payoff to undersea vehicle by providing drag reduction and reduced radiated noise. It has been shown that small particles can cause laminar flow to become turbulent. A technique is needed to measure the trajectory a particle takes as it moves past an underwater vehicle. Specifically it is necessary to determine a high-speed, small particulate's position very accurately (within one particle diameter) as it moves past underwater vehicle in a water tunnel frame of reference. It is necessary to track these particles over a length of several feet as they pass around the nose of the vehicle. Particle size ranges from 50 to 200 microns and the particle speed up to 50 ft/sec. The particle may pass very close to the vehicle (within the boundary layer). The vehicle may have a diameter up to 12 inches. Technologies that have been considered include tracking fluorescent particles passing through a sheet of ultraviolet light, and tracking particles as they pass through a light sheet created using an oscillating laser beam. These techniques may be improved or new technologies developed to achieve the desired result.

N87-201 TITLE: Robust Surface Heaters

CATEGORY: Engineering Development

DESCRIPTION: These heaters or heating techniques should be controllable and applicable to a complex curvature surface. The heat flux required is in the range of 10 to 30 KW/ft. These heaters are used in seawater to heat a submerged axisymmetric shell section ranging from 6 inches in diameter to over 21 inches in diameter. It is desirable to have the heaters resistant to moisture and high temperatures. Technologies that have been considered in the past utilize tubular nichrome wire heaters, which proved to be susceptible to high moisture levels.

N87-202 TITLE: Fabrication Of Non Spherical Particulates

CATEGORY: Engineering Development

DESCRIPTION: The ocean contains a variety of small scale particles known as plankton. In order to simulate the ocean in tow tank and water tunnel testing, it is desirable to seed the water with artificial particles. Particles in the size range from 30-1000 microns and with a specific gravity in the range of 1.01-1.30 are required. The desired shapes include rods, disks, "bristle brush", octopus shaped" or any other geometric shape. These particles must be capable of keeping dispersed in freshwater and saltwater and should be sufficiently robust to last at least one week submerged.

N87-203 TITLE: Thermal Conducting Plastics

CATEGORY: Advanced Development

DESCRIPTION: A nonmetallic material is being sought that can to manufacture coatings or complete sections of prototype coverings for heat exchangers which are submerged in saltwater for long periods of time. These coatings should be resistant to the seawater exposure and at the same time provide excellent thermal conductivity. An added bonus would include structural integrity to allow fabrication of heat exchanger subsections entirely out of the nonmetallic material. The axisymmetric models are 6-21 inches in diameter and 3-15 feet long.

N87-204 TITLE: Laminar/Turbulent Flow Detector

CATEGORY: Advanced Development

DESCRIPTION: Laminar flow experiments are frequently conducted in tow tanks and water tunnels using axisymmetric models that are 6-21 inches in diameter. A significant problem in these tests is to determine whether flow is laminar or turbulent at a given point on the model surface. An instrument/sensor package is required which can make nearly simultaneously multipoint evaluations of laminar/turbulent flow condition. These measurements should be real time at a rate of one Hz or better. The instrument would operate preferably, but not protrude beyond (or ideally not even penetrate) the model surface. The package must be active or passive acoustics, electromagnetics, or any other may be employed.

N87-205 TITLE: Architecture Modeling

CATEGORY: Advanced Development

DESCRIPTION: A need exists for the development of architecture modeling methodologies for evaluation of complex information management and command and control system architectures for both manned and autonomous system applications. These systems require sophisticated processing necessary to convert low level data from multiple sources into high level information needed for intelligent decision making and appropriate response. The architecture must provide the signal processing, data sorting, data fusion, information extraction, pattern recognition, hypothesis testing, decision making, control laws, etc. within the appropriate time intervals, and with numerical techniques), while maintaining the required reliability, flexibility, adaptability and overall performance parameters in order to establish architectural requirements and/or evaluate candidate architecture.

N87-206 TITLE: Transient Electromagnetic Flowmeter

CATEGORY: Engineering Development

DESCRIPTION: Develop a 21 inch inside diameter electromagnetic flowmeter capable of measuring transient volumetric flowrates with a data rate of at least 250 Hz. The measuring fluid is water between 40 degrees F to 120 degrees F flow 0.5 to 50 fps must be measured with a total accuracy of +2% of reading or better at each meter output update. Meters to have both analog (0-10V) and digital output and an upper range span setting adjustment between 25 and 50 fps. Meter is also to be capable of operating at steady state conditions for an indefinite period of time.

N87-207 TITLE: Real –Time Forecasting Of Future Ship Motion

CATEGORY: Advanced Development

DESCRIPTION: Investigate concepts for development of real-time methods to forecast future ship motion. Proposals which address the development, design and implementation of a device/system to forecast future quiescent periods in ship motion are solicited. The device is to be utilized during V/STOL aircraft recovery operations aboard air capable ships. Efforts are to be identified from the following areas: (a) Specification of additional naval applications of such a methodology and the requisite forecast periods; (b) Investigation of the relevant capabilities of existing and proposed forecast techniques (both operational and theoretical); ocean wave measuring techniques and devices; ship motion measuring devices; and, ship motion models which predict the responses of a ship to known forcing functions; and (c) Development/Identification of computer programs, methods, and devices for operational real-time ship motion forecasting; and the necessary ocean wave and ship motion measuring techniques and devices.

N87-208 TITLE: CV Fixed Wing Aircraft Tracking & Surveillance System

CATEGORY: Exploratory Development

DESCRIPTION: Us Navy Carrier (CV) fixed wing aircraft use a “long approach” during night time operations or during periods of limited visibility such as dawn, dusk, or adverse weather (rain, fog, snow, sleet, etc.). Aircraft typically form up for a straight line approach to the carrier at eight to ten nautical miles, with an aircraft spaced 1.5 to 2.0 nautical miles apart. To effect a reduction in CV approach and landing mishaps, it is desired to develop an all weather, all operating environment and all climate system for aircraft surveillance, automatic (computer graphics) aircraft type identification, and 6 d.o.f. tracking. Surveillance and tracking information shall be passed to Primary Flight Control and to the Landing Signal Officer Station. The system shall also be capable of operating in a Emission Control (EMCON) environment with a low Probability of Intercept (LPI) for electrical, magnetic and thermal signatures. Specific requirements are:

Aircraft Surveillance
Aircraft Tracking
Aircraft Configuration (Hook down, Landing gear down, etc.)
Automatic Aircraft Type Identification

Using a system approach, the contractor shall investigate the utilization of a sensor or a combination of sensors such as FLIR, Laser, Millimeter Wave, Solar Blind Ultra Violet, etc. for attainment of the above objectives. The contractor shall conduct trade-off studies to devise an optimal system architecture. The evaluation criteria shall include, but not be limited to, performance, development risk, predicted reliability, expected maintainability and logistics support requirements, development schedule and costs as well as estimated life cycle costs.

N87-209 TITLE: Approaching Carrier Aircraft Extended Range Glideslope System

CATEGORY: Advanced Development

DESCRIPTION: Presently the useful range of the Fresnel Lens Optical Landing System (FLOLS) is one nautical mile (nm). This is the only glide slope information presented to approaching carrier aircraft. It is desired to extend glide slope information to two nm. Vendors shall submit proposals outlining conceptual systems for satisfying Navy needs. The system shall satisfy all Navy requirements for all aircraft approach and landing operations in all weather, all environment, day/night/dawn/dusk and during Emission Control (EMCON) conditions. Phase I efforts shall include, but not be limited to, trade-off studies relative to the feasibility of the concept, definition of system performance and development risk as well as presentation of a development plan with major milestones and costs.

N87-210 TITLE: Aircraft Support Equipment Shock Response

CATEGORY: Advanced Development

DESCRIPTION: Current shipboard support equipments have inadequate design capability to resist expected shock levels. It is therefore required to develop concept algorithm and associated software for parametric analysis of shipboard-installed aircraft support equipment with respect to response to underway shock levels Induced by (a) heavy weather operations and (b) severe combat operations. Analytic procedure shall have flexibility to consider overall equipment shock response based upon summation effects of individual internal components (crt's tape drives, pc boards). Format shall be compatible for use in engineering analyses to determine shock requirements for specific vessel types and mounting locations for proposed new systems or for retrofit mounts of existing systems.

N87-211 TITLE: Automation Of Shipboard Bomb Assembly Operations

CATEGORY: Engineering Development

DESCRIPTION: Design, fabrication and demonstration of an automated bomb assembly system for a carrier based environment. The system must be flexible, capable of handling four bomb types. The functions should include loading onto conveyor, removal of shipping screws, fuse caps/nose plugs, and installation of fuses and fins. Installation of fin release wires and fuse arming wires will remain manual operation. Then off loading onto transporting vehicle. Current operation utilizes 4 two man teams, bomb types handled include MK81, MK82, MK83 and M117A1. Other constraints include the system should not occupy much more space than approximate 18 ft. x 9 ft. x 8 ft. and the operation must be capable of being done manually should failure occur, and must achieve better than 9 minute cycle time.

N87-212 TITLE: Non-Destructive Evaluation Of Composites

CATEGORY: Advanced Development

DESCRIPTION: Atmospheric condensation, rain, and icing conditions cause water ingress in composite materials, and water being entrapped in aircraft honeycomb structures due to cracks and defective adhesive bonding . A non-destructive evaluation method is required to detect the presence of water entrapped in aluminum and nomex honeycomb structures bonded to aluminum and composite materials such as graphite/epoxy and glass/epoxy. The method must be operable by field personnel at the operational or depot level with a minimum amount of training.

N87-213 TITLE: Fins and Wings Made Of Molded Matrix Material

CATEGORY: Advanced Development

DESCRIPTION: The SPARROW would benefit from a low-cost alternate source for wings and fins. The wings and fins should be constructed of high-strength matrix metals or materials, and be molded with minimum machining. The resulting wings and fins must have rigidity, aeroelasticity, and bending mode characteristics that will avoid wing buzz and wing flutter frequencies and modes. The weights should be uniform to SPARROW wing and fin specifications.

N87-214 TITLE: Infrared Target Source For Missile Test And Evaluation

CATEGORY: Engineering Development

DESCRIPTION: At present, R.F. guided missiles are tested in the laboratory using hardware-in-the-loop (HIL) simulations that require a moving R.F. target source. This R.F. source is usually moved by some mechanical means. Future missile designs are planning which will incorporate infrared seekers and R.F. seekers on the safe missile for

multi-mode guidance. In order to test these new designs in the laboratory, an infrared (IR) target source will have to be incorporated into the R.F. target source. Various parameters of the IR source need to be controlled so that the missile IR seeker will be stimulated as it would be during an actual target engagement. Some of the parameters to be controlled are: (a) intensity – a function of range, target type and target aspect; (b) angular extent of target – a function of range and target; and (c) spectral content and dispersion – a function of target and particular missile seeker-to-target source distance of 20 feet.

N87-215 TITLE: Automated Best Source Selector

CATEGORY: Engineering Development

DESCRIPTION: Higher telemetry data rates greater missile ranges and dynamics, and the increase in Interfering frequencies of modern weapons testing, greatly increase the need for space diversity to ensure telemetry data. Space diversity is achieved through the use of multiple telemetry receive sites. Currently the PMTC Realtime Data Collection Facility receives and records data from to 6 sources, and the best source manually selected. Data is frequently lost in the reaction or faulty judgment if the operator responsible for switching. An automated best source selector is required to accept digital data inputs from up to 6 sources, time align the data, and output one digital data stream which is the “best” of the received data. A form of combining would be developed to eliminate switching, with the potential of providing signal enhancement beyond that of the best signal alone. This project is high risk, since no known manufacturer has designed such a device. It has high potential use due to minimizing data loss and increasing data quality for real-time recording, processing, and display. The application would be to most missile and aircraft ranges using multiple telemetry receive sites.

N87-216 TITLE: Multipoint Target Radio Frequency Augmentation

CATEGORY: Advanced Development

DESCRIPTION: An augmentation method to make small missile-type targets have the distributed multi-point radar signatures of physically large fighter bomber and bomber targets is required by the test and evaluation community. The multipoint augmentor should provide fade, glint, scintillation and angle noise typical of large targets by generating multiple RF sources and wave fronts from extended points on the target. The augmentation may be a number of small (subscale) corner reflectors for passive enhancement or a Traveling Wave Tube (TWT) or solid state amplifier with multiple transmit horns, and phase and amplitude modulators. General specifications are:

Coverage +60 off nose or tail

Frequency 9.0 GHz to 10.3 GHz

Augmentation 1 sqm to 15 sqm

Altitude 0.1 KFT to 90 KFT

Mach 0.9 at 0.1 KFT to 25 KFT, increase to 1.8 at 45 KFT and to 3.0 at 70 KFT

N87-217 TITLE: Head Attitude Sensor

CATEGORY: Advanced Development

DESCRIPTION: A system capable of measuring the pointing direction of a pilot/trainee’s head relative to the cockpit is required for a head coupled display system being developed for a flight training simulator. The required performance is an accuracy of ½ minute of, arc in pitch, azimuth, and roll anywhere within 240 degrees azimuth and +90 to –60 degrees in pitch relative to the forward direction of the cockpit. Since the pilot’s head is free to move in any direction, systems which restrict head movement, either in position or orientation, are not suitable. Another performance requirement is a response time which must be less than 10 milliseconds and preferably less than 5 milliseconds. If the system samples, the sample rate must be at least 120 Hz and preferably 240 Hz, or better.

N87-218 TITLE: Implementation of ADA On Distributed Microprocessor Computer Architectures For Aircrew Training Systems

CATEGORY: Engineering Development

DESCRIPTION: Distributed microprocessor computer architectures will be utilized in aircrew training systems in the near future due to their reduced acquisition costs and improved life cycle supportability characteristics. To realize the full potential of this approach and to comply with DOD requirements, it will be necessary to use the Ada programming language. Ada is a very comprehensive and complex language with is intended to force better programming techniques, make software more easily modifiable and reusable, and reduce life cycle costs. Relatively little is known about real time tasking in Ada and its associated problems. There is a very real potential that this feature may be difficult, or impossible, to apply in complex real-time a aircrew simulation applications. The scope of the Phase I effort is to develop a plan for implementing and evaluating Ada as the software language on major training systems acquisitions which incorporate disturbed microprocessors as the simulation system. The plan will outline the research issues, advantages/disadvantages to implementation, alternative approaches, critical path elements.

N87-219 TITLE: Remotely Piloted Vehicle (RPV) Training System

CATEGORY: Management and Support

DESCRIPTION: Because of its relative low cost, high survivability based on small size, inherent flexibility, and state of the art technology, the remotely piloted vehicle (RPV has become more attractive for expanded military applications. RPV's can significantly lower cost in equipment and personnel loss and are being introduced into military operations with increasing regularity. A need exists for the development of a training system that will improve skill retention and performance to acceptable levels of military operational readiness without any attendant loss of actual RPV systems. This system must be a deployable RPV trainer that can be used at forward based sites as well as board ship to provide the training and over learning required to retain RPV control skills. The system should not only have an accurate aerodynamic simulation model of the RPV but must also provide diagnostic feedback for the student.

N87-220 TITLE: Computer-Based Item Pools Evaluation Software

CATEGORY: Advanced Development

DESCRIPTION: The measurement precision of an ability test can be degraded when the test taker is asked questions that are very similar, essentially equivalent, to not independent of previously asked questions. With paper-and-pencil tests, this is prevented with an easily-performed manual comparison of the items on the printed booklet. However, this task becomes substantial when the number of questions to be checked is large, as is the case in the item pools required for computerized adaptive testing. Emphasis should thus be on developing and delivering a computer program to automate item-pool checking in the Navy-developed tri-service computerized adaptive testing system.

N87-221 TITLE: Assessing Effectiveness Of A Functional-Work-Context In Training

CATEGORY: Management and Support

DESCRIPTION: Universally, military technicians in electrical and electronics occupations are trained in a curriculum that begins with instruction in the basic concepts and physical laws of electricity. The courses are taught in large numbers (numbers (25,000 in the Navy alone), are abstract/academic in nature, have high attrition, and provide imperfect basic knowledge as a basis for further training or for follow –on jobs. A system was developed for designing a functional-work-context for training basic knowledge and skill. It calls for designing an interactive setting, work-like in character, in which the student learns to use the appropriate concepts and vocabulary, perform the appropriate procedures, make predictions and solve representative problems. The setting is tailored both to the

student's level of understanding and knowledge, and to representative work requirements. The advantage of the system is that what students learn should be more useful in subsequent training or in carrying out job functions. This needs to be tested. It is proposed that this system be used to develop a functional-work-context course in basic electricity, and that the quality of student learning assessed. The deliverable is 60 hours of training materials for the Direct Current portion of the basic with the functional-work-context approach.

N87-222 TITLE: Chemical, Biological, And Radiological Defense Training

CATEGORY: Management and Support

DESCRIPTION: Actual or threatened chemical, biological, And radiological-defense conditions impose severe limitations on the capability of military personnel to perform essential operations, such as communications, emergency maintenance, damage control, and other critical tasks. Critical tasks most vulnerable to perform degradation under chemical, biological, radiological-defense conditions have been identified. To overcome this performance loss, this present effort proposes evaluation of various training interventions or job aids, including the possibility of equipping individuals with strategies or alternative means of performing the essential tasks associated with their jobs. The deliverable is a report on the results of researching the human factors of performing critical tasks with recommendations regarding training and aiding interventions.

N87-223 TITLE: Synthetic Line Hardware

CATEGORY: Advanced Development

DESCRIPTION: Synthetic lines are widely used in marine applications because they are lightweight, corrosion-resistant, easy to handle and have relatively high strength-weight ratio. They are found on Navy vessels as mooring lines, lifting lines, guys stays and tow lines to name a few uses. Deficiencies in the current applications are in part caused by deficiencies in associated hardware (terminations, linkages, etc.) These deficiencies also limit the potential of synthetic line for a wider range of Navy applications. The current techniques and hardware used with synthetic lines were adapted from wire rope technology. As a result, the associated hardware is heavy and is usually the weak link in the line system because the differences in mechanical properties between steel wires and synthetic fibers have not been adequately addressed. Handling this hardware, which can weigh over 300 pounds is both difficult and hazardous. In addition, corrosion of metallic end fittings is a major problem. One viable alternative is to use synthetics. There is a need for high strength, lightweight line handling hardware, synthetic sheaves, quick release stoppers, shackles and thimbles of composite materials, e.g., kelvar reinforced plastics. Development of materials and fabrication technology are needed.

N87-224 TITLE: Ground Penetrating Radar

CATEGORY: Advanced Development

DESCRIPTION: A ground penetrating radar (GPR) system is needed to locate underground utility lines and other manmade and naturally occurring objects (Metallic and Non-Metallic) in the ground profile to 20 feet. A detection rate of better than 90% under all ground profile conditions is required. This includes high water table conditions.

N87-225 TITLE: Non-Metallic Steam Line Jackets

CATEGORY: Advanced Development

DESCRIPTION: The Navy waterfront has many miles of underpier and underground steam lines. These lines suffer from a highly corrosive environment caused by high water tables and high sea levels. Jacketed steam lines eventually allow water tables and high sea levels. Jacketed steam lines eventually allow water penetration that accelerates corrosion, insulation breakdown, and massive heat losses. Underpier steam lines additionally experience

abuse from wave activity and floating debris. A jacket material is required that has no seams, is non-corrosive, retrofittable, objects, and retains long life integrity.

N87-226 TITLE: Reduced Diameter Centrifugal Impeller Diffuser Investigation

CATEGORY: Engineering Development

DESCRIPTION: With the development of the axial compressor, the centrifugal compressor with its large diameter and lower efficiency was used less. Recently engine designs with axial/centrifugal configurations have been used. The centrifugal stage replaces several axial stages (small blades) but still has a larger diameter than an all axial machine. The centrifugal impeller is more rugged than axial blading and has a better stall margin capability. The area of the centrifugal compressor that must be investigated is the diffuser. With improved efficiency and a reduced diameter the centrifugal stage can be competitive with axial stages. The payoff will be fewer parts that are more durable and operable for application to patrol and possibly multi-mission fighter attack type aircraft.

N87-227 TITLE: Expert System For Directing Propulsion Technology

CATEGORY: Management & Support

DESCRIPTION: Two areas of experience exist regarding aircraft gas turbine engine technology. The first is the component expert who has many years of experience and is thoroughly knowledgeable in a particular engine component area. The second is the personnel who work close to the operational equipment and are knowledgeable regarding past and current engine problems. The purpose of this development is to capture the knowledge base of these experienced personnel and incorporate this knowledge into an expert system. This expert system will identify exploitable technology areas which will eliminate the carryover of current problems into future engine systems.

N87-228 TITLE: Ceramic Development For Aircraft Engines

CATEGORY: Exploratory Development

DESCRIPTION: Develop ceramic components or coatings for high temperature gas turbine engines. The objective is to reduce turbine cooling air requirements, improve life, reduce cost of future gas turbine engine components. The components or coatings must meet future engine life requirements.

N87-229 TITLE: Aircraft Engine Turbine Instrumentation

CATEGORY: Advanced Development

DESCRIPTION: Develop non-intrusive, durable instrumentation to measure turbine temperature, pressure and stress at turbine inlet, interstage and exit locations. The objective is to develop this instrumentation to provide analytical, diagnostic and monitoring data to determine turbine health and performance.

N87-230 TITLE: Radiative Ignition And Combustion Enhancement

CATEGORY: Advanced Development

DESCRIPTION: Future Navy aircraft propulsion system missions put severe strains on conventional spark ignition combustion systems relying on recirculation zones or bluff bodies for flame stabilization. The use of radiative sources should be investigated as a potential technique for extending aircraft operating limits associated with combustion processes. The proposed program would be analytical and/or experimental. Potential payoffs to Navy

propulsion systems include improved altitude relight, potentially shorter combustion systems, enhanced operations on alternative/high density fuels, and the development of zero-drag flame holders.

N87-231 TITLE: Turbine Engine Damage Resistance Technology

CATEGORY: Engineering Development

DESCRIPTION: The vast majority of unscheduled engine removals is to Navy turbofan/turbojet powered aircraft are caused by Foreign Object Damage (FOD). Typical FOD consists of stones, safety wire, NO-SKID (carrier deck surface), ice aircraft fasteners and fairing. The first stages of the fan section (blades and stators) sustain the heaviest damage. In particular, the leading edges of these blades and stators become dinged and notched resulting in aerodynamic losses and additional damage to successive compressor stages. The repair and/or replacement of these damaged parts have a significant impact on readiness, logistics support costs and manpower. Currently, the only way to inhibit the FOD problem is to thicken the leading edges of fan blades and stators. This additional material weight adds weight to the engine and is aerodynamically inefficient. In order to avoid thick airfoil leading edges and attendant aerodynamic losses, we need to develop a protective coating or leading edge treatment for fan blades and stators. This coating or leading edge treatment for fan blades and stators. This coating or leading edge treatment will have the capability to absorb the impact energy or deflect small foreign objects ingested by high performance fans and compressors. This technology will be essential for application of high efficiency, low weight blisks for Navy turbofan/turboshaft engines.

N87-232 TITLE: Repair of J-52 Bolt Hole Low Cycle Fatigue Damage

CATEGORY: Engineering Development

DESCRIPTION: Each year the Navy retires an estimated 50-100 million dollars worth of aircraft engine disks from service because they have reached the life limit set by the manufacturer. In some cases, such as the J-52, disks are being removed only when cracked. However, in both cases there is enormous payback to be achieved (e.g. 10:1) if the bolt holes could be worked using conventional metalworking techniques such as cold expansion. This process has been used successfully on fastener holes of fuselage sections of F-18 aircraft to increase fatigue life 3 X with no reported failures. Using a split sleeve cold expansion process, fatigue critical holes are expanded into a state of high residual compressive stress with no metallurgical changes. This process could be applied to compressor disks using an insert bushing and similar cold expansion techniques. Such a process is needed on J-52 disks because of a critical shortage of parts and the long lead times required in the procurement of new disks. The savings in maintenance dollars for disks could be reduced by an order of magnitude since for each unit of disk repair cost, there are 10 units of disk savings. Restoring the fatigue life of used disks is 6X quicker than making a new disk. Therefore, fleet readiness is greatly improved.

N87-233 TITLE: Noise Suppressor Development

CATEGORY: Advanced Development

DESCRIPTION: Develop a noise suppressor for pneumatic quiet valves and air pressure reduction manifold stations in submarines using innovative fluid dynamic/acoustical techniques to provide a counterpoint (alternate sources) for the existing technology developed in the 1970's. Required to insure quiet operating conditions.

N87-234 TITLE: Submarine Structural Model

CATEGORY: Exploratory Development

DESCRIPTION: Develop analytical model for submarine structure borne vibration due to active sonar operation. Model is urgently needed in order to predict noise in new and advanced submarines.

N87-235 TITLE: Waterside Security Robotics

CATEGORY: Engineering Development

DESCRIPTION: The objective is to develop a conceptual robotic system for the detection, assessment, and response of waterborne intrusions. The required mechanical, electrical, and control system characteristics of the bionically enhanced vehicle must be determined. The feasibility and cost benefits of the underwater security robot must also be evaluated. The timely detection, assessment, and response to a waterborne intruder (i.e., swimmer or scuba diver) is essential to ensure the security of waterside facilities and their associated high value assets. An underwater robotic vehicle with bionic sensors, such as broadansonar, binaural hearing, and stereovision, will combine the conventionally separate operations of intruder detection, assessment, and response into a single waterside security system. An underwater robot is needed to carry the bionic sensors and to provide the necessary speed and mobility for waterside security operations.

N87-236 TITLE: High Pressure Optical Penetrator For Single Mode Fiber

CATEGORY: Engineering Development

DESCRIPTION: Develop a penetrator capable of accepting a dematable fiber which can withstand pressure differentials of 10,000 psi and operated reliably with multiple connect/disconnect cycles.

N87-237 TITLE: Optical Slip-Ring For Single Mode Fiber

CATEGORY: Advanced Development

DESCRIPTION: Use of cables with single mode optical fiber data transmission elements is not presently feasible using existing winch rotary joints. A rotary joint must be developed to transmit optical signals with minimal attenuation.

N87-238 TITLE: Undersea Visibility Condition Monitor

CATEGORY: Advanced Development

DESCRIPTION: A problem in the development of undersea systems which operate visually is to quantify performance of the system as a function of the visibility conditions. The specific parameters of interest when characterizing the visibility conditions are the light level and turbidity. A high performance underwater visual system which is in advanced development has a requirement to generate performance curves and to find the system limits as a function of turbidity and light level. A small, rugged instrument package is required to measure these parameters. This instrument must be able to measure illuminance in the range between 10 and 10 foot candles for wavelengths between 400 and 700 nanometers. It is also must be able to measure turbidity between 0 and 100% transmission/10 cm, and be able to indicate the depth at which these other parameters are measured. This instrument must be highly portable, battery powered and able to operate from a 22-foot Boston Whaler boat.

N87-239 TITLE: Teleoperator Feedback Systems

CATEGORY: Advanced Development

DESCRIPTION: The improvement and increased reliability of teleoperator systems necessary to produce man-like dexterous performance requires the development of advanced end-effector sensors and displays, as well as advance in actuator or end-effector devices capable of exerting forces with the same efficiency as a man's hand and fingers. Some of the issues associated with the display of end-effector sensor information can be resolved through the development of models and methods to stimulate the somatosensory system of the operator. Problem areas which

need to be explored include the type to sensors and displays necessary to produce sensations of object apprehension, (i.e., the realization of structural, surface and functional properties of objects).

N87-240 TITLE: Develop Permeable membrane Compressed Air Dehydrator

CATEGORY: Advanced Development

DESCRIPTION: Develop a thin-film permable membrane/material and support composite optimized for removing water vapor from shipboard compressed air stream . Design and fabricate a suitable module, incorporating this membrane technology, for evaluation by DTNSRDC. Designs Conditions are as follows:

Inlet Pressure 80-125 psig
Inlet Temperatures 50 to 122F
Inlet Humidity saturated at pressure and temperature
Outlet humidity-40F dewpoint

The module should be sized for a minimum capacity of 5 standard cubic feet per minute. The module shall be capable of 85% efficiency , that is 85% of the volume entering shall have leave as product air at -40F dewpoint.

N87-241 TITLE: Oxygen Generation Utilizing Non-Cryogenic Processes

CATEGORY: Advanced Development

DESCRIPTION: Small quantities of oxygen at 1800-2300 psia are used on naval surface vessels for emergency life support purposes. Non cryogenic processes capable of producing 10-20 ib/hr of oxygen meeting the purity requirements of MIL-0-27210 are of interest. Proposals for the oxygen generation process, the oxygen presurizer or for both will be considered.

N87-242 TITLE: Novel Method Of Filtration For Reverse Osmosis Pretreatment

CATEGORY: Advanced Development

DESCRIPTION: Reverse Osmosis Prefiltration System. Navy reverse osmosis (RO) desalination systems utilize a diatomaceous earth filter for pretreatment in order to prevent particulate and biological fouling of the membrane. There would be considerable interest in identify new methods of filtration which could result in improved filtrate quality, reduced system size and complexity, and reduced system maintenance requirements. Proposers are requested to propose (1) new method(s) of filtration for RO application and (2) a program to evaluate the feasibility of the concept for shipboard RO desalination.

N87-243 TITLE: Reverse Osmosis Membrane Development

CATEGORY: Exploratory Development

DESCRIPTION: Reverse Osmosis Membrane Development. The Navy has developed a reverse osmosis (RO) desalination system for shipboard desalination. RO membranes (which are incorporated in a modular configuration are susceptible to degradation by (1) oxidizing agents used to control biofouling and (2) fouling by suspended solids. A membrane less vulnerable to these threats would improve RO plant knowledge in membrane/polymer development would be encourage to submit proposals on the development of a membrane resistant to oxidating agents and foulants.

N87-244 TITLE: Freon Absorption Air Conditioning

CATEGORY: Engineering Development

DESCRIPTION: Investigate recent developments in commercial Freon based absorption air conditioning technology for potential application to naval ships. Determine state-of-the-art parameters such as weight/space/power requirements per ton of cooling and assess environmental hazards, reliability, safety, and complexity. Prepare report.

N87-245 TITLE: Mixed Refrigerant Application To Shipboard Air conditioning

CATEGORY: Advanced Development

DESCRIPTION: Investigate mixed refrigerants for application to naval shipboard air conditioning. Determine optimum mixture combinations. Assess heat exchanger performance with widely varying loads (10%-100% capacity) and widely varying condensing conditions (seawater temperature from 28F – 95F) Investigate control strategies and systems for optimizing mixture at off-design conditions. Investigate methods for determination of mixture and prepare report.

N87-246 TITLE: A Comprehensive Model For Robotic Applications

CATEGORY: Advanced Development

DESCRIPTION: The contractor shall develop a comprehensive model for identify military logistics applications for robots. The literature contains many good but limited robotic models, which shall be reviewed and incorporated into the comprehensive model. These past-models are limited in the sense that they relate only to some dimensions, such as robot capabilities, and not to others such as justification of robots on the basis of safety, labor savings, reducing boredom, or other considerations. As a minimum, the model shall include descriptions of: robot capabilities, justification of robots, robot tasks (e.g., welding, etc.), and frequency of current applications. The model shall also identify applications that may not satisfy all robot criteria (e.g., teleoperated robots are interest even if they are not reprogrammable).

N87-247 TITLE: Robot Performance Considerations In Naval Environments

CATEGORY: Exploratory Development

DESCRIPTION: This effort will consist of identifying Naval environmental factors relevant to the performance of industrial style robots. Considerations will include: ship motion, corrosion, ship vibration, space limitations, wetness, etc. The effects on performance of these and other factors will be studied (analytically where possible) and possible solutions proposed.

N87-248 TITLE: Composite Piping Systems

CATEGORY: Advanced Development

DESCRIPTION: Develop improved composite materials and processes to extend the capability of composite piping systems. Properties requiring upgrading include: (a) Impact resistance - tougher resin/glass systems; (b) Higher temperature service – high temperature adhesive systems; (c) Fire/smoke /toxicity – improve performance of existing materials and products; and (d) Conductive resin systems and adhesives to allow use on fuel piping. The work should include evaluation and demonstration of improved capability.

N87-249 TITLE: Weapons Launch

CATEGORY: Exploratory Development

DESCRIPTION: Develop a concept for launch of submarine weapons. Concept must be appropriate for post-SSN-21 class submarine (2010 or later). The Phase I study should include the selection of a concept to be developed by considering potential impact/interfaces of alternative concepts on a submarine including arrangement, weight, space, power required, ability to launch at high speeds without weapon damage and ability to launch covertly.

N87-250 TITLE: Fast Optical Switch For Multimode Fiber Optics Applications

CATEGORY: Engineering Development

DESCRIPTION: There are signal processing functions that could be more efficiently performed by optics than electronics if the appropriate switches are available. Unfortunately, current optical switch technology provides switching speeds on the order of 10 milliseconds for commercially available mechanical switches to 100 picoseconds for single-mode laboratory switches and nothing in between. The objective of this development effort is to design and fabricate a single-pole, double-throw multimode optical switch that can be actuated in less than 1 microsecond and interfaced to popular logic circuitry such as TTL or ECL.

N87-251 TITLE: Autonomous Target Identification

CATEGORY: Exploratory Development

DESCRIPTION: Develop innovative approaches and new technology for autonomous target recognition and identification. Advanced missile seekers and targeting systems will require autonomous target identification capability to improve effectiveness and survivability, and to decrease pilot workload, respectively. Such capability requires the development of target identification algorithms for potential use with sensor such as visible, infrared, radar, or multiple sensors, etc. The objective of this effort is to propose and sufficiently develop candidate algorithms to demonstrate their expected performance through computer simulation against target imagery. Since the proposed algorithms will be ultimately implemented in a size/weight/volume compatible with aircraft/missile avionics, an estimate of hardware/software implementation requirements and cost shall be made for the candidate algorithms.

N87-252 TITLE: Data Acquisition System For Infrared Thermography

CATEGORY: Engineering Development

DESCRIPTION: To analyze engine generated hot gas flow patterns, an AGA-780 thermovision infrared system is used. The analysis is restricted to real time because no method exists to record the full dynamic range of the video signal for post –test analysis. A record of limited steady state quantitative data is produced, but data from transient events are missed. Acquiring the thermal imagery data in a real time mode requires recording the raw data directly from the infrared camera. The analog signal varies from 0 to 10 volts at frequencies of DC to 80k with a 48 dB S/N ratio required for maximum resolution at playback. There is a requirement to develop a data acquisition system for this data.

N87-253 TITLE: Resource Allocation Model

CATEGORY: Management and Support

DESCRIPTION: A requirement exists for the development of a computer model for use in resource allocation decision making in the research, development, test and evaluation environment. The model must deal with existing

resources, existing and prospective workloads and varied funding scenarios. User friendliness and ability to run on commonly available microcomputers are important parameters.

N87-254 TITLE: Compact Communication Simulation Equipment

CATEGORY: Advanced Development

DESCRIPTION: There is a need to develop innovative approaches to the problem of providing a large quantity of simulated communications signals for the test and evaluation of equipment to be installed in confined spaces. Evaluation of communication/electronic warfare equipment requires exposing the systems under evaluation to a large quantity of controlled signals. Signals under interest include clear voice, secure voice, command control signals, data link/nets, etc., of all modulation types. Realistic battlefield signal densities of 1000 to 2000 simultaneous signals are required. Emphasis is to be placed on obtaining maximum signal density with the smallest possible equipment size. Frequencies include HF, VHF, UHF and Microwave bands. All signals need to be computer controllable and to be generated at the radio frequencies.

N87-255 TITLE: Digital Filtering And Smoothing

CATEGORY: Engineering Development

DESCRIPTION: Many test and evaluation tools and techniques require data filtering and smoothing and the derivation of rates. Data sources include radars, cine-theodolites, laser theodolites, fixed airborne and ground cameras, and aircraft sensor data. These data are utilized in such tests as weapon delivery accuracy, carrier takeoff and landing, store separation, ballistics, flying qualities and performance, etc. A classical least square moving arc polynomial technique has been utilized for data smoothing and rate determination. While this technique is reliable for some applications, it does not lend itself to real-time applications or applications such as a carrier landing where an abrupt landing influences the smoothing and rate determination for both real-time and post flight consideration.

N87-256 TITLE: Search Sensor Innovation

CATEGORY: Exploratory Development

DESCRIPTION: Conduct a study to develop new and innovative ideas/concepts for a long Airborne Early Warning search sensor not of the conventional radar type, and for utilization in lighter-than air platforms. There is continuing effort to innovate in the area of sensor ideas/concepts. The reintroduction of the concept of utilizing lighter-than-air platforms for Airborne Early Warning could precipitate development of sensors not of the conventional radar type. There is a need to investigate and determine the test and evaluation implications and requirements that such new sensors might foster. Infrared, electronics, electromagnetics and any other applicable sensor technologies should be considered.

N87-257 TITLE: A High Resolution, Low Altitude Flight Test Anemometer Ground Station For Helicopter And Vertical Take Off And Landing Aircraft Testing

CATEGORY: Engineering Development

DESCRIPTION: The need to identify ambient wind conditions for flight testing of helicopters and other VTOL aircraft is made more difficult by the influence of high-velocity jet exhausts and rotor wakes on the local air mass motion under light to moderate wind conditions and in the presence of the ground boundary layer. The objective of this study is to identify the equipment needs and analysis techniques that will provide an accurate measure of ambient wind conditions for altitudes below 100 feet above the ground surface. The system should provide a permanent record of the mean velocity vector and some measure of the unsteady velocity as a function of altitude. Time synchronization with aircraft test data should be provided. Portability, to allow remote site testing and to

minimize airfield obstruction when not in use, is important. Identification of component accuracies, frequently response (or response distance) and number of sensors should be addressed.

N87-258 TITLE: Compact Dynamometer For Turboshaft Engines

CATEGORY: Advanced Development

DESCRIPTION: Performance testing of turboshaft engines requires the use of large and enormously expensive dynamometer could effect significant savings and efficiencies. It could be of a portable configuration which could enable on-wing testing of engines for P-3, C-130, E-2, and V-22 aircraft, as well as on-the-aircraft testing of helicopters engines. This requirement is for the exploration of the applicability of existing steam generating dynamometer designs to the T-56-427 engine and the development of a proposed configuration of a prototype model.

N87-259 TITLE: Optical Design Innovations For Aircrew Display And Test Devices

CATEGORY: Advanced Development

DESCRIPTION: Develop and demonstrate improved optical mirror-beamsplitter devices for use with head-up displays, helmet mounted displays and short relief non-helmet mounted displays. Innovations should capitalize on improved materials and coatings (including plastic optics), on improved design and component selection, manufacturing and acceptance testing techniques, and on other innovations for the development of conventional optics, (reflective and refractive) for these special applications. Since display devices themselves are not an element of this effort, all demonstrations may be with static imagery, such as photographic transparencies. The goal of the effort is to enable image optics. Advances will also improve certain other combined devices, such as test equipment for eye relief space of present night vision goggles, face protective visors or masks and eyeglasses. The innovations sought will streamline design practices and improve size, weight, cost, durability and performance of these devices.

N87-260 TITLE: Plane Wave Generation

CATEGORY: Advanced Development

DESCRIPTION: Develop innovative approaches to provide plane waves at radio frequencies within a confined space. Modern testing of electronic warfare (EW) equipment includes testing of receivers in anechoic chambers. The generation of plane wave fronts is important when evaluating systems with interferometer type antenna systems but difficult when dealing with limited size chambers of appropriately 60 feet by 90 feet. Maximum separation of the source to the system under test is 20 to 30 feet. The systems vary in aperture size; and the frequency of interest is from 0.5 to 100 GHz. The source needs to provide a means of controlling the direction of emanation for full evaluation of systems.

N87-261 TITLE: Extended Flight Analysis

CATEGORY: Exploratory Development

DESCRIPTION: Currently under investigation are Airborne Early Warning missions requiring extended flights. The duration of these flights may extend from several days to several weeks. Crew sizes might range from twelve to twenty-four persons, and crew members will be required to perform many function, including operation and maintenance. Crew related technical and human factors issues concerning these extended flights need to be identified, cataloged and studied. Relevant historical data must be collected and analyzed. Problems and solutions in similar environments should be evaluated for applicability. Proposed methodologies for the formulation of solutions to anticipated problems need to be developed.

N87-262 TITLE: Helmet Mounted Occulometer

CATEGORY: Engineering Development

DESCRIPTION: As a part of a data acquisition system for the monitoring of visual gaze point, a requirement exists for a helmet mounted occulometer which will be lightweight, flightworthy, self-calibrating and operable in a variety of lighting conditions. It should be capable of operating with night vision goggles and/or helmet display devices. Outputs should include digital eye movement records and a machine scoreable record of eye location suitable for summary statistics for analysis. The requirement is for the design and development of such an occulometer which will lead to the production of a prototype.

N87-263 TITLE: Research Instrumentation Based On New Measurement Techniques

CATEGORY: Exploratory Development

DESCRIPTION: Progress in scientific and engineering research is becoming more dependent on the availability of instrumentation incorporating new physical measurement techniques. Examples of recent promising developments or evident future needs include sophisticated acoustic sensing techniques, the scanning tunneling electron microscope, "smart" chemical microsensors for detection and analysis, fiber-optic based systems, automated instruments to speed measurements and to provide processed information (rather than raw data), stable picosecond pulse generators, non-destructive test and evaluation apparatus, laser measurements of fluid flow, and many others. The timely development of new instrumentation based on new sophisticated measurement techniques now being developed at university and other research laboratories would make advanced measurement techniques more widely available thru commercial instrumentation and thus could be of great demonstrate knowledge and understanding of modern scientific measurement techniques are requested to submit proposals to develop instruments utilizing these latest techniques.

*Proposals for topic N87-263 should be mailed to Office of Naval Research (see information listed for topics N87-1 Through N87-9).