NAVY

Proposal Submission

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

Office of Naval Research
ATTN: Mr. Vincent D. Schaper
ONR 4130 SBIR
800 North Quincy Street
Arlington, VA 22217-5660
(703) 696-4286

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

The Navy's SBIR program has been redirected for FY 1994 from one that was integrated with the needs and requirements of the Navy through engineering development headquarters activities to one that is primarily integrated with the needs and requirements of the Navy through its science and technology centers while providing "dual-use " topics. The program is a balance between science (S) and technology (T) areas that the Navy has identified as necessary to meet its mission responsibilities. While a total of 31 S&T areas has been identified (see Table 1), all of these areas may not be funded equally during the two annual DOD SBIR solicitations in which the Navy participates. The Navy will fund topics according to a priority it has established to meet its mission goals and responsibilities.

This solicitation contains 126 technical topics to meet the requirements of the Navy's mission and PL 102-564 to which small R&D businesses may respond. The Navy will provide potential awardees the opportunity to reduce the gap between phases I & II by providing a $70,000 Phase I feasibility proposal award with a $30,000 Phase I Option, or small businesses may elect to just submit a Phase I proposal for $100,000. If small businesses choose the former, the Option effort should form the initial part of the Phase II work. Only companies whose Phase II proposal has been recommended for award will be funded for the Phase I Option. Therefore, those who have finished or almost finished their "Phase I feasibility" portion should submit their Phase II proposal with a "demonstration Phase II" portion and an option. The Phase II proposal package should contain a plan of how the proposer will commercialize the technology to the government (and the private sector) in addition to the technology demonstration portion of the proposal. At the end of the "demonstration Phase II" portion, a determination will be made by the Navy as to whether the proposer has satisfied the commercialization plan sufficiently for the government to fund the "Phase II option" portion of the proposal. The Phase II option should address the further R&D or test and evaluation aspects of the proposal. The total Phase II funding will not exceed $750,000 with 80% going to the "demonstration Phase II" portion and 20% for the "option Phase II" portion. Proposed options for Phase I should fit within the 25-page limit, which is specified in the "PROGRAM DESCRIPTION" section of this solicitation. The requirements for the Phase II proposal will be given to companies at the time of Phase I award.

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

TABLE 1. NAVY MISSION CRITICAL SCIENCE AND TECHNOLOGY AREAS

TECHNOLOGY	SCIENCE
Aerospace Propulsion and Power	Computer Sciences
Aerospace Vehicles	Mathematics
Chemical and Biological Defense	Cognitive and Neural Sciences
Command, Control, and Communications	Biology and Medicine
Computers	Terrestrial Sciences
Conventional Weapons	Atmospheric and Space Science
Electron Devices	Ocean Science
Electronic Warfare	Chemistry
Environmental Quality and Civil Engineering	Physics
Human-System Interfaces	Electronics
Manpower and Personnel	Materials
Materials and Structures	Mechanics
Medical	Environmental Science
Sensors	Manufacturing Science
Surface/Undersurface Vehicles	
Software	
Training Systems	

NAVY SMALL BUSINESS INNOVATION RESEARCH PROGRAM

Submitting Proposals on Navy Topics

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

Topic Nos. N94-124 through N94-166

Administrative SBIR Contact

Mail/Handcarry Address:
Office of Naval Research
Attn: ONR 36D Room 604
SBIR Program, Topic No. N94-____
800 N. Quincy Street, BCT #1
Arlington, VA 22217-5660

Mr. Douglas Harry
(703) 696 4287

Topic Nos. N94-167 through N94-171

Mail Address:
Commander
Marine Corps Systems Command
Attn: Code AW, SBIR Program, Topic No. N94-_____
Quantico, VA 22134-5010

Mr. Joseph Johnson
(703) 640-4801

Handcarry Address:
Commander
Marine Corps Systems Command
Attn: Code AW, SBIR Program, Topic No. N94-_____
Building #3097, 2nd Deck
Quantico, VA 22134-5010

Topic Nos. N94-172 through N94-176

Mail/Handcarry Address:
Commander
Naval Air Systems Command
Attn: Code AIR-05TE2, SBIR Program, Topic No. N94-_____
1421 Jefferson Davis Highway
Jefferson Plaza #1, Room 444
Arlington, VA 22243-5003

Ms. Cathy Nodgaard
(703) 692-7393

Topic Nos. N94-177 through N94-185

Administrative
SBIR Contact

Mail Address:
Commanding Officer
Naval Air Warfare Center
Aircraft Division Warminster
Attn: Code 01B, SBIR Program, Topic No. N94-_____
P.O. Box 5152
Warminster, PA 18974-0591

Ms. Carol Van Wyk
(215) 441-2375

Handcarry Address:
Commanding Officer
Naval Air Warfare Center
Aircraft Division Warminster
Attn: Code 01B, SBIR Program, Topic No. N94-_____
Street Road/Jacksonville Road
Warminster, PA 18974-0591

Topic No. N94-186 and N94-187

Mail Address:
Commanding Officer
Naval Air Warfare Center
Aircraft Division Lakehurst
Attn: Code 02T (POD), SBIR Program, Topic No. N92-_____
Lakehurst, NJ 08733-5000

Mr. Pete O'Donnel
(908) 323-7566

Handcarry Address:
Commanding Officer
Naval Air Warfare Center
Aircraft Division Lakehurst
Attn: Code 02T (POD), SBIR Program, Topic No. N92-_____
Bldg. #342
Lakehurst, NJ 07833-5000

Topic No. N94-188

Mailing Address:
Commander
Naval Air Warfare Center Aircraft Division
Flight Test and Engineering Group
Attn: Code CT24, SBIR Program, Topic No. N94-192
Patuxent River, MD 20670-5304

Mr. Curt Snyder
(301) 826-1144

Handcarry Address:
Commander
Naval Air Warfare Center Aircraft Division
Flight Test and Engineering Group
Attn: Code CT24, SBIR Program, Topic No. N94-192
Building #304/3169
Patuxent River, MD 20670-5304

Topic Nos. N94-189 through N94-192

Administrative
SBIR Contract

Mailing/Handcarry Address:
Commander
Naval Air Warfare Center
Weapons Division
Attn: Code P3402, SBIR Program, Topic N94-_____
512 9th Street, Building 50, Room 1076
Point Mugu, CA 93042-5001

Mr. Eugene Patno
(805) 989-9209

Topic Nos. N94-193 through N94-195

Mail/Handcarry Address:
Commanding Officer
Naval Training Systems Center
Attn: Code PDR2, SBIR Program, Topic No. N94-_____
12350 Research Parkway
Orlando, FL 32826-3224

Ms. Janet Weisenford Healy
(407) 380-8276

Topic Nos. N94-196 through N94-207

Mail/Handcarry Address:
Commander
Naval Sea Systems Command
Attn: Code 03R5E, SBIR Program, Topic No. N94-_____
Crystal Plaza #5, Room 924
2211 Jefferson Davis Highway
Arlington, VA 22242-5160

Mr. William Degentesh
(703) 602-3005

Topic Nos. N94-208 through N94-214

Mail Address:
Commander
Naval Surface Warfare Center
Carderock Division
Attn: Code 0112, SBIR Program, Topic No. N94-_____
Bethesda, MD 20084-5000

Mr. Frank Halsall
(301) 227-1094

Handcarry Address:
Commander
Naval Surface Warfare Center
Carderock Division
Attn: Code 0112, SBIR Program, Topic No. N94-_____
Building #1, Room 216M
Bethesda, MD 20084-5000

Topic Nos. N94-215 through N94-217

Administrative
SBIR Contact

Mail Address:
Commander
Naval Surface Warfare Center
Dahlgren Division
Attn: Code D-45, SBIR Program, Topic No. N94-_____
Silver Spring, MD 20903-5000

Mr. Donald Wilson
(301) 394 -1279

Handcarry Address:
Commander
Naval Surface Warfare Center
White Oak Detachment
Attn: Code D-45, SBIR Program, Topic No. N94-_____
Building #1, Reception Room
Silver Spring, MD 20903-5000

Topic No. N94-218

Mail Address:
Commander
Naval Surface Warfare Center
Dahlgren Division/Costal Systems Station
Attn: Code L03B, SBIR Program, Topic No. N94-222
Panama City, FL 32407-5001

Mr. Ed Linsenmeyer
(805) 234-4161

Handcarry Address:
Commander
Naval Surface Warfare Center
Dahlgren Division/Costal Systems Station
Attn: Code L03B, SBIR Program, Topic No. N94-222
Building #110, Room 2C2
Panama City, FL 32407-5001

Topic No. N94-219

Mail Address:
Commander
Naval Undersea Warfare Center
Detachment New London
Attn: Code 102L, SBIR Program, Topic No. N94-223
New London, CT 06320-5594

Mr. Jack Griffin
(203) 440-4116

Handcarry Address:
Commander
Naval Undersea Warfare Center
Detachment New London
Attn: Code 102L, SBIR Program, Topic No. N94-223
Building #80
New London, CT 06320-5594

Topic Nos. N94-220 through N94-230

Administrative SBIR Contact

Mail/Handcarry Address:
Commander
Space and Naval Warfare Systems Command
Attn: Code SPAWAR OOK, SBIR Program, Topic No. N94-_____
Crystal Park #5, Room 110
2451 Crystal Drive
Arlington, VA 22245-5200

Ms. Betty Geesey
(703) 602-6092

Topic Nos. N94-231 through N94-233

Mail/Handcarry Address:
Commanding Officer
Naval Command, Control and Ocean
Surveillance Center (RDT&E) Division
Attn: Code 0144, SBIR Program, Topic No. N94-_____
53560 Hull Street
San Diego, CA 92152-5001

Dr. Richard November
(619) 553-2104

Topic Nos. N94-234 through N94-237

Mail Address:
Commanding Officer
Navy Personnel Research and Development Center
Attn: Code 13, SBIR Program, Topic No. N94-_____
San Diego, CA 92152-7250

Dr. Meryl S. Baker
(619) 553-7681

Handcarry Address:
Commanding Officer
Navy Personnel Research and Development Center
Attn: Code 13, SBIR Program, Topic No. N94-_____
53335 Ryne Road
San Diego, CA 92152-7250

Topic Nos. N94-238 through N94-242

Mail Address:
Commanding Officer
Naval Medical Research and Development Command
Attn: Code NMRDC-42, SBIR Program, Topic No. N94-_____
Bethesda, MD 20889-5606

CDR Jim Beddard
(301) 295-0885

Handcarry Address:
Commanding Officer
Naval Medical Research and Development Command
Attn: Code NMRDC-42, SBIR Program, Topic No. N94-_____
8901 Wisconsin Avenue
Building #1, 11th Floor
Bethesda, MD 20889-5606

Topic Nos. N94-243 through N94-245

Administrative SBIR Contact

Mail/Handcarry Address:
Commanding Officer
Naval Facilities Engineering Services Center
Attn: Code L03B, SBIR Program, Topic No. N94-_____
560 Laboratory Drive
Port Hueneme, CA 93043-5003

Mr. Nick Olah
(805) 982-1089

Topic Nos. N94-246 through N94-249

Mailing Address:
Commanding Officer
Naval Research Laboratory
Attn: Code 3204, SBIR Program, Topic No. N94-_____
Washington, DC 20375-5326

Ms. Patricia Schaefer
(202) 767-6263

Handcarry Address:
Commanding Officer
Naval Research Laboratory
Attn: Code 3204, SBIR Program, Topic No. N94-_____
4555 Overlook Avenue, SW
Building, 222, Room 115
Washington, DC 20375-5326

SUBJECT/WORD INDEX TO THE NAVY SBIR SOLICITATION

DEPARTMENT OF THE NAVY FY94.2 TOPICS

OFFICE OF NAVAL RESEARCH

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N94-125 Giant Magnetoresistance Sensors

N94-126 SQUID Detection Systems

N94-127 Robust Cold Cathodes for Displays and Millimeter Wave

N94-128 Super-High-Density Non-Volatile Memory

N94-129 4-Dimensional Oceanographic Instrumentation

N94-130 Platforms for 4-Dimensional Environmental Sensing

N94-131 Coastal Ocean Observing Systems

N94-132 Compact Remote Sensing Systems for Coastal Environments

N94-133 Miniaturized Chemical Oceanographic Instrumentation

N94-134 Remote Probing of Marine Atmospheric Storms for Assimilation

N94-135 Nonlinear Optical Materials for Hybrid Semiconductor Optoelectronic Integrated Circuits

N94-136 Electrochromic Displays

N94-137 Novel Methods for Synthesis of Nanoscale Powders

N94-138 New Generation of Atomic Clocks

N94-139 Stochastic Resonance Detectors

N94-140 High-Frequency Microwave Processing of Ceramics

N94-141 Turnkey System for fMRI Studies of Human Cognition

N94-142 Active Sonar Target Imaging and Classification System

N94-143 Prognostic Techniques for Mechanical Failure Prediction

N94-144 Non-fouling Materials for Submerged Optical Sensors

N94-145 Inexpensive Phase Fluorometer for Lifetime-based Fiber-Optic Biosensing

N94-146 Bioemulsifiers and Enzymes for *in situ* Sludge Removal from Oil/water Separators

N94-147 Tactical Exploitation of National Capabilities through Science and Technological Advances

N94-148 Interoperability of Commercial Small Low Earth Orbit (LEO) Satellite System with the Navy Fleet Satellite (FLTSAT) Terminal

N94-149 UHF 25 Khz Voice Channel Expander

N94-150 Optoelectronic Signal/Image Processing for C3I Applications

N94-151 Modeling of Composite Explosive Detonations

N94-152 Surf Zone Mine Neutralization/Clearance

N94-153 Stabilizing Materials for Beachhead Mine Immobilization

N94-154 Unmanned Undersea Vehicle Sensors for Mine Survey and Wave Conditions

N94-155 Zinc-Selinide (ZnSe) Substrates for Blue Lasers

N94-156 Molecular Electronics Device Support

N94-157 Bistatic Passive Ranging

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N94-159 Piezoelectric Composite Transducers

N94-160 Overcoming Environmental Limitations on Active Sonar Detection Performance

N94-161 Artificial Intelligence, Data Fusion and Mine Recognition System

N94-162 Ship Construction Process Modeling

N94-163 Regenerated Diesel Engine for Low Emissions and High Power Density

N94-164 Low-Cost Stealth Surface Craft for Minehunting Applications

N94-165 Iconic, Graphic, Data Flow Programming for High-Performance Real-Time Workstations

N94-166 Protection of Naval Computers from Denial-of-Service Attacks

MARINE CORPS SYSTEMS COMMAND

N94-167 Long-Term Corrosion Prevention for Marine Corps Equipment

N94-168 New Methods to Desalinate Seawater

N94-169 Point Recognition Terrain Marking Technology

N94-170 Co-Site-Interference Mitigation Effort for Amphibious and Land Combat Vehicles

N94-171 High-Accuracy Azimuth Sensor

NAVAL AIR SYSTEMS COMMAND

N94-172 Low-Cost, Lightweight Night Vision Capability for Hand Launched Unmanned Aerial Vehicle (UAV) System

N94-173 Heat Blankets for Composite Bonded Repair

N94-174 LCD Off-Axis Light Leakage

N94-175 Unmanned Aerial Vehicles (UAV) Meteorological Sensors

N94-176 Integration of Flat-plate X-band and Wideband Antennas for Surveillance/Identification

NAVAL AIR WARFARE CENTER/AIRCRAFT DIVISION/WARMINSTER

N94-177 Compact, Low-cost, Micropowered Fiber Optic Bypass Switch

N94-178 Air-Deployable Expendable Multi-Parameter Environmental Probe

N94-179 Ultra Lightweight Ejection Seat

N94-180 Laser Radar for Instantaneous Aircraft Flight Control Correction During Carrier Landings

N94-181 Assessment Model for Environmental Requirements Compliance

N94-182 Aircraft Canopy Trajectory Simulation Model

N94-183 Spoken-Language Interface to a Mission Planning System

N94-184 Electrochemical Stripping of Aircraft Coatings

N94-185 Simulation Environment for the Rapid Prototyping of Advanced Avionics

NAVAL AIR WARFARE CENTER/AIRCRAFT DIVISION/LAKEHURST

N94-186 Visor-Mounted Display for Landing Signal Officer (LSO)

N94-187 Automated Accurate Aircraft Weighing System (A^3WS)

NAVAL AIR WARFARE CENTER/AIRCRAFT DIVISION/PATUXENT RIVER

N94-188 Volumetric Airwake Measuring Equipment

NAVAL AIR WARFARE CENTER/WEAPONS DIVISION

N94-189 High-Visibility Signal Cartridge for Practice Bombs

N94-190 Adaptive Wavelets

N94-191 Integrated Image Processing Focal Plane Array

N94-192 Low-Profile Broadband Radiating Elements

NAVAL AIR WARFARE CENTER/TRAINING SYSTEMS DIVISION

N94-193 Constructivist Learning Approaches to Training Decision-Intensive Tasks

N94-194 Electroluminescent Displays for Helmet Mounted Displays

N94-195 Tools for Creating Real-Time, 3-D Computer Graphic Environments

NAVAL SEA SYSTEMS COMMAND

N94-196 Permanent Magnet Variable Speed Drives

N94-197 Membrane System for Graywater/Oily Waste Water Treatment

N94-198 Internal Fault Detection/Classification System for Permanent Magnet Machines

N94-199 Affordable Disconnect Device for Large HP Permanent Magnet Motors

N94-200 Image and Data Management System

N94-201 Advanced Lightweight Influence Sweep

N94-202 Surf Zone and Craft Landing Zone Obstacle Clearance

N94-203 Submarine Combat System C4I Interoperability

N94-204 Infrared Window Material Improvement

N94-205 Growth of Ce:LiCAF/LiSAF for Tunable Laser Operation in the Ultraviolet

N94-206 Fiber-Optic Environmental Sensor for ASW/ASUW Applications

N94-207 Propulsion Capability for 3-Inch Submarine Countermeasures

NAVAL SURFACE WARFARE CENTER/CARDEROCK DIVISION

N94-208 Shipboard Sensors for Fuel and Oil

N94-209 Infrared Coating

N94-210 Dynamic Simulation of High Power Machinery Systems

N94-211 Recycling Ships' Plastic Waste

N94-212 Low-Energy Non-Invasive Methods for Membrane Cleaning

N94-213 Radiation Curing of Pigmented Coatings

N94-214High-Current Switchgear

NAVAL SURFACE WARFARE CENTER/DAHLGREN DIVISION/WHITE OAK DETACHMENT

N94-215Compact Integrated Electro-Optic Information Storage and Retrieval System

N94-216 Radar Tracking Improvement in Multipath and Deception Environments

N94-217 Structured Essential Model for Mine Warfare

NAVAL SURFACE WARFARE CENTER/DAHLGREN DIVISION/COASTAL SYSTEMS STATION

N94-218 Quiet, Non-Magnetic Propulsion System for Small Expendable ROVs

NAVAL UNDERSEA WARFARE CENTER/NEWPORT DIVISION

N94-219 Integrated Digital Electronic Warfare (ESM) - Communications Receiver Technology

SPACE AND NAVAL WARFARE SYSTEMS COMMAND

N94-220 Standard Database User Interface

N94-221 Controllable Take-Off Angle High Frequency Antennas

N94-222Automated Detection and Identification of Materials in Hyperspectral Images

N94-223 Demand Assigned Multiple Access (DAMA) Network Manager

N94-224GPS Anti-Jam Antenna

N94-225 Shallow Water Surveillance Data Fusion

N94-226 Neural Net Temporal Pattern Signal Recognition and Classification

N94-227 Improved VHF Antenna System

N94-228Navigation Systems for Drifting Buoys, Autonomous Vehicles and Underwater Platforms

N94-229 Increased Antenna Bandwidth at High Frequency HF and Ultra High Frequency UHF Applications

N94-230Distributed Feedback Laser for Fiber Optic Multiplexing

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

N94-231 A Technique to Integrate Independently Developed Decision Aid Models

N94-232 Microelectronic Packaging Using Diamond Film Heat Spreaders

N94-233 Encyclopedic Browsing

NAVY PERSONNEL RESEARCH AND DEVELOPMENT CENTER

N94-234 Measuring the Effect of Drawdown Programs on Personnel Retention

N94-235 Configuring the Total Navy Workforce under Alternative Strategic Scenarios

N94-236 Models of Test Compromise

N94-237 A System for Designing Random Access Instruction for Navy Courses

NAVAL MEDICAL RESEARCH & DEVELOPMENT COMMAND

N94-238 Tactile Transducer Design/Development

N94-239 Radiolucent Shrapnel Locator

N94-240 Combat Swimmer Underwater Decompression Computer for Air and Nitrogen Oxygen Diving

N94-241 Enhancement of Protective Immunity against Malaria by Targeting DNA Immunization

N94-242 Virtual Environment Training for Trauma Management

NAVAL FACILITIES ENGINEERING SERVICES CENTER

N94-243 Monitoring Contaminant Releases in High Permeability Materials

N94-244 Integrated Geotechnical-Geophysical Assessment Device For Offshore and Nearshore Sites

N94-245 Standard Reference Coating for Accelerated Testing or Weathering of Paints and Coatings

NAVAL RESEARCH LABORATORY

N94-246 Micro-Turbojet Engine

N94-247 Image Data Mapping, Compression, Archive and Display Software

N94-248 Improved Sources for MBE (Molecular Beam Epitaxial) Growth of Nitrogen-Based Materials

N94-249 Simulation of Fire in a Virtual Environment

DEPARTMENT OF THE NAVY TOPIC DESCRIPTIONS

OFFICE OF NAVAL RESEARCH

N94-124 TITLE:Automatic Target Recognition

CATEGORY: Basic Research

SERVICE CRITICAL TECHNOLOGY AREA: Mathematics/Sensors

OBJECTIVE: To develop new mathematical techniques for the representation of objects subject to random variation in form with respect to a prototype, and to employ these techniques in optimal target recognition problems.

DESCRIPTION: Mathematical models of objects subject to random variation in form with respect to a prototype can be used to build in prior real world knowledge specific to the object recognition application at hand, and thus improve the performance of target recognition systems of Navy interest. In recent years the theories of stochastically deformable templates and stochastic mathematical morphology have shown great promise for the representation of objects of randomly variable shape and form. The goal is to further develop the theory of stochastic object representation and to exploit these models in enhanced target recognition algorithms. Typical applications of Navy interest include radar, side scan sonar, infrared, LIDAR, and a variety of target types including minefield imagery, ships, aircraft, among others. Dual use applications include automatic recognition of handwritten characters and medical image analysis.

PHASE I: Demonstrate the utility of stochastic geometric approaches to object recognition in automatic target recognition applications.

PHASE II: Apply the techniques developed in Phase I and create prototype software to the point of feasibility demonstration and test on real image data sets.

PHASE III: Commercialize improved software systems for automatic target recognition, optical character reader, and medical imaging applications.

COMMERCIAL POTENTIAL: For optical character recognition, medical imaging, and industrial part tracking applications.

N94-125 TITLE:Giant Magnetoresistance Sensors

CATEGORY: Exploratory Development

SERVICE CRITICAL TECHNOLOGY AREA: Electronics/Sensors

OBJECTIVE: Develop new sensor devices based on the novel giant magnetoresistance properties of multilayered magnetic metal films for use in motion detection and for sensitive detection of magnetic fields.

DESCRIPTION: New multilayered magnetic metal films exhibit a giant magnetoresistance effect which can be exploited in a variety of new applications which require sensitivity to magnetic fields. High sensitivity means smaller devices, and the materials provide increased sensitivity with rugged structure, insensitivity to temperature and can be developed with a simple materials technology. Military applications include mine detection, metal detection and navigation. Other interests include sensors for linear and angular motion detection with increased dynamic range and linearity.

PHASE I: Develop models for sensor operation and fabrication, including operating parameters and estimated performance.

PHASE II: Develop prototype sensors and appropriate technology in collaboration with commercial or government laboratories in anticipation of transfer to a production facility.

PHASE III: Transfer materials and modeling technology to commercial production facilities.

COMMERCIAL POTENTIAL: Small, rugged, high performance sensors will be used in a variety of motion detection systems requiring cheap and versatile devices which are compatible with electronic signal processing. High sensitivity magnetic field sensing will also find many applications including magnetic data storage and readout systems.

N94-126 TITLE:SQUID Detection Systems

CATEGORY: Exploratory Development

SERVICE CRITICAL TECHNOLOGY AREA: Materials

OBJECTIVE: To design, build, and evaluate Superconducting Quantum Interference Device (SQUID) detection systems employing high temperature (HTS) materials and analog or digital circuitry for use in corrosion detection and/or Non-Destructive Evaluation (NDE). The systems should be field deployable.

DESCRIPTION: The development of HTS SQUIDs and associated electronics has progressed so that a field operable system can be designed, built, and evaluated for potential use in the Navy to detect hidden corrosion or other types of material flaws. The system should consist of a sensor or sensor array designed for rapid data acquisition. The system could be passive or employ a current or a magnetic field source for active detection. A cost effective, field deployable concept should be the ultimate goal of the system.

Phase I: Design an HTS SQUID system, of sensor(s) and compatible electronic circuitry. Calculate anticipated system sensitivity and describe mode of operation for detection of corrosion or material flaws.

Phase II: Construct an HTS SQUID system and perform laboratory evaluation of performance including sensitivity, noise, and response or slew rate. The system will be delivered to the Navy for operational testing and evaluation.

Phase III: Multiple systems will be built for testing and demonstration.

COMMERCIAL POTENTIAL: Wide use in aircraft industries, manufacturing industries, transportation industries, etc.

N94-127 TITLE:Robust Cold Cathodes for Displays and Millimeter Wave Amplifiers

CATEGORY: Exploratory Development

SERVICE CRITICAL TECHNOLOGY AREA: Electronic Warfare

OBJECTIVE: Develop robust cathodes that (1) are not subject to the built-in wear-out mechanism that amperes x hours is a constant and (2) that are not easily poisoned by poor vacuum conditions.

DESCRIPTION: New semiconducting materials exhibiting bandgaps greater than 5.4 eV generally (1) exhibit Negative Electron Affinity (NEA) and (2) possess chemical surface bonds of sufficient strength to impede chemisorption of impurities (and thus poisoning). Superlattice-emitted electrons with energy spreads of less than 0.05 Ev will significantly reduce noise in microwave/millimeter wave vacuum tubes and enable electron microscopy improvements. Emphasis shall be placed on (1) enhancing the reproducibility and uniformity of cold cathodes (CC), (2) demonstrating their robust nature, and (3) demonstrating significant improvement in reducing energy spread to below 0.05 Ev.

PHASE I: Demonstrate cold cathode efficacy of selected material.

PHASE II: Demonstrate and optimize the resistance of the CC to poisoning, determine its operating life as a function of emitted current density, and demonstrate energy spread reduction.

PHASE III: Demonstrate the use of a cold cathode in a millimeter wave traveling wave tube (TWT) amplifier or as a ballasted 2-D array of emitters for a large area (e.g., >14" diagonal) flat panel display.

COMMERCIAL POTENTIAL: This concept provides the potential for a U.S.-dominated $10B/year flat panel color display market.

N94-128 TITLE:Super-High-Density Non-Volatile Memory

CATEGORY: Exploratory Development

SERVICE CRITICAL TECHNOLOGY AREA: Electron Devices

OBJECTIVE: Develop a totally new approach to super high density, non-volatile, rapid and random access digital memory.

DESCRIPTION: New means of rapidly depositing/repositioning atomic particles in extremely dense configurations coupled with quantum well/optical readout technology engenders a new digital memory concept for a terabit memory that is not vulnerable to power outage, replaces both RAM and mechanical storage, and is low power. This non-volatile aspect plus the low power aspect are both expected to impact avionics and shipboard systems currently subject to frequent power outages. Emphasis is placed on (1) demonstrating concept validity, (2) demonstrating absence of wear-out mechanisms, and (3) demonstrating super high density.

PHASE I: Demonstrate 64 bit non-volatile memory

PHASE II: Demonstrate 64 kbit memory; demonstrate resistance to G forces; demonstrate random access.

PHASE III: Design terabit memory; demonstrate 4 Mbit memory; demonstrate rapid (e.g., 10 nanosecond) access for both read and write.

COMMERCIAL POTENTIAL: $10B/yr commercial DRAM and hard drive original equipment and replacement market. Eliminate hard drives from portable computers.

N94-129 TITLE:4-D Oceanographic Instrumentation

CATEGORY: Basic Research

SERVICE CRITICAL TECHNOLOGY AREA: Ocean Sciences

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

DESCRIPTION: Innovative sensors and measurement techniques are solicited to obtain marine atmospheric and oceanographic variables (eg acoustical, optical, physical, biological, chemical, and geophysical) in 3-D space and time. The emphasis is on (1) novel approaches and concepts for measuring multiple parameters coherently in 4-D; (2) new methods of measuring turbulent fluxes, acoustic wavefields, or fluid motion of multi-phase mixtures (e.g. water/bubbles/sediments/biologics). Instruments can be individual towed/tethered sensors, elements in arrays, or suites of instruments on unmanned vehicles/platforms to cite a few examples. Lost cost, reliable and possibly expendable sensors/components are particularly desirable. Full depth capability is desired in instrumentation planned for subsurface use. Particular capabilities are sought for bubble and spray population measurements, dynamic void fractions in water, small scale turbulent fluxes of heat mass & momentum, and near bottom sediment fluxes.

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

PHASE II: The Phase II effort would develop hardware and demonstrate feasibility via laboratory and/or field testing (as coordinated with ongoing ONR efforts).

PHASE III: Phase III would transition the instruments to ocean science researchers, ocean monitoring systems and operational DOD systems.

COMMERCIAL POTENTIAL: New instruments can be used in commercial ocean monitoring systems.

N94-130 TITLE:Platforms for 4-Dimensional Environmental Sensing

CATEGORY: Basic Research

SERVICE CRITICAL TECHNOLOGY AREA: Sensor

OBJECTIVE: To develop/adapt airborne/underwater remote vehicles to sensors for measuring 4-dimensional environmental parameters.

DESCRIPTION: Unmanned underwater vehicles (UUVs) and aerial vehicles (UAVs) have been developed and used for numerous applications. The difficulty and affordability of 4-dimensional environmental sensing strongly suggests application of low cost remotely controlled or autonomous vehicles and platforms for environmental parameter measurements. A vehicle/sensor system integration analysis is desired to identify the compatible measurements that are possible from such platforms, the state of the art instrumentation which is required, the payload requirements versus mission, the power requirements and endurance, together with a functional description of the vehicle/platform and its control system. Particularly desired are designs which would allow undisturbed high resolution sampling of the sea floor topography, autonomous vertical profilers and surface vehicles which may be small enough to be nearly unobservable when in use.

PHASE I: The Phase I effort should provide descriptions of the sensor/platform system and its measurement capabilities together with analysis indicating why a remotely controlled platform is scientifically/fiscally superior to the present methods of making such measurements.

PHASE II: The Phase II effort would develop hardware and demonstrate feasibility via laboratory and/or field testing (as coordinated with ongoing ONR efforts).

PHASE III: Phase III would transition the instruments to ocean science researchers, ocean monitoring systems and operational DOD systems.

COMMERCIAL POTENTIAL: Low cost unmanned vehicles have many commercial monitoring applications.

N94-131 TITLE:Coastal Ocean Observing Systems

CATEGORY: Basic Research

SERVICE CRITICAL TECHNOLOGY AREA: Ocean Sciences

OBJECTIVE: Development of innovative observing systems to measure oceanographic and meteorological parameters in and above the coastal ocean.

DESCRIPTION: Innovative instruments and measurement techniques are solicited to obtain oceanographic and atmospheric (acoustical, optical, physical, biological, chemical and geophysical) variables in three dimensional space and time in the coastal environment via in-situ or remote sensors. The coastal ocean is defined as the region above the continental shelf extending from the surf zone to the upper continental slope (typically from the swash line to a few 100 m depth). Important differences between the coastal and open ocean include: short spatial and temporal scales of dominant phenomena, proximity of the surface and bottom, proximity of land, poor water clarity, high biological activity, high acoustical background noise, intense fishing, etc. Many of these differences offer potential for innovative observational techniques, or for creative adaptation of existing techniques. Examples include, but are not limited to, bottom-mounted instrument systems, land or air-based remote sensing, shore-launched autonomous vehicles, and sensors for moorings or drifters. Systems with low-cost, high reliability, high efficiency, small size, and low-power consumption and/or expendable sensors and components are highly desirable. Telemetry in real time should be considered where appropriate and fusion of in-situ and remotely observed data is also desirable.

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

PHASE II: Phase II would develop hardware and operationally demonstrate the system via lab or field testing.

PHASE III: Phase III would transition the prototype systems to commercial production for use in ocean science research, coastal monitoring systems, and commercial applications.

COMMERCIAL POTENTIAL: Such instrumentation would have great private sector significance.

N94-132 TITLE:Compact Remote Sensing Systems for Coastal Environments

CATEGORY: Basic Research

SERVICE CRITICAL TECHNOLOGY AREA: Ocean Sciences

OBJECTIVE: To develop compact sensors that can be deployed on small, remotely-piloted aircraft for measuring the electromagnetic properties (optical, microwave, infrared and thermal) of coastal environments.

DESCRIPTION: Innovative plans are solicited to develop scanners/detectors to remotely sense the electromagnetic properties (e.g. optical, microwave, near infrared, and/or thermal) of coastal and estuarine environments (water, the low-level atmosphere and coastal land). Emphasis should be placed on small, portable, multi-sensor packages that may be deployed on Remotely Piloted Aircraft. Low-cost, reliable systems are particularly desirable that are capable of storing data internally (downloadable to PCs after retrieval) and/or transmitting data to a ground station, including platform location (altitude, latitude/longitude and time). Either exploitation/adaptation of existing technologies or new developments particularly suited to the coastal regime are encouraged.

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

PHASE II: Phase II would develop hardware and operationally demonstrate the equipment via lab or field testing.

PHASE III: Phase III would transition the prototype instruments to commercial production for use in ocean science research, coastal monitoring systems, and commercial applications.

COMMERCIAL POTENTIAL: Private sector applications include climate forecasting and long-range prediction models for coastal industries.

N94-133 TITLE:Miniaturized Chemical Oceanographic Instrumentation

CATEGORY: Basic Research

SERVICE CRITICAL TECHNOLOGY AREA: Ocean Sciences

OBJECTIVE: Develop miniaturized chemical oceanographic instrumentation for deployment from towed arrays, moorings, aircraft and small autonomous vehicles.

DESCRIPTION: Innovative miniaturized chemical oceanographic instruments that take advantage of recent developments in chemical and biological technology and in micro-machining are needed to permit cost-effective collection of environmental chemistry data on appropriate time and space scales. The instruments should be capable of determining fine-scale chemical gradients in the ocean or marine atmosphere and be capable of telemetering the data. The emphasis is on (1) novel approaches and concepts for measuring multiple chemical variables; (2) Small, low-power instruments that can be towed, tethered, or incorporated into the sensor suite of small autonomous underwater vehicles or aircraft and (3) Low cost, reliable and/or expendable devices. Full depth capability is desired in instrumentation planned for subsurface use.

PHASE I: Design instrument and perform proof of concept testing.

PHASE II: Develop, test and operationally demonstrate the analytical system in the laboratory and in the field.

PHASE III: Initiate production of hardware for both commercial and military monitoring of chemical oceanographic parameters.

COMMERCIAL POTENTIAL: Applications include environmental monitoring and monitoring chemical and biochemical production facilities.

N94-134 TITLE:Remote Probing of Marine Atmospheric Storms for Assimilation

CATEGORY: Basic Research

SERVICE CRITICAL TECHNOLOGY AREA: Ocean Sciences

OBJECTIVE: Define/develop innovative remote sensing techniques which can obtain details on the structure and dynamics of storms that can be assimilated into numerical models to improve forecasts in real-time.

DESCRIPTION: The structure and dynamics of severe marine storms and their interaction with their mesoscale and synoptic environment determines their evolution, propagation, and decay. An opportunity exists for defining new, innovative remote sensing techniques which can obtain details on the structure and dynamics of storms at sea together with their surrounding environment. The parameters to be obtained remotely are likely to be combined with numerical models, so that the combined model derived data bases combined with satellite inverted remote sensing signatures will greatly advance our scientific understanding and lead to dramatically improved operational predictions. Issues to be addressed are likely to include: innovative use of existing satellite sensors either in operational use or under development; data assimilation of satellite imagery into existing numerical atmospheric models; and/or the development of new innovative remote sensing techniques which capture processes and/or parameters currently unobtainable with existing sensors and systems.

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

PHASE II: The phase II effort would include a more detailed proof of concept and perhaps include an operational test.

PHASE III: Phase III would transition the prototype instruments to commercial production for use in ocean science research, atmospheric monitoring/prediction systems, and commercial applications such as atmospheric monitoring.

COMMERCIAL POTENTIAL: Private sector applications include climate forecasting and long-range prediction models for coastal industries.

N94-135 TITLE:Nonlinear Optical Materials for Hybrid Semiconductor Optoelectronic Integrated Circuits

CATEGORY: Basic Research

SERVICE CRITICAL TECHNOLOGY AREA: Electron Devices

OBJECTIVE: Prepare organic 2nd order nonlinear optical (NLO) materials for incorporation into silicon/organic integrated optical modulators.

DESCRIPTION: Small scale applications such as optimal devices incorporating optical fiber interconnection technology for applications such as chip-to-chip interconnections would combine organic NLO materials and silicon or gallium arsenide semiconductors into hybrid integrated optical circuits (HIOC). An attractive approach for

manufacturing HIOCs (utilizing materials compatible with current IC manufacturing) is large-hyperpolarizability chromophores in or bound to high temperature polymer matrixes (with poling). The critical process that limits HIOC device performance is the lifetime of the chromophore/polymer during chip bonding and the long term thermal stability of the poling process. If the NLO material were intrinsically thermodynamically stable, long term HIOC device performance would also be enhanced. An NLO material that can be fabricated into an HIOC with lifetime/performance characteristics superior to existing devices is desired.

PHASE I: Demonstrate materials characteristics superior to existing NLO polymers. The NLO material should be easily fabricated into waveguides and have a high electro-optic coefficient (r>20pm/V), resulting in a large electro-optic figure of merit. Intrinsic optical losses of the bulk NLO material should not exceed 1 db/cm. Scheme(s) for fabricating silicon integrated optoelectronic circuits with the new NLO materials are required.

PHASE II: Demonstrate waveguide device incorporating fast (> 500MHz) electro-optic effect. Design of new HIOC. PHASE III: Integration of NLO polymer(s) into first generation HIOC.

COMMERCIAL POTENTIAL: Communication technology including cable TV and telecommunication networks.

N94-136 TITLE:Electrochromic Displays

CATEGORY: Basic Research

SERVICE CRITICAL TECHNOLOGY AREA: Chemistry

OBJECTIVE: Develop high readability, low cost displays for dual use applications in Naval and commercial instrumentation.

DESCRIPTION: Electrochromic information displays, like liquid crystals, are non-emissive. Unlike liquid crystals, their readability does not require polarizers and is generally independent of viewing angle. These properties make them highly legible in varying light conditions as might be found in a cockpit, for example. Electrochromic displays can also be made to exhibit open circuit memory of a display image. Evidence suggests that they can be scaled in size more cost-effectively than liquid crystals, making them suitable for large area displays. Night vision goggles are another potential application, as electrochromic displays may also be made legible selectively in the infrared. Innovations in electrochromic materials and devices are required, however, to develop displays which are multicolor and matrix addressable without sacrificing the benefits of image retention and structural simplicity. In addition, electrochromic materials with improved coloration efficiencies are required to enhance update rates and decrease power consumption. All electrochromic materials and structures, however, must begin with demonstrations of reversibility of the Faradaic reactions on which they are based.

PHASE I: Develop an electrochromic display which shows the feasibility of multicolor or matrix addressable operation.

PHASE II: Demonstrate a 100cm^2 alphanumeric electrochromic display exhibiting at least two colors, matrix addressability of less than 1mm^2/pixel, and reversibility of greater than 10^6 update cycles. The device will require less than 10^{-3} coulombs/cm^2 and less than one second to update, and exhibit long-term image retention in the unpowered state. Projected cost of manufacture will be less than liquid crystal displays of similar size.

PHASE III: Demonstrate a technology to be employed in specific Naval instrumentation.

COMMERCIAL POTENTIAL: Commercial applications include consumer appliances and signs.

N94-137 TITLE:Novel Methods for Synthesis of Nanoscale Powders

CATEGORY: Basic Research

SERVICE CRITICAL TECHNOLOGY AREA: Materials

OBJECTIVE: Develop novel, cost effective techniques for synthesizing nanoscale powders.

DESCRIPTION: Nanoscale powders can be synthesized by a number of techniques. When consolidated into coatings and structures,nanocrystalline materials exhibit a wide range of outstanding mechanical properties, such as enhanced wear resistance and superplasticity at relatively low temperature. The cost of these powders will be critical to efforts to exploit these materials commercially. New techniques for synthesis of nanoscale ceramic and metallic powders which can produce large quantities of material and reasonable cost will be needed.

PHASE I: Develop innovative techniques for synthesizing nanoscale powders. Characterize the resulting powders and demonstrate the feasibility of producing material with desirable properties such as purity and particle size distribution.

PHASE II: Scale up process and optimize parameters to maximize yield and control properties. Demonstrate the feasibility of large scale production and competitive cost.

PHASE III: Initiate full scale production.

COMMERCIAL POTENTIAL: New class of materials with greatly enhanced mechanical properties.

N94-138 TITLE:New Generation of Atomic Clocks

CATEGORY: Basic Research

SERVICE CRITICAL TECHNOLOGY AREA: Physics

OBJECTIVE: Develop a new generation of atomic clocks taking advantage of breakthroughs in laser cooling and trapping of atoms and ions.

DESCRIPTION: The Navy, DOD, and the commercial sector currently use atomic clocks in navigation through GPS satellites. Recent breakthroughs in laser cooling/atomic physics open the possibility of clocks that are one to three orders of magnitude more precise while at the same time being more stable, smaller and hence more portable, and cheaper. This would have major impact on navigation, guidance, and commercial sector applications.

PHASE I: Demonstrate the most likely candidate atoms and/or ions; cooling schemes; clock transitions; interrogation schemes; and laser systems to be used in the next generation atomic clock.

PHASE II: Develop, test, and operationally demonstrate a compact, robust, and stable atomic clock with precision at least an order of magnitude improved over those currently flying in GPS satellites.

PHASE III: Develop usable compact clocks for applications such as GPS satellites.

COMMERCIAL POTENTIAL: Compact atomic clocks of ultra-high precision will have direct benefit to consumer-oriented navigation product ranging from on-board maps in cars to route selecting software based on traffic density, to hand-held displays of current location (e.g., for use when backpacking or visiting an unfamiliar city).

N94-139 TITLE:Stochastic Resonance Detectors

CATEGORY: Basic Research

SERVICE CRITICAL TECHNOLOGY AREA: Physics

OBJECTIVE: Develop detectors which operate on the principal of stochastic resonance.

DESCRIPTION: The detection of signal in the presence of noise plays a key role in meeting many DOD requirements in many areas including surveillance, and strike warfare. This task is difficult when the signal is weak and the signal-to-noise ratio is less than one. Stochastic resonance is a newly discovered phenomenon where a detector is operated in a manner that the addition of sufficient noise causes transitions in the output of the detector. When the average rate of these transitions matches the frequency of a signal of interest a nonlinear locking can occur which amplifies the signal.

This mechanism has been shown to work in electronic and biological systems, even when a noise free signal is too weak to be detected directly.

PHASE I: Stochastic resonance will be demonstrated for weak signals buried in noise in a system which may detect acoustic, magnetic, electromagnetic, or another signal of interest. The effect of adding different types of noise, and adjusting the potential in the detector will be explored to find the optimum operating regime.

PHASE II: An operational stochastic resonance system will be developed and tested. Various methods of coupling stochastic resonators will be explored to increase the detector sensitivity.

PHASE III: Compact coupled stochastic resonators, perhaps in the form of an integrated circuit, will be designed, tested, and used as detectors underwater, on the sea, and in the air.

COMMERCIAL POTENTIAL: Stochastic resonance acoustics detectors can be used to detect earthquake precursor tremors. New types of hearing aids can be devised based on the principal of stochastic resonance.

N94-140 TITLE:High-Frequency Microwave Processing of Ceramics

CATEGORY: Exploratory Development

SERVICE CRITICAL TECHNOLOGY AREA: Materials and Structures

OBJECTIVE: Develop microwave-based techniques for processing of ceramics and nanopowders.

DESCRIPTION: In conventional sintering of ceramics heat is transferred into the bulk of the workpiece by conduction. This process is relatively slow and often produces internal stresses in the material due to nonuniform heating. In microwave heating, energy id deposited as the molecules vibrate in response to the electric field. Since the energy is absorbed near the grain surfaces throughout the workpiece, microwave heating of ceramics has several advantages over heating in a conventional oven. These advantages include rapid and uniform heating leading to short processing times, improved material properties and higher throughput.

PHASE I: Develop the basics of a high frequency microwave processing procedure for application to ceramics and novel materials such as nanopowders. Processes of interest include sintering, densification, coating, and jointing. Devise means of avoiding or controlling thermal runaway. Explore means to scale the microwave processing method to practical commercial levels.

PHASE II: Develop, test, and operationally demonstrate microwave processing of ceramics and nanopowders by implementing the methods formulated under the Phase I effort. Characterize the radiation source and the physical properties of the ceramic after microwave processing. Demonstrate superior properties of finished product such as higher densification or improved fracture toughness. Facilities at NRL may be made available for the Phase II portion of the program. Develop methods and techniques to commercialize the process.

PHASE III: Construct a practical, high volume, high frequency microwave ceramic processing facility.

COMMERCIAL POTENTIAL: The potential benefits of this technology will impact the capabilities of the multi-billion dollar U.S. ceramics industry. High frequency microwave facilities for processing of ceramics can be used to manufacture industrial products ranging from turbine rotors to military armor to electronics substrates.

N94-141 TITLE:Turnkey System for FMRI Studies of Human Cognition

CATEGORY: Basic Research

SERVICE CRITICAL TECHNOLOGY AREA: Cognitative and Neural Sciences

OBJECTIVE: To enable large numbers of cognitive researchers to exploit the potential of brain imaging technology to improve understanding of human information processing capacities, by reducing the technological difficulty of engaging in this research.

DESCRIPTION: Functional magnetic resonance imagery is a newly developed technique which uses the conventional MRI machines widely installed for clinical medical applications to provide pictures of brain activity while mental activities are being carried out. Because of the wide installed equipment base and non-invasive character of the technique, it has great potential. However, numerous technical details must be addressed in successfully carrying out such research, such as special adjustments of the MRI machine, stimulus displays in the presence of high magnetic fields, and coordination of image data analysis with conditions of stimulus display. A turnkey system is needed, which would incorporate facilities for efficient programming of a wide range of likely perceptual and cognitive experiments.

PHASE I: Design the turnkey FMRI system in detail, including the range of experiments to be provided for.

PHASE II: Develop a functioning prototype of the system, user instruction and documentation. Perform user testing.

PHASE III: Make the system commercially available.

COMMERCIAL POTENTIAL: Because of the exciting potential of this research and the large number of available MRI machines, this system would have a research market of respectable size. Potential applications in clinical neurosurgery, precisely locating functionally vital brain areas would provide a larger market.

N94-142 TITLE:Active Sonar Target Imaging and Classification System

CATEGORY: Basic Research

SERVICE CRITICAL TECHNOLOGY AREA: Cognitative and Neural Sciences

OBJECTIVE: Design and implement an analog VLSI system to accurately and robustly classify underwater objects in acoustic clutter and reverberation based on computational principles derived from active biosonar processing systems such as bat and dolphin.

DESCRIPTION: Active sonar-based target classification will play an important role in the Navy's future littoral warfare mission for the detection and classification of mines and other operationally relevant objects. Current active sonar systems are inadequate for anticipated shallow-water mission scenarios because they require many emissions per potential target, yield high false alarm rates, suffer high cluster interference, and have too limited a dynamic range. New models of active biosonar signal analysis, including bat-like target range profiling and the dolphin-like image construction have been demonstrated to eliminate or significantly reduce these problems. Biosonar-based signal processing systems can classify target reflections with one or a very small number of emissions, effectively identify and cancel ghosts produced by multipath scattering, and exploit narrow beam widths to reduce clutter interference and enhance dynamic range. Further work is needed to integrate these capabilities within analog VLSI technology to achieve the target imaging and classification capability required for Navy application.

PHASE I: Design a software simulation to demonstrate the feasibility of an integrated biosonar-based imaging system to achieve the advantages described above. Establish the feasibility of an analog VLSI implementation of the system.

PHASE II: Design, implement, test and evaluate a prototype system in analog VLSI based on principles and techniques incorporated into the software simulation developed during Phase I.

PHASE III: Refine and produce the prototypes developed in Phase II and make them available for commercial exploitation.

COMMERCIAL POTENTIAL: Efficient reliable VLSI technologies for underwater object imaging and classification will find application in undersea exploration, robotic guidance, radar imaging technologies for air traffic control, medical imaging and undersea resource commercialization.

N94-143 TITLE:Prognostic Techniques for Mechanical Failure Prediction

CATEGORY: Basic Research

SERVICE CRITICAL TECHNOLOGY AREA: Cognitative and Neural Sciences/Materials

OBJECTIVE: Develop prognostic techniques for predicting time to failure of machine components which integrate advanced signal processing with models of fault propagation in machine components such as bearings and gears.

DESCRIPTION: In order to implement condition-based maintenance on Navy sea and air fleets the technology for real-time diagnostics and prognostics of mission critical machinery needs to be developed. Recent advances in pattern recognition, such as neural networks operating on spectral features, have been applied to fault detection/isolation of vibration signatures of machinery with faulted components. In order to enable condition-based maintenance, such techniques need to be integrated with knowledge of the failure process to predict failure of the component and machine. We seek prognostic capability which would integrate pattern recognition of signatures of incipient or developing faults (based on sensors for vibration, acoustic, temperature, pressure, chemical composition and/or active sensors) together with models of fault propagation in machine components such as bearings, shafts, and gears.

PHASE I: Develop a hybrid architecture which combines advanced pattern recognition of fault signatures with models of fault propagation.

PHASE II: Demonstrate the capability of this system to accurately predict time to failure of machinery components, using real data.

PHASE III: Develop a design for compact hardware implementation together with sensors suitable for Navy machinery.

COMMERCIAL POTENTIAL: Potential commercial applications for mechanical failure prognostics are strong and include mechanical systems in helicopters, turbine engines, electric power generating facilities, saw mills, refrigeration equipment and manufacturing equipment.

N94-144 TITLE:Non-fouling Materials for Submerged Optical Sensors

CATEGORY: Exploratory Development

SERVICE CRITICAL TECHNOLOGY AREA: Materials

OBJECTIVE: Develop non-fouling, optically clear (visible and/or UV spectral ranges) materials that are suitable for submerged optical sensor windows with applications for long-term (months to years), unmaintained seawater deployment.

DESCRIPTION: The Navy currently exploits a wide-range of submerged optical sensors and the need to expand the use of such sensors and newly developed ones, particularly in the littoral zone, requires that new materials be developed that provide non-fouling features and allow for light transmission in either or both the ultraviolet and visible spectral ranges. These materials must maintain transmission properties and be fouling-free for deployment periods of months to years without maintenance.

PHASE I: Develop materials that possess appropriate transmission features for use as windows on submerged optical sensors in the visible and/or ultraviolet spectral ranges that do not foul under long-term field deployment.

PHASE II: Test and evaluate the long-term non-fouling capacity of materials for optical windows and define the resistance to crazing and decoloration over time of materials developed in the Phase I SBIR. The materials should be moldable and should have field life-time in excess of 1 year.

PHASE III: Produce materials suitable for a range of optical sensor applications making such materials available to the optical sensor industry with the specifications established in the Phase II effort.

COMMERCIAL POTENTIAL: New technology can be exploited in DOD, other federal and civilian sectors where optical monitoring is required in aquatic environments.

N94-145 TITLE:Inexpensive Phase Fluorometer for Lifetime-based Fiber Optic Biosensing

CATEGORY: Basic Research

SERVICE CRITICAL TECHNOLOGY AREA: Electronics

OBJECTIVE: Produce an inexpensive phase fluorometer suitable for lifetime-based sensing of chemical analytes through optical fiber.

DESCRIPTION: The Navy and DoD have an ongoing requirement for continuous monitoring of chemical analytes such as pollutants, wastewater contaminants,and process byproducts. One promising and cost-effective means for meeting these requirements is a fiber optic biosensor based on fluorescence lifetime changes of a suitable indicator phase. The heart of these sensors is a time-commercially available, they are very expensive and have more capabilities than are required for a particular sensing scenario. A phase fluorometer designed for a single sensing task might be much cheaper than a research-grade multifrequency instrument, while exhibiting all the performance necessary.

PHASE I: Design and construct a laboratory breadboard phase fluorometer with nanosecond resolution, suited to a particular sensing task to be agreed upon with the sponsor. Acceptable designs will be small, rugged, lightweight, require modest power, and not be liquid cooled. Use of all solid state components is encouraged.

PHASE II: Develop, test, and field demonstrate a phase fluorometer for fiber optic biosensing based on the Phase I breadboard and sensing task. The Phase II device should meet the Phase I criteria, and additionally be transportable easy to calibrate, and manufacturable in quantity. Production drawings should be completed.

PHASE III: Produce a fiber optic phase fluorometer which meets Navy and DoD requirements. Civilian applications will require little or no modification.

COMMERCIAL POTENTIAL: DoD/DoE environmental cleanup estimates exceed $400 billion, of which sampling and analysis may account for up to 30%. Other dual-use potential for advanced biosensors includes process control, explosive/drug detection, diagnosis, therapeutic monitoring, water purity assessment, agricultural testing, food and beverage production.

N94-146 TITLE:Bioemulsifiers and Enzymes for *in situ* Sludge Removal from Oil/Water Separators

CATEGORY: Exploratory Development

SERVICE CRITICAL TECHNOLOGY AREA: Environmental Quality and Civil Engineering

OBJECTIVE: Develop new, biologically based, materials and processes for sludge removal from shipboard oil/water separators

DESCRIPTION: The Navy must operate ships in compliance with federal and international laws governing oily wastewater discharge. The International Maritime Organization (IMO) is expected to lower the acceptable oil discharge limit from 15 ppm to 5 ppm by the year 2000. Oily wastewater discharge is controlled primarily through the use of oil/water separators. The performance of oil/water separators is impaired by build-up of oily sludge. Sludge removal now requires dismantling of separators, a laborious, expensive, and dangerous (because of release of H_2S generated by anaerobic conditions within the tank and accumulation of heavy metal in the oily sludge) operation. Biotechnologies for *in situ* cleaning of oil/water separators would provide economical and safe procedures that would be in compliance with environmental regulations.

PHASE I: Screen, identify, and characterize biosurfactants and/or enzymes that are effective sludge removal agents.

PHASE II: Develop, test, and demonstrate processes utilizing biosurfactants and/or enzymes that can be used *in situ* for sludge removal in oil/water separators that operate at no less than 10 gallon per minute.

PHASE III: Produce materials on a commercial scale for use in oil/water separators.

COMMERCIAL POTENTIAL: The world-wide business opportunities for environmental biotechnologies are tremendous. It is anticipated that all commercial vessels will be required to comply with IMO discharge standards. There is growing interest in the use of bioemulsifiers and biosurfactants to enhance the bioavailability of contaminants.

N94-147 Title:Tactical Exploitation of National Capabilities through Science and Technological Advances

CATEGORY: Basic Research/Exploratory Development/Advanced Development

SERVICE CRITICAL TECHNOLOGY AREA: Primarily Command, Control, Communications/All

OBJECTIVE: To systematically explore the tactical use of National Systems and conduct cross-program cooperative studies between National, tactical, and commercial programs. To assess, coordinate, and transition new capabilities resulting from the scientific and technological exploitation of these systems toward fleet utilization and increased Naval and joint warfare capabilities.

DESCRIPTION: This SBIR topic is in direct response to the Department of Defense Appropriations Act of 1977 and Congressional direction for the revitalization of service Tactical Exploitation of National Capabilities (TENCAP) programs following the unprecedented use of National Systems during Operations Desert Shield and Desert Storm. Through a Memorandum of Agreement with Chief of Naval Operations (N6), the Office of Naval Research has established a Science and Technology TENCAP office that will develop high-risk, high-payoff advanced technological demonstrations, with supporting scientific and exploratory developmental programs, aimed at exploiting and optimizing National Systems' capabilities for increased Naval and joint warfighting capabilities.

PHASE I: Develop system concepts of operation for the further exploitation of National Systems for increased Naval and joint warfighting capabilities. These system concepts should consider cooperative interactions between National Systems, tactical, and commercial programs. Based on these concepts of operation, propose simulations and laboratory/experimental demonstrations that verify increased warfighting potential.

PHASE II: Demonstrate system concepts in simulations and/or laboratory/experimental demonstrations to verify increased warfighting potential. Prepare detailed documentation on experimental results. Propose follow-on operational demonstrations in Joint Chiefs of Staff (JCS) Fleet Exercises to test concepts of operations in realistic operational scenarios.

PHASE III: Demonstrate system concepts in JCS Fleet Exercise to verify operational utility of proposed National/tactical/commercial system exploitation. Prepare detailed documentation of system operational concept for use in system tasking and CINC utilization.

COMMERCIAL POTENTIAL: Algorithm development and system concepts have application in search and rescue, natural damage and environmental impact assessment, surveying, commercial shipping, and passive identification.

N94-148 TITLE:Interoperability of Commercial Small Low Earth Orbit (LEO) Satellite System with the Navy Fleet Satellite (FLTSAT) Terminal

CATEGORY: Exploratory Development

SERVICE CRITICAL TECHNOLOGY AREA: Command, Control, Communications

OBJECTIVE: Demonstrate interoperability of commercial LEO system such as ORBCOMM with the Navy's FLTSAT terminals.

DESCRIPTION: Commercial small LEO satellite services such as ORBCOMM will become available in 1994. This system is suitable to transmit small messages (120 characters) at low cost ($0.01/byte). It is cost effective to off-load non-critical small messages from the FLTSAT system to commercial system sparing more capacity for critical usage.

An RF subsystem should be developed and integrated into the FLTSAT terminal so that it can transmit short messages at 148 Mhz up link to the ORBCOMM satellite. This system can also receive 137 Mhz down link message according to the public X400 email standard. The software of the Navy's FLTSAT terminal should be modified to handle the ORBCOMM Dynamic Channel Assignment Algorithm System (DCAAS) protocol. The Total system should work in the Navy's Copernicus communication architecture.

PHASE I: Develop the basics and design of the RF subsystem. It probably should be an VME bus card (6U) in the open architecture of the FLTSAT terminal. The modification of the software in the terminal should be simulated to handle the ORBCOMM DCAAS protocol.

PHASE II: Develop, test, and operationally demonstrate the operation of the FLTSAT terminal by sending and receiving short messages to the ORBCOMM satellite system. This subsystem is implemented according to the design in PHASE I. Message delay should have an average value of less than 15 minutes. If the average delay can not be guaranteed, priority level message transfer in ORBCOMM system should be considered.

PHASE III: Produce an RF subsystem and a software system that can work in a FLTSAT terminal as developed in the PHASE II effort.

COMMERCIAL POTENTIAL: New methodology can be used in commercial satellite terminals that requires access to small LEO system.

N94-149 TITLE:UHF 25 Khz Voice Channel Expander

CATEGORY: Exploratory Development

SERVICE CRITICAL TECHNOLOGY AREA: Command, Control, Communications

OBJECTIVE: Use 4.8 kbps CELP vocoder and associated forward error coding (FEC) to concentrate two secure voice channels into one 25 Khz UHF satellite channel.

DESCRIPTION: Shortage of UHF satellite channel occurs at the operational level. This project is able to expand available voice channels. Currently many commercial efforts concentrate on narrow band digital radio. NSA also has an effort to develop STUIII D device compatible to digital modulation. It is cost effective to expand the 25 Khz FLTSAT channel to accommodate multiple secure voice channels. The secure voice channel expander most likely includes a new design of the modulation and encoding methods under the constraints of power, bandwidth and interference of the FLTSAT channels.

PHASE I: Develop the basics of the vocoder, FEC, frames, modulation and encoding method to concentrate two secure voice channels. The effort also includes design of the new STUIII D end to end encryption device for the voice channel.

PHASE II: Develop, test and operationally demonstrate a 25 Khz voice channel expander that implements the encoding methods formulated under the Phase I effort. The expander should be a modular and open architecture design integratable into the Navy's Copernicus TADIXS communication architecture.

PHASE III: Produce an UHF SATCOM voice expander that implements the design demonstrated in Phase II.

COMMERCIAL POTENTIAL: New methodology may be used to expand the voice capacity in existing commercial links.

N94-150 TITLE:Optoelectronic Signal/Image Processing for C3I Applications

CATEGORY: Exploratory Development

SERVICE CRITICAL TECHNOLOGY AREA: Command, Control, Communications

OBJECTIVE: Develop optoelectronic technology and/or signal processing modules that support Navy C3I systems based on multi-function phased array antennae shared by radar, ESM, ECM, and communications subsystems.

DESCRIPTION: Future Navy C3I systems will reduce the number of separate shipboard and airborne antennae by sharing adaptive phased array antennae, multifunction receiver modules, and common signal processing resources. Enabling technologies for this concept include wideband phase shifters, methods for adaptive multiple-beam steering, optical techniques for addressing and interconnecting large numbers of wideband T/R modules, and robust methods of Automatic Target Recognition (ATR). Proposals which exploit the inherent parallelism of optical systems or the speed/bandwidth of photonic technology, including nonlinear optical phenomena, will be considered.

PHASE I: Investigation of proposed concept; identification of innovation and discussion of technical issues. If necessary, laboratory demonstration proving feasibility of concept or resolution of controversial issue.

PHASE II: Design of prototype; demonstration of concept with prototype system; discussion of all relevant performance scaling issues and production or manufacturing issues.

PHASE III: Commercialization of prototype developed in phase II; market surveys and analyses; business plans commercializing product, either in-house or in conjunction with an appropriate industry.

COMMERCIAL POTENTIAL: The wideband technology components and systems developed for this program have numerous commercial opportunities within the high-speed telecommunications, satellite communications, and digital multimedia distribution markets. In addition, relevant software products designed for efficient DoD resource allocation and data fusion are equally applicable to industrial concerns.

N94-151 TITLE:Modeling of Composite Explosive Detonations

CATEGORY: Exploratory Development

SERVICE CRITICAL TECHNOLOGY AREA: Conventional Weapons

OBJECTIVE: Development of enhanced composite metallized explosives for underwater applications with maximum total energy and energy release rate profile tailored to optimize application specific performance.

DESCRIPTION: For underwater applications, it is essential to design high performance composite metallized explosive formulations whose characteristics can be tailored with a user prescribed profile for energy release and other detonation processes. A thorough understanding of the processes responsible for the conversion of chemical energy in the explosive into kinetic energy released into the water column as shock and expanding detonation product gases during and after the detonation, is required before this can be achieved. There is an excellent understanding of the thermodynamics, and there are good equilibrium codes which are adequate to describe the detonation of "ideal" explosives. However, there is no adequate description of the kinetic and microscopic transport processes which control the kinetic energy profile and thus the performance of "non-ideal" (composite) explosives.

PHASE I: Identify the physical and chemical processes which occur during the decomposition of oxidizer molecules and subsequent reaction of these molecular fragments with metal fuel particles at temperatures and pressures characteristic of detonations.

PHASE II: Develop the methodologies necessary to describe the time dependent processes which control the rate of energy release in the detonation of composite metallized explosives.

PHASE III: Produce a computer code which incorporates the chemical kinetics and microscopic transport processes inherent to the detonation of metallized composite explosives which can be integrated with existing thermodynamic and fluid dynamic codes to accurately describe the detonation and energy release characteristics of metallized composite explosives.

COMMERCIAL POTENTIAL: Private sector applications include mining and tertiary oil recovery technology in which a combination of both shock and high impulse (integrated pressure with time) is essential to maximize oil fracturing and rubbleization processes.

N94-152 TITLE:Surf Zone Mine Neutralization/Clearance

CATEGORY: Exploratory Development

SERVICE CRITICAL TECHNOLOGY AREA: Conventional Weapons

OBJECTIVE: Identify and quantify the effectiveness of using smart munitions for clearance of anti-invasion mines and obstacles in the surf zone (0-10 feet water depths) preceding an amphibious assault. This includes, materials that can be released to immobilize, desensitize or otherwise render safe.

DESCRIPTION: Anti-invasion mines are placed in large quantities in beach areas to prevent an amphibious landing. These mines must be quickly cleared or neutralized using techniques which are cost-effective and deliverable form available platforms. Munitions using smart sensors may provide accurate payload placement and a cost-effective solution to this problem.

PHASE I: Develop concept using above suggestion or alternate method. Identify and describe concept in terms of size, weight, and explosives or other materials delivered. The mechanisms for target detection and reacquisition and all development/not development items will be identified and described. Quantified analysis will be made to estimate percent effectiveness for the proposed concept.

PHASE II: A prototype will be developed and demonstrated. Effectiveness to clear or neutralize mines and/or obstacles will be demonstrated. Simulation models of the prototype in varying scenarios will be developed to aid in concept demonstration.

PHASE III: Field test against inert targets.

COMMERCIAL POTENTIAL: Supporting sensor technology will be useful in location and marking of hazardous objects in the coastal environment. Ordnance disposal artificial reefs.

N94-153 TITLE:Stabilizing Materials for Beachhead Mine Immobilization

CATEGORY: Exploratory Development

SERVICE CRITICAL TECHNOLOGY AREA: Conventional Weapons

OBJECTIVE: Develop easily deployed stabilizing materials (e.g., a foam) that can be released in very shallow water and the surf zone region to immobilize or desensitize mines on or near the bottom to allow safe passage.

DESCRIPTION: The very shallow water and surf zone mine clearance operation involves divers or small UUV's that must locate, identify, and mark bottom, near bottom, and buried mines. These mines would generally be triggered by movement of a tilt rod, or by exceeding the pressure, magnetic, or acoustic signature needed to exceed the influence triggering threshold. Currently each mine so located must be exploded of immobilized by placing an explosive charge on the mine. New and unique ways for dealing with high density minefields of this type are needed. Conceptually, one can imagine covering the mines with some type of rapidly hardening material that would inhibit the operation of tilt rod mines or shield the influence sensors of the mine from the signature of the passing vessel. Such materials would need to be effective in the presence of the diluting effects of the large volume of sea water.

PHASE I: Develop the concept via a paper study and system conceptual design.

PHASE II: Fabricate a prototype system and demonstrate the concept in a suitable test environment.

PHASE III: Transition the technology to the acquisition sponsor upon successful completion of Phase II.

COMMERCIAL POTENTIAL: Explosive ordnance disposal, artificial reefs.

N94-154 TITLE:Unmanned Undersea Vehicle Sensors for Mine Survey and Wave Conditions

CATEGORY: Exploratory Development

SERVICE CRITICAL TECHNOLOGY AREA: Sensors

OBJECTIVE: Develop systems for UUVs to survey for mines in shallow and very shallow water, sense oceanic parameters of interest and report results of survey and sensing in real or near-real time to tactical decision makers.

DESCRIPTION: Unmanned Undersea Vehicles will play an important role in littoral warfare due to their ability to covertly survey for moored, bottom and buried mines and simultaneously measure ocean characteristics of interest to the tactical commander. Systems are needed that combine sensors to improve range and resolution of mine location and identification processes, to sense oceanographic conditions, particularly wave and surf, process data on board and report results promptly and accurately. It is desirable to combine these missions using an appropriately sized package to minimize power and space requirements aboard the chosen unmanned platform.

PHASE I: Perform conceptual system design that maximizes mine hunting performance. Topic focus may be on system components rather than the entire system. Identify requirements to be met in area of measurement of wave and surf parameters, data processing and storage, and appropriate data relay.

PHASE II: Develop a prototype system that can be integrated and field tested with a suitable UUV. Perform field tests and evaluate results.

PHASE III: Finalize system design and develop final designs for production:

COMMERCIAL POTENTIAL: Underwater well head, piping survey, underwater salvage, sea floor surveys etc.

N94-155 TITLE:Zinc-Selinide (ZnSe) Substrates for Blue Lasers

CATEGORY: Exploratory Development

SERVICE CRITICAL TECHNOLOGY AREA: Electron Devices

OBJECTIVE: Develop ZnSe substrates for the epitaxial growth of ZnSe based alloys for light emitting diodes and, particularly, lasers in the blue-green region of the optical spectrum to meet Navy and commercial requirements including communications and displays.

DESCRIPTION: A major problem in growing epitaxial materials for light emitting devices in the blue-green spectral region is lack of suitable substrates. This is particularly true for the case of blue lasers since direct bandgap materials are required.[1, 2] Zinc selenide shows promise for such development and is advantageous for lasers since the epitaxial ZnSe based alloys are direct bandgap materials. It is particularly desirable to develop (100) ZnSe substrates for subsequent molecular-beam-epitaxial (MBE) active-materials growth.

PHASE I: Develop optimized rates of ZnSe substrate material growth and optimize pretreatment steps. In particular, substantially slower initial growth rates ($\leq$ 3 mm/h) and somewhat slower end growth rates than those currently used are desired. This Lightweight Surveillance Radar phase should address other areas such as growth conditions, crucible design, and doping parameters, but growth rates and pretreatment steps should be emphasized.

PHASE II: Develop highly doped n-type materials ($\approx 1 \times 10^{18}$ cm^{-3} doping densities), developing optimized temperature and vibrational growth conditions, design of crucibles and gradient applications, and exploring the potential of using different growth gas ambients. While these tasks are expected to involve substantially more effort than the phase I efforts, it is expected that growth rates and pretreatment steps will continue to receive attention and be optimized as the tasks emphasized in Phase II tasks are carried out.

PHASE III: Produce commercial blue-green ZnSe based semiconductor lasers.

COMMERCIAL POTENTIAL: Blue-green lasers and LEDs for communications and displays.

N94-156 TITLE:Molecular Electronics Device Support

CATEGORY: Exploratory Development

SERVICE CRITICAL TECHNOLOGY AREA: Electron Devices

OBJECTIVE: To identify techniques to measure electronic properties of molecular scale devices.

DESCRIPTION: Molecular electronics consists of devices that are constructed from individual molecular components upward rather than from bulk systems downward. These devices offer great promise for reducing weight and power consumptions as well as increased operational speed. Molecular wires, switches, sensors and a host of other devices have been constructed; however, no capability exists to measure their electronic properties. While the construction of single devices is a significant achievement, the production of complex devices with appreciable yields is the real goal. This will only be achieved when we are able to characterize the component devices adequately.

PHASE I: Develop experimental techniques to characterize any of the electronic properties of molecular scale devices and identify the most promising.

PHASE II: Develop prototype of the system proposed in Phase I studies and evaluate the system on several devices.

PHASE III: Refine prototype for transition to a naval advanced development program, the Navy microelectronics program and/or a Cooperative Research and Development Agreement with naval R&D laboratory.

COMMERCIAL POTENTIAL: The commercial potential is very large as nanoelectronics replace the microelectronics of today.

N94-157 TITLE:Bistatic Passive Ranging

CATEGORY: Exploratory Development

SERVICE CRITICAL TECHNOLOGY AREA: Electronic Warfare

OBJECTIVE: Employ bistatic range/geometry correction techniques using ship's Electronic Warfare (EW) systems to solve for instantaneous range to selected emitters. Provide an increased Ships Self Defense EW capability to existing SLQ-32 and SLQ-32 upgrades/Advanced Integrated EW System (AIEWS) equipped ships by providing a technique to generate range data to supplement the EW system's threat emitter identification, azimuth and elevation information.

DESCRIPTION: Present EW systems provide threat emitter location in azimuth and elevation but cannot provide instantaneous threat range. The subject technique will exploit the threat emitter's signal and target returns to provide range information automatically, thereby enabling more efficient use of replenish-able and non-replenishable EW techniques, tactics and devices. Inclusion of a capability to passively track radiating threat seekers would furthermore allow early determination of the targeted platform, and would facilitate closed-loop Electronic Protection (EP) effectiveness evaluation. Performer must have appropriate security clearance.

PHASE I: Define operational parameter of threats, methodology for interfacing passive range system to EW system, algorithm concepts to generate passive range data, algorithms to extract and correlate data, and EW system modifications required, as well as hardware, software, system concept. Prepare proof of concept demonstration plan and detailed phase II cost and schedule.

Phase II: Develop passive ranging hardware brassboard and interface designs with ship's EW System. Make ship's EW system modifications. Prepare detailed test plan. Conduct limited proof of concept tests. Prepare and submit test results and test report.

Phase III: Produce and successfully demonstrate a prototype system
compatible with existing shipboard EW systems at sea. Prepare and submit test results, test report and recommendations. Prepare system functional and performance specifications.

COMMERCIAL POTENTIAL: As with the majority of EW technologies, this EW technique affords exceptionally limited potential for commercial applications.

N94-158 TITLE:Large-Area Acoustics Control Panels

CATEGORY: Exploratory Development

SERVICE CRITICAL TECHNOLOGY AREA: Structures and Materials

OBJECTIVE: Devise methods to make materials, in the form of large area panels incorporating sensors and actuators as integral constituents, for adaptive control of structural, fluid borne, or air borne acoustics.

DESCRIPTION: Currently, the control of structural acoustics is achieved by attaching external localized sensors and actuators to the structure. In contrast, this materials research topic targets the synthesis of large area panels containing integral sensors and actuators that can be directly imbedded within the structure to achieve the desired acoustic control, for example, reducing the structure's own motion, acoustic radiation, or acoustic reflectivity. These research efforts will focus on cost-effective methods to make materials incorporating acoustic sensors and actuators for structural acoustics control, and not extend to the electronics or control algorithms involved in their use.

PHASE I: Devise materials fabrication methods to produce large area panels incorporating, as integral material constituents, acoustic sensors and actuators that could be used to control the acoustic characteristics of structure in which they are imbedded.

PHASE II: Fabricate large area acoustic control panels, imbed them within a large (linear dimensions exceeding one meter) prototype structure, and demonstrate their potential to control the motion, acoustic radiation, or acoustic reflections from the prototype structure.

PHASE III: Design and manufacture large area panels containing integral sensors and actuators to control structural acoustics in military ship and aircraft applications as well as civilian aircraft, automotive, and building applications.

COMMERCIAL POTENTIAL: Broad civilian applications in environmental quieting in buildings, aircraft and automobiles are supplemented by critical defense applications for controlling structural acoustics in ships, helicopters, and airplanes.

N94-159 TITLE:Piezoelectric Composite Transducers

CATEGORY: Exploratory Development

SERVICE CRITICAL TECHNOLOGY AREA: Structures and Materials

OBJECTIVE: Devise acoustic and vibration control applications for piezo composite materials. Concentrated R&D efforts have made feasible manufacture of composite piezoelectric elements for sensing and actuation. This topic targets the development of applications for these materials. Potential Naval applications include acoustic sensing and vibration control. Similar applications are visible in aircraft, automotive, and environmental noise abatement. Innovative proposals to expand the application domain to entire new fields are encouraged. Applications can use single layer or stacked applications of this technology. The focus here lies on imaginative uses rather than materials synthesis.

DESCRIPTION: Recent developments in the manufacture and design of composite transducers has resulted in products with attractive properties. Piezoelectric ceramic rods oriented vertically in a horizontal polymer matrix form the so-called 1-3 composite transducers. Panels measuring 46 cm on a side and 1 cm thick have been produced based on piezoelectric ceramic rods 1 mm diameter * 6 mm long. This composite contains 15 volume % ceramic and the polymer filling the spaces between rods is cellular, providing a low-density transduction material. Thin, rigid face plates are bonded to the surfaces to permit uniform surface response or planar actuation. This materials research topic targets development of applications for this technology, not necessarily in the dimensions and configuration described above.

PHASE I: Devise applications for 1-3 and/or 0-3 composite transducer technology having military or commercial applicability. Devise concepts to exploit current manufacturing processes.

PHASE II: Fabricate and/or procure materials and configure demonstration device or devices which can be tested against the proposed performance or function.

PHASE III: Demonstrate application by total prototype fabrication and testing could include, but are not limited to, critical defense applications for controlling structures or devices in ships, helicopters, and airplanes.

COMMERCIAL POTENTIAL: Private sector applications could include, but are not limited to, applications in acoustic instrument isolation, environmental quieting in buildings, aircraft and automobiles.

N94-160 TITLE:Overcoming Environmental Limitations on Active Sonar Detection Performance

CATEGORY: Exploratory Development

SERVICE CRITICAL TECHNOLOGY AREA: Software/Sensors

OBJECTIVE: Demonstrate improved active sonar detection performance by understanding and overcoming the oceanic environment.

DESCRIPTION: The Navy increasingly relies on active sonar for detection, but performance is degraded by time dependent multipath propagation. This vertically integrated demonstration program seeks to improve performance and overcome these degrading effects by defining the environmental information required, acquiring it, and demonstrating improved detection performance by its use. Conventional, side scanning sonars used widely for both military and commercial bottom search applications suffer from reduced resolution at long range. Therefore, search rates are limited at high resolution without increasing the length of the acoustic array to an unmanageable size. Synthetic aperture techniques offer, in principle, the possibility of obtaining high resolution at much longer ranges with the same size physical array; however, significant difficulties must be overcome, including very stringent requirements on motion compensation, compensation for fluctuations in the medium, and calibration and stability of the acoustic transducers and electronics. In addition, efficient synthetic aperture processing and display algorithms must be developed to enable real-time operation.

PHASE I: Define the environmental information required and the means to obtain it. Estimate the improvements in system performance that will be achieved when the environmental information has been acquired. Justify the predicted performance improvements by modeling or with actual data.

PHASE II: Verify the performance improvement predictions by obtaining and employing the necessary environmental information and employing it in a prototype system.

PHASE III: Develop, test and demonstrate sonar system detection performance improvement based on overcoming the effects of time dependent multipath propagation in the ocean.

COMMERCIAL POTENTIAL: It is desired that the environmentally based improvements in performance should be demonstrably capable of providing similar benefits in commercial active sonar systems.

N94-161 TITLE:Artificial Intelligence, Data Fusion and Mine Recognition System

CATEGORY: Exploratory Development

SERVICE CRITICAL TECHNOLOGY AREA: Software/Sensors

OBJECTIVE: Develop a high resolution underwater imaging systems using artificial intelligence to combine or fuse multiple sensor inputs and machine learning algorithms to detect, classify and identify a variety of mines.

DESCRIPTION: At present underwater mines are detected by sonar, and identified by television from a two-dimensional gray shaded image. A system combining sonar, electro-optical and laser derived imagery with artificial intelligence offers a means of increasing the accuracy of the detection, classification and identification process.

PHASE I: Identify the sensors and assess the ability of the technology to perform the needed mission. Design algorithms necessary to perform data fusion and target classification/identification from the fused images.

PHASE II: Construct a prototype system and demonstrate its capability in a laboratory test.

PHASE III: Construct document and demonstrate a field-robust system in a Navy-selected shallow water area.

COMMERCIAL POTENTIAL: Supports use of sonar imagery for other applications, including shallow water sea salvage, and location and mapping of underwater objects such as shipwrecks, pipelines, etc.

N94-162 TITLE:Ship Construction Process Modeling

CATEGORY: Exploratory Development

SERVICE CRITICAL TECHNOLOGY AREA: Surface/Undersurface Vehicles

OBJECTIVE: Create a higher quality and better integrated design package by utilizing commercially available software to develop innovative modeling components that facilitate the communication of shipbuilding production concepts without building prototypes. The modeling components are independent of ship type, therefore this generic design package has equal applicability to commercial shipbuilding as to U.S. Naval shipbuilding.

DESCRIPTION: To build more affordable ships, the need to design ships with production processes in mind is paramount. Modern shipyards build ships by dividing the ship into sub-components or blocks and pre-outfit those blocks to the fullest extent possible before actual ship installation. This is a three dimensional process that is most easily explained through visualization. Currently the Navy uses two dimensional system diagrams and plan views in an attempt to visualize this combination linear and non-linear process. In order for the Navy to generate a quality design product that facilitates modern construction techniques a visualization analysis tool is needed. This can best be accomplished through the concept of virtual reality. Preliminary demonstration projects funded by the Advanced Research Programs Agency (ARPA) show great promise through the utilization of commercial hardware and software.

PHASE I: Model the hull block construction of a recent U.S. Naval ship showing the sequencing. Satisfactory completion and demonstration of the modeling allows transition to Phase II. Deliverables are reports documenting the model development and a video tape showing, in real time, the process.

PHASE II: Model representative detailed subassemblies and completely outfitted modules containing habitability spaces. Incorporate the above detailed models into the model from Phase I. Utilize commercially available human factors programs to analyze habitability spaces and determine benefits gained from such an approach both in terms of shipyard assembly and in terms of day to day living. Satisfactory completion and demonstration of the modeling allows the transition to Phase III. Deliverables are reports documenting the model development and approach analysis as well as a video tape showing, in real time, the process.

PHASE III: Develop a generic ship hull block construction sequencing procedure and modeling method that incorporates prefabricated and outfitted modules. Demonstrate technique by modeling a recent or proposed commercial ship. Deliverables are reports documenting the model development a video tape showing, in real time, the process, the software used, a training course on how the software modeling is accomplished, and a menu driven system for walking through the process. All software utilized and developed must be compatible with on going ARPA/DON efforts in this area.

COMMERCIAL POTENTIAL: The software tools developed would be ship generic and would apply to developing designs for commercial ships (both new and overhaul). Commercial shipyards could also use this software to help them better fabricate new acquisition U.S.Naval ships.

N94-163 TITLE:Regenerated Diesel Engine for Low Emissions and High Power Density

CATEGORY: Advanced Development

SERVICE CRITICAL TECHNOLOGY AREA: Surface/Undersurface Vehicles

OBJECTIVE: Develop a concept to reduce emissions, improve fuel efficiency and increase power density of a diesel engine by employing regeneration.

DESCRIPTION: Diesel engines presently available in the U. S. Navy do not meet proposed emissions regulations and have a low power density when compared to gas turbines and gasoline engines. This program will identify candidate materials and concepts that will allow a diesel engine to meet the environmental regulations for exhaust emissions as well as the Navy requirement for high power density and fuel efficiency.

PHASE I: Present a concept to employ regeneration in a diesel engines. Candidate materials for the regenerator will have undergone evaluation of material properties in an engine environment. The deliverables will include a data base for all the materials evaluated.

PHASE II: The regenerator will be tested in a single cylinder diesel engine to determine its effectiveness in terms of emissions, power density and fuel efficiency.

PHASE III: The concept will be tested in a multi-cylinder diesel engine which is representative of a Navy diesel engine.

COMMERCIAL POTENTIAL: Interest from major engine companies is expected after completion of a successful Phase II. Significant potential for applications in commercial U. S. shipbuilding regulated by The U. S. Coast Guard and MARAD. Other applications in commercial aircraft, pleasure boats, offshore drilling platforms and land based systems.

N94-164 TITLE:Low-Cost Stealth Surface Craft for Minehunting Applications

CATEGORY: Exploratory Development

SERVICE CRITICAL TECHNOLOGY AREA: Surface/Undersurface Vehicles

OBJECTIVE: Develop a low-cost, remote controlled, stealthy surface and submerged vehicle as a minehunting platform for near-vertical, acoustic detection of bottom and buried mines in shallow and very shallow water, and in the surf zone.

DESCRIPTION: Most minehunting sonar concepts focus on detection outside the lethal range of the mine being detected. This results in shallow incident angles for the acoustic energy from the sonar beam and greater difficulty for sediment penetration and detection of buried mines. At near normal incidence, better bottom penetration and detection will occur. The difficulty with operating at normal incidence is that the proximity of the sonar platform to the mine is increased and the liability that the platform may be destroyed is increased as well. If the acoustic and magnetic signatures of the platform are of such a low level that they do not trigger the mine detonating mechanism, or the system is of such low cost as to be expendable, then mine detection at normal incidence with greater assurance may be possible.

PHASE I: Develop the concept including studies predicting acoustic and magnetic signatures for a vehicle concept able to perform the minehunting mission.

PHASE II: Build a prototype to measure the actual signatures.

PHASE III: Transition technology to an Advanced Development Program.

COMMERCIAL POTENTIAL: Underwater wellhead/piping survey, underwater salvage, sea floor sediment surveys, etc.

N94-165 Title:Iconic, Graphic, Data Flow Programming for High-Performance Real-Time Workstations

CATEGORY: Exploratory Development

SERVICE CRITICAL TECHNOLOGY AREA: Software

OBJECTIVE: Develop and implement efficient [automated] software development tools for developing architecture-independent software for antisubmarine warfare processing systems. Develop high performance graphs (including parallelism) for signal processing including passive beamforming, data processing, and graphic data display.

DESCRIPTION: Develop for a coarse grained parallel multiple instructions/multiple data workstation a software tool that will permit the real-time processing of acoustic data using data flow graphs. Such a work station might consist of a SUN outfitted with a mercury quad board, transputer board(s) or other parallel processor options; to include: 1) A graphical programming language consistent with the Navy's Processing Graph Method (PGM) Specification providing for iconic description of parallel implementations of signal processing applications; 2) A mandatory intermediate textual representation of the graphical program consistent with Processing Graph Notation; 3) Ada or C++ programs, consistent with PGM Command Programs, for supervising graph execution parameter changing, starting and stopping

graphs in an efficient manner, etc.; 4) A library of primitives supporting standard signal, image, data, and display routines which underlie the nodes of that data flow graphs; 5) Translation tools that translate graphs and command programs to executable code that allows the operator to change the topology of the processing graphs without restarting the processing session; 6) Run-time support to effect data flow execution of the application graphs to be based on some specific description of the workstation's architecture. Perhaps this could be accomplished with a formal set of architecture services that can be ported to various environments. The hardware architecture and instruction sets being data that is provided independently to the software tool that can be changed independent of the processing graphs. This layer should be beneath the user operating system calls such as POSIX or some other standard.

PHASE I: Develop a system which shall include front end specification tools so that a target machine is a selectable entity, requiring only the notation that describes a new architecture and not requiring applications to be rewritten.

PHASE II: Design, develop, and assemble an ASW processing workstation using off-the-shelf commercial components for Navy approved tactical algorithmic processing chains.

PHASE III: Specification of the software tool will be provided to prime contractors of SURTASS, Surveillance Direction System (SDS), and Advanced Distributed Systems (ADS) as an enhanced software programming capability for potential technology insertion and for significantly reduced software development and maintenance through plus reuse and minimum cost transportability.

COMMERCIAL POTENTIAL: Several corporations are now offering non-real-time. non-parallel architectures, non-distributed processing, and hardware unique capabilities of iconic data flow graphic programming. The cost of producing real-time systems and then moving from one hardware architecture to another is prohibitive, requiring the rewriting of most or all of any existing application software.

N94-166 TITLE:Protection of Naval Computers from Denial-of-Service Attacks

CATEGORY: Exploratory Development

SERVICE CRITICAL TECHNOLOGY AREA: Software

OBJECTIVE: To render Navy operational and development systems free from inadvertent intrusion and potential destruction or unauthorized use.

DESCRIPTION: The Navy is making increasing use of networks of commercial desktop computers with standard Unix operating system software. Some of these computers are updated with new software from remote locations. Ideas are solicited about how to protect these computers, their software, and their networking components, from deliberate or accidental attacks that would cause widespread denial of service. This solicitation is not for technology to prevent unauthorized disclosure of information, but centers on preventing a contaminated or hostile node from interfering with the proper operation of other computers to which it is connected. Detection and identification of attacking nodes would be useful, but limitation of spread of contamination and maintenance of normal operation by uncontaminated nodes are most important.

PHASE I: Compose a taxonomy of denial of service vulnerabilities covering system-level vulnerabilities by degree of vulnerability, operating system (e.g. Unix, MS-DOS, Windows/NT, Macintosh), network (e.g., Internet, AppleTalk, Novell), degree of compromise of hostile nodes (individual account, operator privileges, system administrator privileges, etc.), motive (e.g. curiosity, terrorism, information warfare), and any others deemed helpful. Identify and prioritize important tasks needed to remove/reduce current vulnerabilities. Create, in coordination with the PI, a plan for carrying out at least two from the list. Provide the results at a (government-sponsored) workshop and revise findings according to peer review.

PHASE II: Develop a proof-of-concept prototype or methodology demonstration to demonstrate the effectiveness of one or more approaches to reducing or removing denial of service vulnerabilities in a prototypical Navy environment. Identify and justify the environment to be used, carry out the plan, and evaluate the results. Document methodologies.

PHASE III: Apply approaches from Phase II for full scale systems. The goal in this phase is to demonstrate concepts and approaches developed in Phases I and II to a full-scale Navy systems. Successful results of this research will be transitioned to full-featured, reliable products or well-documented services that can be used to protect Navy systems.

COMMERCIAL POTENTIAL: Because the commercial world will depend on the same commercial technology to which the Navy is moving, approaches, tools, and solutions developed under this project should have direct and immediate application there, as well as in all facets of government systems.

MARINE CORPS SYSTEMS COMMAND

N94-167 TITLE:Long-Term Corrosion Prevention for Marine Corps Equipment

CATEGORY: Exploratory Development

SERVICES CRITICAL TECHNOLOGY AREA: Materials and Structures

OBJECTIVE: Develop low cost, low maintenance, corrosion control for Marine Corps equipment, especially tactical vehicles.

DESCRIPTION: Many corrosion problems experienced by the Marine Corps are caused by exposure to salt air/spray during exercises or on deployment. Vehicles are typically found throughout the world, used in every conceivable environment, embarked on Landing Craft Air Cushion (LCAC) and in the well deck of ships. A method is needed to protect the equipment from the environment and reduce or eliminate maintenance requirements. This effort is to design/develop a system that can be used to protect equipment from the environment. The Marine Corps requires a process that can be used in many situations to prevent corrosion and protect equipment. Technology needs to address the multiple needs encountered in a system level. For example, a system such as, the Assault Amphibian Vehicle, has unacceptable corrosion levels found on the engine, the transmission, the electric\communications systems, suspension systems and virtually all attached or collateral gear.

PHASE I: Identify one or more processes that provide low cost, low manpower, corrosion prevention for Marine Corps equipment. Conduct detailed study of Marine Corps assets at two Marine Corps locations.

PHASE II: Demonstrate low-cost, low-maintenance corrosion control process/system for Marine Corps equipment.

PHASE III: Integrate results in one or more major systems to evaluate effectiveness.

COMMERCIAL POTENTIAL: Improved processes for corrosion control would be especially useful in the dual use applications in regards to the automotive industry and heavy construction equipment manufacturers. The technology would also be useful for other applications where equipment needs to be protected from the environment during operation, and just as importantly, when in storage.

N94-168 TITLE:New Methods to Desalinate Seawater

CATEGORY: Exploratory Development

SERVICE CRITICAL TECHNOLOGY: Environmental Quality

OBJECTIVE: To investigate advanced and innovative desalination methods that can produce potable water from seawater.

DESCRIPTION: Current military water desalination equipment uses a membrane separation technology called Reverse Osmosis (RO) in order to desalinate seawater by means of the Reverse Osmosis Water Purification Unit

(ROWPU). Although relatively energy efficient compared to distillation technologies, RO still requires an appreciable amount of power, chemical resupply, and multi-stage filtration for pretreating the feed water. In addition, knowledgeable operators are required to constantly monitor and maintain the ROWPU and its chemical addition system. There are emerging technologies today that posses the potential to desalinate water with less operator interface and pretreatment requirements than RO technology now requires. These technologies should be evaluated for their military as well as industrial and municipal applications. The new technologies developed must be compared against current RO desalination processes.

PHASE I: Develop new desalination equipment. Provide a detailed description of the technology indicating the size, weight, and cost for a system capable of producing 1200 gallons per hour (GPH) of potable water from a seawater source.

PHASE II: Based on the results of Phase I construct a 1200 GPH prototype to prove and demonstrate the engineering design parameters for the new technology. All test data and relevant information regarding this prototype such as reliability, maintenance, and manpower requirements shall be provided. The prototype shall be provided for extensive testing at the seawater desalination test facility.

PHASE III: The new technologies developed could replace the aging ROWPU systems as the military updates its equipment needs and requirements.

COMMERCIAL POTENTIAL: There is a large amount of commercial potential for new desalination methods. The municipal water supply industry could greatly benefit from research in this area. The current drought conditions in many areas of the world and need for reliable and additional sources of fresh water to meet the needs of an increasing urban population make this a timely and important topic of research.

N94-169 TITLE:Point Recognition Terrain Marking Technology

CATEGORY: Exploratory Development

SERVICE CRITICAL TECHNOLOGY AREA: Materials/Software/Conventional Weapons

OBJECTIVE: Design and develop prototype/proof of concept demonstrators for an Advanced point recognition Terrain Marking capability to enhance daytime and nighttime target acquisition for close air support for mobile and static battlefield situations involving combined arms forces.

DESCRIPTION: Development of innovative terrain marking concepts should include artillery, mortar, rocket delivered devices, and hand held/man portable devices to provide enhanced target marking capabilities. These concepts should (1) maximize the target marking duration from 5 to 30 minutes, (2) provide an easily recognizable common point of reference on the battlefield to assist in the acquisition of targets by CAS aircraft and ease communications required to direct aircraft on a specific target, (3) define the battlefield for the pilots and commanders alike in the attack of targets and the reduction of fratricide during day and night operations, (4) optimize marker/terrain contrasts. Reductions in weight and size required for hand held/man portable devices. Potential desired for innovative materials, durability, and reuse.

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

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

PHASE III: Produce a PRP that implements all of the improvements demonstrated in the Phase II SBIR effort.

COMMERCIAL POTENTIAL: New marker concepts can be used in search and rescue operations, life flights, and police operations.

N94-170 TITLE:Co-Site-Interference Mitigation Effort for Amphibious and Land Combat Vehicles

CATEGORY: Exploratory Development

SERVICE CRITICAL TECHNOLOGY AREA: Command, Control, Communications

OBJECTIVE: Explore innovative approaches to minimize the co-site-interference for combat radio communication systems in military land combat and amphibious combat vehicles.

DESCRIPTION: Current command and communication control systems are targeted to the co-site-interference generated by radio transmitters, thus degrading receiving (voice and data) performance. Co-site-interference results from collocated transmitters interfering with each other. The current command communications systems in the AAV7CA1 amphibious vehicle controls five transmitters (T) and four receivers (R) in the VHF area; one VHF/UHF R/T, and one HF R/T. In addition, one Position Location Reporting System (PLRS) installation is planned. New configuration will provide the AAVC7A1 with a new generation of VHF SINCGARS radios, maintaining the same HF and VHF/UHF configuration. However, if the new configuration is implemented, a total of 12 antennas will be required and installed on top of the AAVC7A1 for radio communications causing a catastrophic RF environment, thus degrading the capability for voice and data. Any proposed hardware must be based on current technology and must interface with three different types of radios plus PLRS and future requirements such as the Global Positioning System (GPS). Proposed hardware should meet the following requirements:

-Able to fit in the AAVC7A1
-Ruggedized equipment
-User friendly and fault tolerant
-Run from unregulated 18-32 Volt DC power with 500 Hz ripple
-Minimize antenna quantity
-Be able to survive land combat vehicle and amphibious vehicle environment
-Have MTBF greater than 10,000 hrs and
-Have MTTR less than 3 hrs

PHASE I: At the end of six months, the contractor should provide at least 3 optional approaches that are possible solutions to minimize the collocation problem. The proposals should be of sufficient detail to allow for government review and selection.

PHASE II: At the end of a two-year effort, it can be expected that one or two approaches will have been installed and demonstrated in an AAVC7A1.

PHASE III: If successful, it is anticipated that such an approach will have immediate benefits for AAV, other combat vehicle platforms, and other fixed platforms within the Marine Corps as well as other Government agencies.

COMMERCIAL POTENTIAL: The techniques explored here may have immediate use in commercial application for land and air vehicles.

N94-171 TITLE:High-Accuracy Azimuth Sensor

CATEGORY: Exploratory Development

SERVICE CRITICAL TECHNOLOGY AREA: Sensors

OBJECTIVE: The development of a compact, hand-held reliable, automatic, highly accurate azimuth sensor for individual use or integration into individual or crew-served weapons systems.

DESCRIPTION: The proposed effort should address the development of the technology needed to provide a compact sensor capable of measuring azimuth to an accuracy of 0.5 degrees or better. Unit must be compact, hand-held unit that maintains reliability, and operate successfully in adverse field environments for individual use or integration into individual or crew-served weapon systems. Such systems would include the Advanced Forward Observer/Forward Air Controller (FO/FAC) device and Advanced Sensor Air Defense Systems (ASAD) currently under development and testing. Additionally, all other tactical intelligent fire control sensor systems that require highly accurate azimuth information would take advantage of this capability.

PHASE I: Preparation of a technical report describing and examining the proposed azimuth sensor technology. The technical report should include the following information: theory of operation; projected performance and operational characteristics; current state of development; and proposed technical approach.

PHASE II: Development of a device which will provide a demonstration of its operating principle and characterization of its performance.

PHASE III: Transition to EMD or DEMVAL for further development and fielding.

COMMERCIAL POTENTIAL: The azimuth sensor would be suitable for a number of commercial systems such as marine and aviation applications, land navigation, search & rescue, and forest service.

NAVAL AIR SYSTEMS COMMAND

N94-172 TITLE: Low-Cost, Lightweight Night Vision Capability for Hand Launched Unmanned Aerial Vehicle (UAV) System

CATEGORY: Advanced Development

SERVICE CRITICAL TECHNOLOGY AREA: Human System Interface

OBJECTIVE: To investigate feasibility of developing lightweight, low cost night vision technology for integration into Hand Launched UAVs.

DESCRIPTION: There exists a need to develop and integrate a miniature night vision capability into current and future Hand Launched UAV (HL-UAV) systems to improve mission effectiveness in twilight/night environments. The HL-UAV is capable of performing tactical surveillance and reconnaissance within 5-7- km combat radius. The HL-UAV's nominal operating altitude is between 200-500 feet above ground level. The current prototype system uses a single ground control unit with a Styrofoam/Kevlar composite air vehicle. The electrically powered air vehicle has a 9 ft wingspan, is 6 ft long, and weighs approximately 7 pounds (without payload or batteries). The air vehicle carries the imaging payload (currently a black & white/color camera), electric motor (300 watt Samarium-Cobalt), uplink receiver, downlink transmitter, avionics, and batteries. The ground control unit consists of a pilot's controller, observer's monitor, uplink transmitter, and downlink receiver.

State-of-the-art commercial night vision devices do not meet weight, power, or resolution requirements supporting the need for additional research to develop and prototype a miniaturized system for the HL-UAV. The night vision capability must provide sufficient image resolution to meet military and civil reconnaissance and surveillance mission requirements. The current imaging payload weighs only ounces, and its physical dimensions are approximately 5" x 2" x 2". These are extremely important due to air vehicle payload weight and volume constraints. The current daylight capability is approximately 500 lines of resolution and the black and white camera provides high resolution capability approximately 1 hour before and 1 hour after sunset. Neither camera provides a true night vision capability, however. This restricts the system's operating availability to strictly day/twilight hours, which limits its mission effectiveness. A true night vision imaging capability (e.g., uncooled forward looking infrared (FLIR), image intensifiers, low-light camera) could provide the HL-UAV with an around-the-clock mission capability.

PHASE I: Develop advanced state-of-the-art night vision technology and components that could meet the stated requirements.

PHASE II: Provide prototype night vision payload for bench-level testing. If successful, flight tests in a variety of night time mission environments will follow.

PHASE III: US Navy requirements are to be determined. US Army and National Guard Bureau confirmed their requirements for night vision payloads at several Pointer HL-UAV program reviews and management meetings. US Marine Corps and US Air Force requirements are also to be determined.

COMMERCIAL POTENTIAL: Commercial "spin off" potential is strong. The HL-UAV is already a front-runner for transition to other government agencies, paramilitary operations, and commercial applications. A night vision payload will facilitate transition of the HL-UAV into commercial and civil operations, making the system more flexible and capable. Low cost, lightweight, and low power night vision systems and components, when competitively prices, already have a sizable market in the commercial, civil, and military market places.

N94-173 TITLE:Heat Blankets for Composite Bonded Repair

CATEGORY: Advanced Development

SERVICE CRITICAL TECHNOLOGY AREA: Materials

OBJECTIVE: Develop generic heat blankets for composite bonded repair which provide consistent uniform temperature over the entire area of the blanket.

DESCRIPTION: Controlling the variations in cure temperature during hot bonded repair is currently more art than science. Current heat blankets provide non-uniform heating across the repair area often causing under cured or burned repairs. Temperature variations in excess of 50°F from the center of the blanket to the blanket edge exist. Large variations in cure temperature across a repair area produce repairs that are not structurally acceptable. On-aircraft repairs to large structural components are often compromised to attain a balance between under cure and overheating the surrounding structure.

PHASE I: Conduct a study to define requirements and determine feasible methods to maintain uniform consistent temperature/heating for application to field level repair heat blankets. Document results in a final report.

PHASE II: Develop prototype heat blanket and test for use in field repair with portable heat consoles. Document results in a final report.

PHASE III: Implement the configuration for manufacture and use in government and commercial composite repair facilities.

COMMERCIAL POTENTIAL: High quality heat blankets with consistent, uniform temperature distribution have application in the commercial aircraft repair industry.

N94-174 TITLE:LCD Off-Axis Light Leakage

CATEGORY: Exploratory Development

SERVICE CRITICAL TECHNOLOGY AREA: Human System Interfaces

OBJECTIVE: Identify an optimal solution to the light leakage problem and develop a solution on a prototype LCD unit.

DESCRIPTION: State-of-the-art aircraft are required to perform missions with cockpit ambient lighting environments from full sunlight illumination (over 10,000 fl) to moonless night illumination (less than 0.01 fl). This range of operation requires the use of high performance avionic display technology in order to provide acceptable readability from all viewing positions.

Most new cockpits and cockpit upgrades are now using active matrix LCD technology which provides benefits such as higher contrast, lower power, greater packaging density and enhanced reliability when compared with CRT technology. Unfortunately one of the drawbacks is the increased black-state light leakage off-axis (beyond the viewing cone) which can cause canopy reflections at night. At very large angles this black-state leakage can actually exceed the on-state brightness of video symbology.

PHASE I: Three areas of study will be pursued in this phase:

- Control of backlight emissions (independent of the LCD).
- Control of emission lobe on output (viewer side) of LCD.
- Modification of electro-optical properties of LCD to minimize viewing angle dependence.

An initial system trade study will be performed. Sample optical and LCD elements will be procured and evaluated in terms of on-axis as well as off-axis performance. A final report detailing the results of this effort and recommendations for follow-on work will be generated.

PHASE II: A complete LCD unit will be fabricated which will incorporate the features resulting from the phase 1 activity. This unit will be evaluated and the results documented in a final report.

PHASE III: Incorporate technology into Navy aircraft.

COMMERCIAL POTENTIAL: Auto interior dash lighting.

N94-175 TITLE:Unmanned Aerial Vehicles (UAV) Meteorological Sensors for Atmospheric/Environmental Sensing Applications

CATEGORY: Advanced Development

SERVICE CRITICAL TECHNOLOGY AREA: Atmospheric and Space Science/Sensors

OBJECTIVE: Develop a low-cost meteorological (MET) sensors package to be used by UAVs in atmospheric/environmental monitoring operations.

DESCRIPTION: Knowledge of the vertical profile of atmospheric parameters can be an important factor in determining the operational effectiveness of many military and civilian systems. Possible military applications may include: the delivery and use of battlefield obscurants, monitoring and tracking of Nuclear, Biological and Chemical (NBC) agents, adjustment of artillery fire, predicting communication and sensor performance, performing ocean conditions/sea state analyses, and improving military aviation safety, etc. Civilian applications may include: fighting forest fires, monitoring and tracking of pollution, studying and forecasting global weather pattern changes, studying oceanography, and improving civilian aviation safety. A small, low cost, UAV borne MET sensors package capable of measuring and computing the variables affecting atmospheric conditions over a mesoscale sized area in a relatively short time period, could provide more accurate and complete meteorological information than previously available from radiosondes carried aloft by weather balloons. Weather balloons do not give the operator any control in placing sample points, have a limited lifetime utility, and are not normally recoverable. The UAV MET sensors package will become a standard part of the family of UAV's avionics and sensors equipment providing anti-elements warning and self-protection information to the UAV operator. Other MET services and information will be provided to military and civilian users as needed.

PHASE I: Investigate which atmospheric monitoring (i.e., temperature, humidity, pressure, wind, cloud parameters, and atmospheric transmission extinction, etc.) and processing algorithms are required for the UAV MET sensors package to support the various military and commercial applications. Develop a MET sensors package specification and a processing algorithms document.

PHASE II: Develop, test, and operationally demonstrate a UAVMET sensors package for both civilian and military applications.

PHASE III: Produce a UAV MET sensors package which can be integrated into a UAV platform for an operational trial.

COMMERCIAL POTENTIAL: The UAV MET sensors package can provide both civilian agencies and private research organizations with a valuable tool for atmospheric and oceanographic study, hurricane tracking and warning, pollution tracking, and global weather pattern monitoring.

N94-176 TITLE:Integration of Flat-plate X-band and Wideband Antennas for Surveillance/Identification

CATEGORY: Advanced Development

SERVICE CRITICAL TECHNOLOGY AREA: Sensors

OBJECTIVE: Design/develop an integrated X-band and wideband antenna suitable for deployment in the nose of aircraft.

DESCRIPTION: A wideband antenna for shipboard use was recently developed at the Naval Research Laboratory. Interest has been shown in developing a similar antenna for tactical aircraft. The design is more complicated because the antenna would be placed in front of and attached to a flat plate X-band antenna. The technique of near-field radiation pattern measurements was originally developed to measure the radiation patterns of large phased-array antennas which would otherwise need to be measured in ranges many miles long. The phase and magnitude of the radiated fields a few wavelengths in front of the antenna are measured. Then the radiated fields at infinity are calculated using Fourier transform techniques. Fourier transform techniques can also be used to calculate the fields in the plane of the radiating aperture. This second technique would be applicable to the problem of integrating the X-band and wideband antennas. Near field measurement facilities, while still rather elaborate, are becoming more accessible with advances in microwave and computer technology.

PHASE I: Obtain a flat plate X-band antenna. Determine a baseline phase and amplitude distribution of the fields in the plane of the aperture. Model wideband elements as thick conduction sheets. Calculate the effect of model wideband elements on field distribution of flat plate X-band antenna and compare with near field measurements.

PHASE II: Investigate wideband element configurations which minimize impact on the X-band fields. If a wideband configuration is found which minimizes the impact on the X-band fields, determine if the residual errors can be compensated for (or at least reduced to acceptable levels) with changes to the X-band antenna.

PHASE III: NAVAIR will transfer this technology to be implemented in improved Identification Systems.

COMMERCIAL POTENTIAL: Very few, if any, private sector applications.

NAVAL AIR WARFARE CENTER/AIRCRAFT DIVISION/WARMINSTER

N94-177 TITLE:Compact, Low-cost, Micropowered Fiber Optic Bypass Switch

CATEGORY: Exploratory Development

SERVICE CRITICAL TECHNOLOGY AREA: Command, Control, Communications

OBJECTIVE: To develop a compact, low-cost, low-power fiber optic bypass switch to bypass failed or downed nodes in fiber optic data networks.

DESCRIPTION: The Navy is currently developing compact, battery-powered sensor arrays which will be interconnected by fiber optic networks. These networks must be highly reliable and fault tolerant and at the same time consume a small part of the total power and size budgets. To achieve the goals of reliability and fault tolerance the network must be capable of bypassing failed nodes. Currently available active bypass switches are relatively large and power hungry, while passive bypass switches are limited in the number of nodes which may be bypassed, thus decreasing reliability and fault tolerance.

PHASE I: Demonstrate the feasibility of the proposed device. The device should implement a 2x2 bypass switch with a switching time of less than 90 milliseconds. Total insertion loss should be less than 2 Db when used with 50/125 or 62.5/125 micron fiber. Total size of the device should be less than 1 cubic centimeter. The device should be capable of operating from a single 3 Volt supply at a supply current, depending on the switching technique, as described below. A fail-safe mode should be provided in which the device returns to a predetermined state in the event of a power failure. Both latching and non-latching technologies may be considered. For latching technologies peak current drain should not exceed 50 milliamps during the switching time. For non-latching technologies average current drain should not exceed 100 microamps. In addition, the device should be capable of operation after being subjected to shock and vibration characteristic of air deployable systems and over an operating temperature range of -2 to +35 Centigrade (-40 to +55 non-operating).

PHASE II: Develop and demonstrate working model of the bypass switch.

PHASE III: Demonstrate low-cost mass production techniques capable of providing switches in quantities suitable for deploying large numbers of sensor arrays.

COMMERCIAL POTENTIAL: It is anticipated that these devices will find widespread commercial use in networking applications requiring battery-powered remote node operation or in applications where size and power constraints limit the use of conventional networking components.

N94-178 TITLE:Air-Deployable Expendable Multi-Parameter Environmental Probe

CATEGORY: Exploratory Development

SERVICE CRITICAL TECHNOLOGY AREA: Sensors

OBJECTIVE: To develop an expendable probe that senses and reports a set of relevant ocean environment parameters.

DESCRIPTION: Acoustic and non-acoustic surveillance systems development programs are analyzing system requirements for a number of littoral environments worldwide. Measurements in these environments have shown that the homogeneity that enhanced the predictability of the open ocean environment is no longer available in the littoral scenarios. Accurate prediction of system performance in a given location requires concurrent or recent environmental data because of the high temporal and spatial variability of shallow water environments.

PHASE I: Formulate a design concept and demonstrate feasibility through simulations or subsystem demonstrations. As a minimum the sensor should measure and report a bathythermograph, salinity, turbidity, depth, ambient noise, surface current and current velocity profile. Additional parameters of interest are surface wave height, period and direction, and acoustic bottom properties.

PHASE II: Demonstrate the measurement and reporting functions in situ. Demonstrate the autonomous deployment and operation and the feasibility of air deployment. Assess the affordability of the concept.

PHASE III: Transition the concept to a shallow water air-droppable multi-sensor to replace the functions of the SSQ-36 and SSQ-57B sonobuoys.

COMMERCIAL POTENTIAL: Variants of this sensor may provide a low cost expendable pollution monitor for environmental applications.

N94-179 TITLE:Ultra-Lightweight Ejection Seat

CATEGORY: Advanced Development

SERVICE CRITICAL TECHNOLOGY AREA: Materials

OBJECTIVE: Design, fabrication, and testing of ejection seat structure, rails, and aircraft interface using light weight materials

DESCRIPTION: The application of alternate materials on the structural components of the seat can potentially reduce the structure weight by 20 to 30 percent. Research of plausible materials, followed by a trade-off analysis shall establish the final design approach. The analysis shall consider total weight, structural loading, cost, maintenance, repair, interface with sub components, availability of material, mechanical response at temperature extremes, manufacturing techniques, and modification after construction. Technical drawings and data of current technology seats shall be provided.

PHASE I: Develop and provide a detailed conceptual design that can be built and tested. Documentation shall include a phase report, functional description, and technical drawings.

PHASE II: Revise, build and test the conceptual design that was developed in Phase I. Testing shall include ejection tower loading, wind blast loading, and crash loading. Documentation shall include a final report, test reports, and technical drawings.

COMMERCIAL POTENTIAL: New materials for use in the manufacture of commercial seating in automobiles or aircraft.

N94-180 TITLE:Laser Radar for Instantaneous Aircraft Flight Control Correction During Carrier Landings

CATEGORY: Advanced Development

SERVICE CRITICAL TECHNOLOGY AREA: Computers

OBJECTIVE: Develop a laser radar that will integrate with aircraft flight control systems to provide instantaneous remote sensing of carrier deck motion and wind shear effect for enhanced pilot control under adverse landing conditions.

DESCRIPTION: Aircraft carrier landings can be potentially hazardous under conditions of intense cross-winds, wind shear or high sea states. A Laser radar can provide realtime data on local wind conditions (relative velocity and direction) and the motion (displacement and rate) of the deck relative to the sea surface. This realtime information can be processed to provide inputs to the aircraft flight control system for enhanced pilot control and automated aircraft response under adverse landing conditions. An innovative approach is desired to develop a compact, low weight, eye-safe laser radar that is designed for aircraft integration, provides a remote sensing capability and includes signal processing algorithms for flight control integration.

PHASE I: Perform an analytical study that identifies critical laser radar performance characteristics, provides a detailed system design, defines flight control integration approach, and determines potential technical risks.

PHASE II: Develop a laser radar prototype system based on an approved Phase I design, and conduct tests to demonstrate prototype system performance capabilities.

PHASE III: Potential use to Navy, Air Force or FAA.

COMMERCIAL POTENTIAL: Potential use as an adverse landing warning or flight control device on commercial aircraft.

N94-181 TITLE:Assessment Model for Environmental Requirements Compliance

CATEGORY: Exploratory Development

SERVICE CRITICAL TECHNOLOGY AREA: Software

OBJECTIVE: Develop a cost assessment model to identify program costs relating to compliance with environmental requirements.

DESCRIPTION: DoD Instruction 5000.2M requires identification and analysis of potential system inputs on the environment for each alternative during each acquisition phase. Mitigative measures, developed as integral elements of system development, are to minimize adverse impacts throughout the systems life cycle. Costs associated with mitigative measures are not part of existing Life Cycle Cost (LCC) Models, critical to alternative selection. Ability to provide accurate cost estimates to support procurement decisions will become even more critical as environmental regulations become more strict.

PHASE I: Conduct a data search for government and commercial capabilities for modeling environmental compliance costs. Determine which features of which models, including those used by EPA and environmental

engineering firms, support Navy weapon system procurement requirements. Develop a critical features listing and flow chart for a notional model for capturing LCC associated with environmental compliance.

PHASE II: Develop, test, and document a computer model that captures LCC associated with environmental compliance in major Naval programs.

PHASE III: The Navy, DoD, and all government agencies are required to reduce/eliminate hazardous materials from their procurements. The LCC model would provide a tool to do so at lowest taxpayer cost.

COMMERCIAL POTENTIAL: Industry has the same requirements for hazardous waste reduction. The cost model would help to identify and minimize compliance costs and improve profitability.

N94-182 TITLE: Aircraft Canopy Trajectory Simulation Model

CATEGORY: Exploratory Development

SERVICE CRITICAL TECHNOLOGY AREA: Aerospace Vehicles

OBJECTIVE: To develop a computer model that predicts aircraft canopy trajectory after being jettisoned from a stricken aircraft during emergency egress. A first phase shall be considered as the canopy clears the aircraft and a second phase during free flight.

DESCRIPTION: A need exists to simulate the trajectory of an aircraft canopy during an emergency egress or ejection sequence, particularly for new applications. Canopies are currently propelled from an aircraft through the use of a thruster or rocket. Prediction of the trajectory would enable an analysis of potential mid air collision with air crew or ground collision with operations personnel. The canopy trajectory model should consider the initial aircraft conditions and a full six degree of freedom analysis, including aerodynamic effects. The trajectory should cover a wide performance envelope including 0 to 600 KEAS at sea level, and up to M=2 at 50,000 feet altitude.

PHASE I: Provide research and analysis of the most promising techniques and the methodology needed to simulate canopy trajectory.

PHASE II: Develop and provide a validated computer model, through both analytical and experimental techniques, that accurately predicts the trajectories for various ejection scenarios.

COMMERCIAL POTENTIAL: Modeling/simulation can be used for civilian accident investigations.

N94-183 TITLE:Spoken-Language Interface to a Mission Planning System

CATEGORY: Advanced Development

SERVICE CRITICAL TECHNOLOGY AREA: Human System Interfaces

OBJECTIVE: Develop a new Human-System Interface to allow a pilot to plan a tactical mission on a mission planning workstation by interacting via a vocal conversation with a speech understanding system.

DESCRIPTION: Pilots should be trained to be proficient in planning a mission, but should not have to be trained to the same level of proficiency in the use of a Unix type workstation. The pilot should be able to dictate a general mission plan, have his dictation accurately recognized and corrected for grammar, and then have his dictation translated into a top level mission plan by a natural language information processing program. The system would then interactively query the pilot in order to develop a more detailed plan. The system should be capable of understanding natural language speech, recognizing large vocabularies, inter-acting with large military databases, high level workstations and interfaces such as helmet mounted displays. The final system should be capable of modifying the mission plan while airborne using a sub-set of the ground based vocabulary.

PHASE I: Demonstrate basic spoken language understanding sub-system. Research and create a development plan for a both a ground based and an airborne voice interactive mission planning system.

PHASE II: Develop and demonstrate a voice interactive mission planning system on a commercial UNIX workstation.

PHASE III: Develop and demonstrate in a simulation an "in-the-air" scenario of the pilot changing his mission and creating an alternate mission plan.

COMMERCIAL POTENTIAL: Commercial aviation versions of this system on a smaller scale could be made available to aid a pilot in planning a cross country flight with the aid of personal computer based system.

N94-184 TITLE: Electrochemical Stripping of Aircraft Coatings

CATEGORY: Exploratory Development

SERVICE CRITICAL TECHNOLOGY AREA: Aircraft Technology

OBJECTIVE: To develop a non-polluting, non-invasive paint stripping technology for aircraft systems by employing electrochemical techniques of phase separation at metal-polymer interface

DESCRIPTION: The Navy currently uses two types of paint stripping methods: one which is solvent based and has concerns of high VOC and end disposal problems; the second which is now widely used is the plastic media blasting (PMB) - this is least polluting but is concomitant with restriction on use in open air. The PMB stripping must be done in closed system as it involves fragmentation to very small particles which do become airborne and pollute the air, therefore must be contained. Thus a new technology is required which is non-invasive and non-polluting, and can be achieved by simply peeling-off the paint without any extensive use of solvents and/or air blasters.

PHASE I: Initial efforts will be devoted in developing an electrochemical method which can cause interfacial separation of polymer (paint system) from the substrate by addressing the mechanism which causes adhesion. Initially, the choice of substrate would be aluminum alloys. Processes such as hydrolysis or cathodic debonding could be developed by this method to create interfacial separation. Alternatively, a controlled corrosion of the substrate by electrochemical reactions may create a natural peel-off effect. Thus, the first phase of work will deal with development of a technique and proof-of-concept to achieve objectives.

PHASE II: Once the above developed concept (technique) has been proven, then this phase of work will be devoted to extending it to large surfaces and modifying the concept to practical applications. Next the methodology will be extended to several different substrate materials such as steels, composites etc.

PHASE III: In this phase a technology demonstration would be expected on fleet aircraft with an intent that the method is applicable to naval systems and meets all EPA requirements.
COMMERCIAL POTENTIAL: There is a technology gap in the paint stripping area. The developed method would be a dual-use technology with extremely high DOD use and commercial (value) application not only in civil aviation but in other private sectors such as automobiles, bridges, storage tanks, utility structures, ships etc.

N94-185 TITLE: Simulation Environment for the Rapid Prototyping of Advanced Avionics

CATEGORY: Advanced Development

SERVICE CRITICAL TECHNOLOGY AREA: Aircraft Technology

OBJECTIVE: The objective is to develop a design for a simulation environment or Avionics Prototyping Tool (APT) that utilizes commercially available elements (computers, modeling tools, and data bases) in a functionally modular architecture. This environment can then be used to design, develop, and demonstrate functionally accurate prototypes of real-time, tactical avionics systems.

DESCRIPTION: Recent advancements in commercially available computing technology have made it feasible to envision a revolution in the way tactical avionics systems are developed. Until now, avionics systems were functionally integrated after the selection and physical integration of hardware components. This approach has led to a variety of factors symptomatic of cost growth: requirements creep, software delays, and expensive hardware tuning during integration. All of these factors have as their source a lack of detailed requirements definition before the commitment to hardware is made. This is where rapid prototyping provides a significant benefit. The APT must include several key capabilities.

-A virtual cockpit, able to simulate a variety of cockpit schemes, either for existing aircraft (F-14), F/A-18, E-2C) or new concepts (AFX, MRF) to allow a man-in-the-loop (MITL) operation/demonstration capability.
-A scenario generator/controller to simulate the external environment including other friendly and hostile platforms (aircraft, missile systems, and ships) in a manual or automatic control mode.
- Data bases to include terrain, terrain features (imagery) and digitized maps.
- Storage/replay capability to enable the post-mission analysis of a particular demo.
- The ability to develop, store, and utilize a library of real-time models. These models will include tactical platforms, tactical sensors, weapons, and groups of the above to a varying fidelity (from "cookie-cutter" quality to performance based on predictions/algorithms).
- Provisions for incorporating selected actual hardware components to replace the software simulations. This would require "gateways" or interfaces between the particular component and the simulation programs.

PHASE I: Feasibility study to concentrate on the refinement of the requirements for APT and the commercial availability of the APT physical and functional building blocks.

PHASE II: Detailed design of the APT system including a breakdown to low-level operational descriptions for both the physical and functional architecture. Physical architecture should include components, interconnects, processing hardware and application software packages, I/O devices, storage devices, control stations, and component sources (vendors). Functional architecture shall include system capability descriptions organized from scenario generation through operation/demo to storage/replay/analysis. Function capabilities must enable the modular insertion and removal of functions as discrete components. This last feature enabling the quick assessment of different combinations of functions in an integrated, tactical avionics system as demonstrated from an aircraft cockpit.

PHASE III: It is anticipated that a number of DOD Agencies, including the Navy, will be pursuing prototyping initiatives on a variety of programs. Of primary interest is the Joint Advanced Strike Technology (JAST) Program. JAST could benefit from an APT approach as the basis of its avionics systems engineering. APT also offers potential in the retrofit and system upgrade arena for platforms such as E-2C and its definition of Block Upgrade Configurations.

COMMERCIAL POTENTIAL: The APT approach could be directly applicable to commercial industry in the development of commercial product prototyping environments for products such as automobiles, aircraft, etc.

NAVAL AIR WARFARE CENTER/AIRCRAFT DIVISION/LAKEHURST

N94-186 TITLE:Landing Signal Officers (LSO) Head Mounted Display with Decision Making Capabilities

CATEGORY: Advanced Development

SERVICE CRITICAL TECHNOLOGY AREA: Human System Interfaces

OBJECTIVE: Develop a head mounted display unit for the Navy's LSO which would not only provide aircraft and ship dynamic parameters but would also provide assistance in the aircraft approach decision making process under high workload conditions.

DESCRIPTION: The LSO is responsible for the safe and expeditious recovery of all seabased Naval aircraft. LSOs are stationed on all aircraft carriers and large deck amphibious ships. It is imperative that the LSO have the necessary dynamic information available to them during the terminal phase of aircraft recovery. Carrier LSOs operate in the severe deck environment currently utilizing information available on a very cumbersome 1970's technology Head-up Display while all other LSOs operate in enclosed environments with restricted volumes with absolutely no display no display tools available to them. Technology has and is providing more and more information to those LSOs with a display. This has resulted in increasingly and dangerously high workload situations. Thus a decision making aid would help the LSO in performing his critical tasks.

PHASE I: Determine the feasibility of such application. Also determine what information parameters are required by the LSO and how LSOs formulate decisions. Develop software to address these issues. terminals involved.

PHASE II: Design, fabricate and produce a breadboard display system that would interface with the LSO Training Simulator or a shipboard LSO Workstation.

PHASE III: Commercialize technology to various users which require continuous information; such as bus terminals, maintenance depots, users of building blue prints, flight deck landing officers, maintenance crews, and etc. Also transition the technology to other agencies for use in air traffic control situations.

COMMERCIAL POTENTIAL: This technology has application in the private sector such as building maintenance crews, various repair crews, attendants and inspectors for mass transportation terminals, on-site training aids, et cetera.

N94-187 TITLE: Automated Accurate Aircraft Weighing System (A^3WS)

CATEGORY: Exploratory Development

SERVICE CRITICAL TECHNOLOGY AREA: Aerospace Vehicles

OBJECTIVE: To develop the capability of acquiring accurate aircraft weight on the carrier's flight deck with alacrity, under all weather conditions.

DESCRIPTION: Aircraft weight is a critical factor in the setting for catapult launch. This factor plays a crucial role to the service life of seabased naval aircraft. Currently, aircraft weights are estimated on the flight deck by summing up the aircraft's ordnance, fuel, and factory measured structural weight.

PHASE I: Investigate and develop the feasibility of acquiring aircraft weight prior to launch for catapult settings. The candidate systems must be employable under all carrier's environments. Develop and identify specifications for sensors that are to be incorporated without hindering any of the current flight deck's operations.

PHASE II: With results gathered from Phase I, develop a prototype system and perform testing to demonstrate the feasibility of such a concept.

PHASE III: Successful concept will be demonstrated, further development and fleet testing for carrier application is anticipated.

COMMERCIAL POTENTIAL: There exist great commercial potential for such systems that could acquire vehicle weights with great alacrity. Such applications could be used for determining vehicle weights before they enter tunnels or bridges and etc.

NAVAL AIR WARFARE CENTER/AIRCRAFT DIVISION/PATUXENT RIVER

N94-188 TITLE:Volumetric Airwake Measuring Equipment

CATEGORY: Exploratory Development

SERVICE CRITICAL TECHNOLOGY AREA: Sensors

OBJECTIVE: Develop instrumentation to make accurate 3-D volumetric airwake measurements for ships, off-shore oil rigs, roof-top heliports, and commercial airports.

DESCRIPTION: The ship airwake is the most important variable in the aircraft shipboard landing task. It is also probably the most difficult parameter to measure and to model for real time pilot-in-the-loop shipboard landing simulation. In the past, engineers have used hand-held anemometers and mobile masts with anemometers to make airwake measurements. The mobile masts improved spot airwake measurements, but they are bulky and require considerable effort to assemble, move around on deck, store, and disassemble. Improved instrumentation is required to measure the airwake volume over ship flight decks, off-shore oil rigs, and roof-top heliports, as well as, approach/departure zones to commercial airports. The equipment should provide accurate 3-D airwake data for a point source and for a specified air volume surrounding the flight structures, for steady and turbulent airwake components. The equipment should be readily transportable to and from the test site, compatible with ship equipment, ship motion, ship EMV, and hostile maritime environment.

PHASE I: Review rotorcraft/ship flight test and simulation programs with respect to ship airwake measuring and modeling. Review airwake measurements at off-shore oil rigs, roof-top heliports, airports, and related structures. Define status of all likely systems/methods for measuring the airwake, describing strengths, weaknesses, relative risk, and limitations of each approach. Propose the best airwake measurement system/method, defining approach, accuracy, reliability, and supportability.

PHASE II: Develop the airwake measuring system. Perform analysis, laboratory and ground-based check-outs, calibrations, and useability/reliability/maintainability evaluations. Support one at-sea airwake measurement test, including test planning, data acquisition, data reduction, and reporting.

PHASE III: Use the equipment to measure the airwake of a commercial off-shore oil rig.

COMMERCIAL POTENTIAL: The volumetric airwake measuring equipment could be used to measure the airwake at a commercial roof-top heliport and to measure downdrafts at commercial airports.

NAVAL AIR WARFARE CENTER/WEAPONS DIVISION

N94-189 TITLE:High Visibility Signal Cartridge for Practice Bombs

CATEGORY: Exploratory Development

SERVICE CRITICAL TECHNOLOGY AREA: Training Systems

OBJECTIVE: Develop a highly visible Signal Cartridge to be used with Practice Bombs, that will not initiate bomb range fires or produce other harmful environmental hazards.

DESCRIPTION: Signal Cartridges provide a means for marking Practice Bombs point of impact when scoring bomb drops for pilot training. The current high visibility signal cartridge, MK 4 MOD 3, uses Red Phosphorus to produce smoke and flame for signaling. This method, on some occasions, produces fires on the bombing ranges. The Military services require a signal that is highly visible during night time exercises that does not produce environmental hazards. Nine requirements for the signal are as follows: 1) Provide a system to instantaneously mark impact point of Practice Bomb, and is detectible from a distance not less than one mile. 2) Provide an emission long enough to be recorded and provide singular discrimination between succeeding impacts. 3) Provide a signal within 1.6 milliseconds of surface

impact of Practice Bomb. 4) Be encased in a cylindrical cartridge 0.85 inches in diameter and approximately 6 inches long. 5) Not contain any material which is toxic, radioactive, or environmentally harmful. Must not require any Ozone Depleting substances for manufacture. 6) Not explode or separate when subjected to five foot drop test of MIL-STD-331, test III, procedure 2. 7) Pass vibration test of MIL-STD-810, method 514.2, procedure I, figure 514.2-2, curve J. 8) Must not initiate fires. 9) Low unit cost.

PHASE I: Demonstrate feasibility and producibility of proposed signal method. Provide prototypes.

PHASE II: Develop and conduct test program to demonstrate that signal method meets requirements. Deliver all test data to U S Government and 40 prototypes for operational evaluation.

PHASE III: Phase II results will be disseminated for evaluation/approval and implemented as practicable.

COMMERCIAL POTENTIAL: May have potential as marker location device.

N94-190 TITLE:Adaptive Wavelets

CATEGORY: Exploratory Development

SERVICE CRITICAL TECHNOLOGY AREA: Software

OBJECTIVE: Explore and develop software to implement wavelet expansions that give arbitrary tilings of the time-frequency domain.

DESCRIPTION: Recently, there has been much development of wavelets and their generalizations. Wavelets coefficients produce local estimates of the region in the time-frequency plane where most of the signal energy is contained. Presently, wavelet waveforms with a fixed time-frequency tiling pattern are used in order to best match the signal structure. What is desired is a time varying filter bank that can automatically select the best match to the local signal structure and transition between different wavelets.

PHASE I: The available options for adaptive wavelets with an arbitrary time-frequency tiling will be addressed. Among the selected alternatives substantial algorithm maturity must be demonstrated.

PHASE II: Algorithms and software will be developed and applied to select set of radar signals and infrared images with structured or patchy clutter. Both synthetic and measured signal must be utilized.

PHASE III: A system demonstration utilizing weapon system sensors and wavelet processing with development of fieldable weapon system hardware/software.

COMMERCIAL POTENTIAL: Adaptive wavelet filters could be applied in voice recognition, in medical imaging, digital cellular phones and audio and image compression.

N94-191 TITLE:Integrated Image Processing Focal Plane Array

CATEGORY: Exploratory Development

SERVICE CRITICAL TECHNOLOGY AREA: Computer Science

OBJECTIVE: The objective of this work is to develop a focal plane array that is combined with a massively parallel processor on a common substrate, preferably in a 3 dimensional stacked configuration. It should be capable of supporting processing methods such as neural networks, fuzzy logic networks, wavelet processing and/or all kinds of conventional parallel image processing techniques.

DESCRIPTION: Advanced optical guidance integrated fuse concepts require very high speed image processing methods to extract the pertinent information to perform both the guidance and fuzing functions. Massively parallel processing methods have the highest potential for providing the data rates needed to perform these functions for future systems. The primary bottleneck to achieve these rates with presently available devices is the data transfer between the

focal plane array and the massively parallel processor. An integrated stacked configuration may eliminate this bottleneck.

PHASE I: Develop an integrated image processing focal plane array concept. Determine and document the capabilities and limitations of the proposed fabrication method. Propose and specify the capabilities of a demonstration model.

PHASE II: Build, test and document the resultant characteristics of the proposed demonstration model.

PHASE III: Upon successful completion of phase II, the resulting technology will be incorporated into several major Navy and other services programs, such as JSOW, JDAM, Javelin and second generation FLIRS.

COMMERCIAL POTENTIAL: This product would be useful in any application which requires extensive image processing, especially at high speeds. Security systems which may need personal recognition may require this capability. Quality control of production items which may be measured or characterized by image processing techniques may require the speeds attainable with this device. Also, automated production that requires a physical reorientation of components at high speeds could use this device.

N94-192 TITLE:Low-Profile Broadband Radiating Elements

CATEGORY: Exploratory Development

SERVICE CRITICAL TECHNOLOGY AREA: Command, Control, Communications

OBJECTIVE: Develop a broadband (2-18 GHz) radiating element design suitable for operation with low-profile active electronically steered array (AESA) antennas.

DESCRIPTION: Inexpensive, dual polarized, broadband (2-18 Ghz) radiating elements having integral circulators and a total depth less than one inch are needed for future low-profile AESA antennas. Current broadband (flared notch) radiating elements with circulators require about twice this depth. Operation over the 2-18 Ghz band is difficult to achieve and increases the cost of the circulator. Future broadband AESAs will require this capability at a production cost well under $100/element.

PHASE I: Develop radiating element/circulator design approach and layout; conduct computer performance simulations; report results.

PHASE II: Refine Phase I design; fabricate and test a radiating assembly based on the design; report results.

PHASE III: Combine Phase II radiating element technology with advanced transmit/receive (T/R) circuitry packaging technology currently being developed by Advanced Research Project Agency initiatives and other funding. Develop a low-profile demonstration AESA suitable for aircraft side array and missile applications.

COMMERCIAL POTENTIAL: The low-profile packaging technology could be useful in a variety of commercial communications applications, including satellite broadcast systems and commercial aircraft. Broadband applications are primarily defense related at this time.

NAVAL AIR WARFARE CENTER/TRAINING SYSTEMS DIVISION

N94-193 TITLE:Constructivist Learning Approaches to Training Decision-Intensive Tasks

CATEGORY: Exploratory Development

SERVICE CRITICAL TECHNOLOGY AREA: Training Systems

OBJECTIVE: To investigate alternatives to traditional instructional design practices for training programs that are heavily weighted with cognitive learning requirements involving decision making.

DESCRIPTION: Traditional instructional design practices center around identifying and addressing a hierarchy of skills and knowledge. However, the demands of some tasks require training programs that are more cognitive in nature. For example, the aviation community talks about training "head skills" as a component of aircrew coordination training. Traditional instructional design with an emphasis on measuring procedural outcomes is an awkward fit for many of these types of training demands. Constructivist learning theory postulates that ready recall of information and smooth execution of procedures do not guarantee active use of knowledge or skills, as the learner later strives to cope creatively with new situations. On the contrary, there is evidence that a drill-and-practice regimen may yield knowledge and skills more contextually welded to particular circumstances, and less easily transferred. Efforts are needed to investigate the applicability of constructivist learning approaches to particular Navy training requirements, such as Aircrew Coordination Training (ACT) and various Combat Information Center (CIC) mission operations.

PHASE I: Examine the literature on constructivist learning approaches and identify areas of research applicable to improving Navy training. Generate a report with recommended hypotheses to be tested and methodology to be used.

PHASE II: Incorporate constructivist learning approaches and test selected hypotheses identified during Phase I.

PHASE III: Based on test result from Phase II, incorporate approaches in additional courses, both Navy and commercial.

COMMERCIAL POTENTIAL: Results of Navy R&D in ACT are transitioning into civilian aviation applications. This effort is a candidate for similar transition. It may also be used in training for nuclear power plant operations, in training responses to emergency medical situations, etc.

N94-194 TITLE:Electroluminescent Displays for Helmet-Mounted Displays

CATEGORY: Advanced Development

SERVICE CRITICAL TECHNOLOGY AREA: Human Systems Interfaces

OBJECTIVE: To develop both monochrome and color high resolution, high brightness, lightweight, miniature, active matrix electroluminescent (AMEL) displays for military and commercial HMD applications. The following minimum display performance will be required:

	Monochrome	Color
Resolution	1280h x 1024v	1280h x 1024v
Lines per inch	1000	1000
Display Size	1.5"h x 1.5"v	1.5"h x 1.5"v
Display Thickness	0.15"	0.15"
Pixel Size	24um x 24um	24um x 24um
Brightness	15 Fl - 500 Fl	15 Fl - 100 Fl
Power	150mw - 2w	15mw - 2w
Contrast Ratio	100:1	100:1
Number of Colors	1	4096
Grey Scale/Color	64	16
Data Rate	60 Hz	60 Hz
Weight	6 grams	6 grams

DESCRIPTION: Helmet Mounted Display (HMD) Technology will be utilized in future deployable or transportable carrier based Out-the-Window simulators and Virtual Environment Training in the commercial/military areas. Current limitations in commercially available HMDs either utilize light valves which require heavy optics or low resolution monochrome or field sequential color CRTs causing the HMDs to be bulky and heavy in weight and increasing the probability of neck and head strain. Current flat panel STN-LCD and ACTIVE Matrix TFT-LCD disadvantages;

difficult and expensive to manufacture in a small display size; cannot stand high vibration and temperature conditions and poor viewing angles. Electroluminescent Displays advantages over LCDs are: Higher Resolution in a small display size, higher luminance, wider viewing angle and better vibration and temperature endurance.

PHASE I: Perform a preliminary concept design which conforms to the above specifications.

PHASE II: Finalize design and construct prototype which will be available for testing at Navy Air Warfare Center TSD.

PHASE III: Inclusion into future helmet mounted display military training and commercial virtual reality systems.

COMMERCIAL POTENTIAL: Virtual reality systems.

N94-195 TITLE:Tools for Creating Real-Time, 3-D Computer Graphic Environments

CATEGORY: Advanced Development

SERVICE CRITICAL TECHNOLOGY AREA: Software

OBJECTIVE: Develop a set of user-friendly graphical tools that could be used to rapidly create 3-D environments and operate those environments in real-time utilizing a subset of the same software.

DESCRIPTION: Various government and civilian organizations are examining the applications of virtual reality. Each application requires extensive modelling by highly trained personnel to create the environments for the various applications. A set of icon based development tools and a integrated playback system that did not require specific graphics programming knowledge would allow rapid development of environments. Elements within the environment could be controlled by events within and external to the software (e.g. joystick, position sensor, etc.). The design should be based on low cost hardware and easily allow for the integration of external hardware and software control inputs to manipulate the tool-created 3-D world.

PHASE I: Develop a modularized hardware and software architecture that could support the real-time, 3D tool set.

PHASE II: Develop the run-time graphics module and basic development tools to create interactive, real-time virtual environments.

PHASE III: Distribute two package sets for evaluation. One set to include the design tools and run-time software and the other set to on include the run-time software with previously created environments for evaluation.

COMMERCIAL POTENTIAL: Several packages currently exist to model 3-D virtual environments. However, they are independent of the run-time software. Two potential markets could open up with this technology. One, the user of previously created environments (it could be a simple game) that wasn't interested in creating them and; two, the developer market with the ability to share icons (e.g. model sets such as planes, human models, etc.) to create these environments.

NAVAL SEA SYSTEMS COMMAND

N94-196 TITLE:Permanent Magnet Variable Speed Drives

CATEGORY: Advanced Development

SERVICE CRITICAL TECHNOLOGY AREA: Surface/UnderSurface Vehicles

OBJECTIVE: Design and construct affordable permanent magnet variable speed drives for auxiliary applications in US Navy ships.

DESCRIPTION: Permanent magnet (PM) variable speed drives (VSD) promise favorable ship impact if they can be substituted for hydraulic systems and actuators in US Navy ships. Other uses include HVAC and the whole range of small motor applications. PM motors are currently much more expensive than induction motors of the same horsepower, and the addition of variable speed controllers raises VSD cost much higher than equivalent power, across-the-line-start, constant speed induction drives. This task will investigate solutions to the affordability problem and construct several PM VSD to verify the results of study

PHASE I: Conduct a study to determine the cost effectiveness of PM VSD in auxiliary applications in US Navy ships. The following should be considered in the study: (1) level of technology today and in the near future (within 5 years) with regard to PM materials and power conditioners, (2) the impact of standardization of equipment and system simplification, (3) the reduction of piece part count, (4) the impact on fuel efficiency of the ship, (5) the impact on maintenance and operational flexibility, (6) the impact on military effectiveness metrics such as quieting and survivability, (7) the impact on component, module and ship size/weight, (8) the impact on ship producibility, and (9) the impact on the US industrial base. Design To Cost targets, a desirable range of applications and preliminary design detail should be established.

PHASE II: Design several PM VSD from the results of the Phase I study.

PHASE III: Construct prototype PM VSD for ship qualification.

COMMERCIAL POTENTIAL: While the Phase I effort will quantify the effect on the US industrial base, PM VSD are already being used in commercial applications such as large buildings.

N94-197 TITLE:Membrane System for Graywater/Oily Waste Water Treatment

CATEGORY: Advanced Development

SERVICE CRITICAL TECHNOLOGY AREA: Chemistry

OBJECTIVE: To develop a membrane system suitable for concentrating shipboard graywater and/or oily water wastes.

DESCRIPTION: Navy ships generate large volumes of graywater and secondary oily wastes which will be required to be treated prior to overboard discharge. Graywater, which is made up of shower, laundry and galley wastes, normally has a high Biological Oxygen Demand (BOD) level which must be reduced prior to overboard discharge. It contains surfactants, lint, oils and fats and food wastes. Secondary oily wastewater, typically from ships' bilges and processed through a parallel plate oil water separator, contains trace concentrations of oil (<20 ppm), organic substances and heavy metals (mostly copper ions). Both waste streams contain high levels of suspended solids. The Government is soliciting for the development of a membrane system or systems using ultrafiltration or direct osmosis for the concentration of one or both of these shipboard liquid wastes to over 95%. These systems should be capable of producing an effluent with a BOD and suspended solids level of less than 30 ppm and a 95 percent rejection of heavy metals, oils, surfactants and other hydrocarbons.

PHASE I: Identification/modification/synthesis of a membrane composed of an appropriate organic polymer which possesses non-fouling characteristics and is maintainable when concentrating graywater and secondary oily wastes. Demonstrate feasibility of membrane system to successfully treat graywater and/or secondary oily wastes.

PHASE II: Develop and demonstrate efficacy of prototype membrane module in the concentration of actual graywater and secondary oily water wastes.

PHASE III: Develop commercial type membrane graywater treatment system.

COMMERCIAL POTENTIAL: Numerous on-site wastewater treatment systems would benefit from a membrane system which is non-fouling and possesses an increased processing rate, longer cleaning intervals and a longer membrane life.

N94-198 TITLE:Internal Fault Detection/Classification System for Permanent Magnet Machines

CATEGORY: Exploratory Development

SERVICE CRITICAL TECHNOLOGY AREA: Propulsion

OBJECTIVE: Design and construct an internal fault detection/Classification system for PM Machines

DESCRIPTION: Since the field of a permanent magnet (PM) machine cannot be turned off, any shaft rotation will induce voltages and currents into the stator windings. If stator winding faults occur, serious damage to the machine may result. Segmented stator windings are an effective defense but require timely detection of the fault and subsequent continuous coordination of the load placed on the faulted segment. PM machines may continue degraded service with several classes of faults by isolating the faulted winding segments, given timely fault detection and subsequent coordination of loads in the faulted segments. Large PM machines may include over 40 segments and require the isolation/coordination of 40 segment loads, including an indeterminate number in a faulted condition.

PHASE I: Design a fault detection/classification system for a PM generator and PM motor, both in the range of 25,000 hp. The design must interface with control systems at the supervisory and power generation (modular) levels, and accommodate the service and no-damage fault tolerance thresholds (times) of current design PM machines of the ASMP Program and the reduced fault tolerance thresholds of future, larger PM machines.

PHASE II: Build the Phase I system and integrate it with PM machines being built by ASMP (SEA-03R22). Demonstrate the ability to detect faults and coordinate isolation, simultaneously, in up to 4 segments.

PHASE III: Qualify for US Navy shipboard use the system

COMMERCIAL POTENTIAL: Such a fault detection/classification system will undoubtedly be adopted for use by the commercial power generation industry, as well as industrial users of large and expensive electric machines

N94-199 TITLE:Affordable Disconnect Device for Large HP Permanent Magnet Motors

CATEGORY: Exploratory Development

SERVICE CRITICAL TECHNOLOGY AREA: Surface/Undersurface Vehicles

OBJECTIVE: Design and construct an affordable disconnect device for large horse power PM motors

DESCRIPTION: Electrical isolation of PM motors may be necessary due to faults either in the motor or motor inverter units. Lack of isolation increases risk of damage or injury. Permanent magnet (PM) motors used for ship propulsion are connected to a propeller shaft that will continue to turn whenever the ship is moving; as long as the shaft is turning an AC voltage will be present at the terminal windings. Disconnection of the shaft from the motor while the motor is turning may involve costly devices.

PHASE I: Conduct a trade-off study covering the following disconnect options: (1) do nothing, (2) add clutch, (3) use disconnect flange, and (4) mechanical brake. Take into account design of motor inverter, required jacking gear and effects on other systems in the ship.

PHASE II: Design and build a prototype for the selected disconnect device for application in a nominal 25,000-hp shaftline.

PHASE III: Systems Command follow-on effort anticipated.

COMMERCIAL POTENTIAL: When PM electric drive begins to be installed in US Navy ships, these devices will need to be supplied. Certain commercial ships will also require them.

N94-200 TITLE:Image and Data Management System

CATEGORY: Exploratory Development

SERVICE CRITICAL TECHNOLOGY AREA: Electron Devices

OBJECTIVE: To design and develop an electronic (non-film based) system for archiving, retrieving, displaying, reviewing, managing, and reporting and printing image, numerical, spectral, text and other data from electron and optical microscopes.

DESCRIPTION: An Image and Data Management system shall be developed based on analog and/or digital storage of images and data on computer-based management. The System shall address several issues including cost, convenience of use, speed flexibility, and quality. The system shall eliminate the use of hard copy material such as film and Polaroid™ materials.

PHASE I: The contractor will develop and evaluate one or more designs for the proposed system. The design(s) will address, at a minimum, major technical hurdles and their implementation; performance targets including retrieval speed, storage capacity, display and hard copy image quality; cost; and data management capabilities. A partial implementation of one or more candidate designs will be presented in sufficient detail to demonstrate feasibility.

PHASE II: During Phase II the contractor will implement and demonstrate a complete prototype system for one of the systems developed and reviewed under Phase I.

PHASE III: Upon successful completion of Phase II, systems would be of immediate benefit to all Navy, DoD or other government installations doing film-based microscopy in reducing film costs and toxic waste production.

COMMERCIAL POTENTIAL: Strong commercial potential exists. The system is expected to have immediate benefits for any industrial, commercial, university, government or other laboratory which does a substantial amount of film-based optical or electron microscopy.

N94-201 TITLE: Advanced Lightweight Influence Sweep

CATEGORY: Exploratory Development

SERVICE CRITICAL TECHNOLOGY AREA: Materials and Processes

OBJECTIVE: Develop a liquid-cryogen-free, high temperature superconducting magnet system operating at a field strength of 1 to 3 Tesla and cooled to a temperature of 20 deg Kelvin or higher without the need for liquid Helium or Nitrogen. Demonstrate the operating performance and reliability of the magnet system for applications to magnetic mine sweeping, high efficiency motors and generators, and magnetic energy storage.

DESCRIPTION: The development of high temperature superconductors has progressed to the point where long lengths of conductors having predictable performance characteristics can be produced. Though these conductors operate at relatively low current densities, they have the capability of operating at temperature above the temperature limits of conventional superconductors. Superconducting magnets, wound with high temperature superconductors and cooled with cryocoolers, can operate without using and liquid cryogens eliminating a major application barrier associated with low temperature superconducting magnets.

PHASE I: Design a superconducting magnet system consisting of a magnet wound with high temperature superconductor which is conductively cooled with a cryocooler refrigerator. The magnet will be designed to produce a magnetic field of 1 to 3 Tesla at an operating temperature of 20 deg K or higher. The design study will include determining the effects of winding and Lorentz force stress upon conductor performance, developing conductor splicing techniques, and magnet quench protection.

PHASE II: Fabricate the high temperature superconducting wire and magnet. Design and fabricate the magnet cryostat and assemble the magnet, cryostat, and cryocooler system. Measure and demonstrate system operating performance and reliability to full field and current.

PHASE III: Transition the high temperature superconductor and magnet technology developments to Navy minesweeping and electric propulsion programs.

COMMERCIAL POTENTIAL: The technology has commercial application potential in the areas of high efficiency electric motors and generators, magnetic resonance imaging system, magnetically levitated trains, and magnetic energy storage.

N94-202 TITLE:Surf Zone and Craft Landing Zone Obstacle Clearance

CATEGORY: Exploratory Development

SERVICE CRITICAL TECHNOLOGY AREA: Conventional Weapons

OBJECTIVE: To develop concepts, equipment, and/or techniques to breach transit lanes through defensive (non-explosive) obstacle complexes located in the Surf Zone (0 - 10) and Craft Landing Zone on the beach.

DESCRIPTION: Technologies may include any mix of explosive or non-explosive techniques. Concepts should emphasize high payoff for rapid obstacle clearance, as well as near-term (1995 - 2000) and far-term (2000 - 2010) applications.

PHASE I: Identify potential concepts, means of deployment and cost per system for obstacle breaching mission. Quantify capabilities of each concept.

PHASE II: Demonstrate optimum concept(s) from Phase I study, showing performance objective is achievable and capable of being deployed from existing fleet assets.

PHASE III: Execute full scale system design and build prototypes for developmental and operational test and evaluation. Demonstrate system readiness for initial operational capability by demonstrating acceptable performance, reliability, maintenance, training procedures, and all other logistic support requirements.

COMMERCIAL POTENTIAL: It could be applicable in the reclamation of abandoned industrial sites located in coastal areas.

N94-203 TITLE:Submarine Combat System C^4I Interoperability

CATEGORY: Advanced Development

SERVICE CRITICAL TECHNOLOGY AREA: Command, Control, Communications

OBJECTIVE: Develop methods to improve the interoperability and integration of the submarine force with other Naval forces, as well as with other Services and Special Operations Forces.

DESCRIPTION: The Navy has shifted its focus from a global threat to one encompassing regional challenges requiring emphasis on joint and combined operations. This new strategic direction, which shifts from open-ocean warfighting "on the sea" toward joint operations conducted "from the sea", most acutely affects the Navy's submarine force. The submarine force needs to evolve its C4I capability to achieve maximum integration of its anti-surface warfare, strike warfare, mine warfare, and special operations capabilities with those of other forces. An analytical methodology is required that addresses and evaluates the effectiveness of the submarine vis-a-vis its prospective roles and missions as the submarine force enhances its capabilities for joint operations, and as they are further tailored to support National needs.

PHASE I: Develop a model of submarine force/other forces C4I interoperability; identify and baseline current capabilities, as well as proposed areas of future integration. Develop a dynamic, simulation/stimulation and scenario-driven techniques to evaluate alternative hardware configuration, and assess the relative contributions of hardware options (including new, developmental, COTS and NDI systems and equipment, as appropriate) in order to optimize information dissemination and interoperability among submarine combat subsystems.

PHASE II: Expand and enhance the Phase I model capabilities to support New Attack Submarine systems, and develop direction and decision-making, resource allocations, engineering design specifications, and

performance assessment functions. Subject information transferred across New Attack Submarine subsystem boundaries to logical simulation and physical models to evaluate information technology applicability to New Attack Submarine systems development.

PHASE III: Produce a submarine force C4I interoperability model that implements methods demonstrated in the Phase II effort.

COMMERCIAL POTENTIAL: Communications resource optimizing techniques and factory process automation.

N94-204 TITLE:Infrared Window Material Improvement

CATEGORY: Basic Research

SERVICE CRITICAL TECHNOLOGY AREA: Material/Sensor

OBJECTIVE: Develop new materials for use in Infrared (IR) Sensor Windows which will exhibit greater resistance to thermal stresses than those currently available. IR bandpass characteristics must be preserved.

DESCRIPTION: The Navy is currently developing several systems critical to the National Defense posture which employ Infrared sensors on board guided missiles. The current applications can expose the protective windows of these sensors to considerable heat loading limitation of existing window material thermal stress characteristics impose significant restrictions upon system capabilities.

PHASE I: Develop a plan to investigate alternative technologies and materials to be used in the IR Window applications. Proceed with analyses and studies to determine the best approach to replacing existing window materials with improved designs. Solutions must meet the functional needs of the IR Sensor as well as requirements for affordability and producibility.

PHASE II: Pending the successful outcome of Phase I efforts, develop and demonstrate improved IR Window technology.

PHASE III: Government-sponsored follow-on R&D is anticipated.

COMMERCIAL POTENTIAL: The new technology may be applicable to design of commercial aircraft sensing systems.

N94-205 TITLE: Growth of Ce:LiCAF/LiSAF for Tunable Laser Operation in the Ultraviolet

CATEGORY: Exploratory Development

SERVICE CRITICAL TECHNOLOGY AREA: Materials/Sensor

OBJECTIVE: Develop growth parameters for boules of Ce:LiCAF/LiSAF and isomorphs for fabrication into high quality laser rods for operation as a frequency-agile, ultra-violet laser source.

DESCRIPTION: Recent research has indicated that the substitution of rare earth ions into the colquirite structure is feasible. Experience from the growth of Cr:LiCAF indicates favorable growth conditions such as low melting points and near unity distributions of the dopant ion. The rare earth ion should occupy the octahedral Ca site in the LiCAF host. In chloride compounds, rare earth ions occupying octahedral sites have exhibited very long lifetimes, which would be favorable for energy storage applications. The Ca site is approximately 1.14 A, which would comfortably accommodate in ion such as Ce, which has an ionic radius of 1.15 A. Recent work by Dubinski, et al, from Kasan State University in Russia has shown that doping of LiCAF with Ce ion is interesting since excitation of the 5d excited state can be achieved with a quadrupled YAG laser at 266 nm, followed by the 5d-4f emission at approximately 280-300 nm. This emission could lead to a tunable UV, laser source, as has been described recently in preliminary reports from Dubinski. This supports ONR/NRL Code 5641 Accelerated research Option on tunable solid state lasers.

PHASE I: Evaluation of the potential to grow high quality boules of Ce:LiCAF/LiSAF. Phase I of such a program would require several boule growths in order to understand the growth characteristics of the Ce-doped crystal. The final portion of Phase I will be to investigate the spectroscopic properties of Ce doped materials, such as emission and absorption cross-sections and upper state level lifetimes. Other such properties to investigate would include the photochemical stability of this material under the uv excitation.

PHASE II: Growth and fabrication of Ce:LiCAF/LiSAF for frequency agile, ultraviolet laser emission. Work with laser researchers to optimize dopant densities and characterize laser output.

PHASE III: The Contractor will grow larger and higher quality crystals and ingots. These materials will be grown with the optimized rare earth (or other) dopant concentrations required to produce power and tunability objectives suitable to application in UV solid state lasers. Phase III will include minimum production capability of crystals suitable for operation in 50 to 100 laser devices.

COMMERCIAL POTENTIAL: This will be the first all solid state tunable UV laser, providing the compactness, reliability, and efficiency necessary for field work. Several communications applications exist for this tunable UV source and additional applications include remote sensing of biological and chemical species. The region around 290 nm is ideal for this remote sensing application since the contaminates have absorption peaks in this region.

N94-206 TITLE: Fiber-Optic Environmental Sensor for ASW/ASUW Applications

CATEGORY: Exploratory Development

SERVICE CRITICAL TECHNOLOGY AREA: Sensors

OBJECTIVE: Develop torpedo environmental sensor with current state-of-the-art sensor technology and miniaturization. The data will update torpedo tactical software executing an attack. The sensor will be required to meet all safety and reliability criteria for ordnance and provide performance in specific tactical scenarios

DESCRIPTION: Address production issues for the proposed sensor to ensure that current and future weapons are safe, reliable, procurable and most importantly capable of defeating any sub, in any water conditions. A capability to incorporate advanced fiber optic sensor technology is required. The new sensor must be capable of measuring temperature, pressure, under water sound velocity and function in various scenarios for the common torpedo of the next century , including missions in ASW, ASUW and Special Operations.

PHASE I: The contractor will examine the constraints of the existing LWT envelope and the specified accuracy requirements; the characteristics of currently available FO sensors (including packaging, power, and performance); and recommend a prototype design for fabrication

PHASE II: The contractor will repetitively re-design (if necessary) and fabricate and test prototype sensor(s), first under laboratory conditions and then in the water, until the feasibility of the selected approach is demonstrated.

PHASE III: Production of design for implementation in torpedoes

COMMERCIAL POTENTIAL: Medicine, Aircraft navigation systems, manufacturing, building and laboratory environmental control

N94-207 TITLE:Propulsion Capability for 3-Inch Submarine Countermeasures

CATEGORY: Advanced Development

SERVICE CRITICAL TECHNOLOGY AREA: Surface/Undersurface Vehicles

OBJECTIVE: Develop propulsion design to provide mobile capability for 3 inch submarine countermeasures.

DESCRIPTION: Mobile acoustic countermeasures provide a distinct tactical advantage against sonar and torpedo threats. Of all the mobile countermeasures developed,only the MOSS is actually in service, and it is expected to be phased out within two years. As a result the submarine community will be left without mobile countermeasures for at least 10 years. Development of an inexpensive mobile countermeasure will provide a cost-effective alternative which will restore this capability to the submarine fleet.

PHASE I: Develop a preliminary design based on launch dynamics and tactical requirements which will include baselines for propulsion, acoustics, electronics, hull and structure, guidance and control systems.

PHASE II: Build and test three demonstration prototypes which will implement the baselines formulated under Phase I. The device will be a 3-inch diameter torpedo jammer capable of speed of 20 knots for three minutes.

PHASE III: Refine tactics and deployment scenarios and compile acquisition and program documentation to support procurement of concept.

COMMERCIAL POTENTIAL: Foreign military sales; fishing accessory.

NAVAL SURFACE WARFARE CENTER/CARDEROCK DIVISION

N94-208 TITLE:Shipboard Sensors for Fuel and Oil

CATEGORY: Exploratory Development

SERVICE CRITICAL TECHNOLOGY AREA: Sensors

OBJECTIVE: Develop new sensors for in-place monitoring the total acid content (to be measured as Total Acid Number (TAN)) of lubricating oils, hydraulic fluids and fuels, and/or for quantitative detection of moisture and water contaminants, in shipboard fuel and oil systems.

DESCRIPTION: New shipboard maintenance concepts are based on the operating condition of fuels and lubricants. Shipboard safe instruments are needed by the Fleet to accurately and rapidly test the acidity/alkalinity of shipboard oils and fuels. Development of sensor-based TAN detection equipment is directly dependent on finding a suitable inexpensive TAN sensor, fabricated with materials whose physical and chemical properties respond predictably and accurately to oil acidity changes. Several promising materials have recently been explored for this purpose and are subject of present studies. New sensors will be used to in-situ accurately measure water/moisture levels over the complete range of contamination concentrations found in both fuel and shipboard lubes/hydraulic fluids. Presently, there are at least three different types of water-specific sensors that may be considered for development.

PHASE I: Explore new sensor technology that would safely characterize fuels and lubricants and choose which sensor(s) could be inexpensively employed in commercial instrumentation.

PHASE II: Build two small prototype instruments for shipboard use. Conduct statistical operational analysis comparing new instruments to ASTM measurements.

PHASE III: Manufacture new instruments and supply to the Fleet, as required.

COMMERCIAL POTENTIAL: The new sensor would replace current laboratory testing and will revolutionize fuel and oil analysis in marine and land-based systems. Financial payback would be enormous since costly and time consuming laboratory testing (e.g., titration) would be eliminated.

N94-209 TITLE:Infrared Coating

CATEGORY: Exploratory Development

SERVICE CRITICAL TECHNOLOGY AREA: Materials and Structures

OBJECTIVE: Develop a coating system, easily and inexpensively applied, that exists in thermal equilibrium with surrounding air temperature, has controlled emissivity, is opaque to IR radiation, does not perturb radiation in the microwave region and meets the standard color requirements of Navy haze gray paint. Coating must be applicable to rubber and other polymeric materials and on metallic surfaces without peeling and cracking in a marine environment. Coating must be easily applied, preferably in a one step method.

DESCRIPTION: This coating treatment must be transparent in the microwave region. The problem of absorbing, storing and reradiating thermal energy in the coating and the substrate which the coating protects will be addressed. Experimentation in particle size, novel use of ceramics as pigments, electrically insulated highly conductive particles, liquid crystals designed for quick response time of energy absorption/dissipation, etc. is encouraged. Resultant coating must not store thermal energy that results in heating to a higher temperature than its surroundings. The coating must prevent solar heating of underlying material and come to thermal equilibrium with its surroundings within a short time frame. Prolonged emission of thermal energy after the surrounding temperature has cooled must be prevented. Investigation of alternatives and novel methods to solve the problem of thermal control may be necessary.

PHASE I: Identify pigments and other materials to be used in formulation.

PHASE II: Formulate system into an easily applied coating.

PHASE III: Scale-up production for economic delivery of coating.

COMMERCIAL POTENTIAL: Control of solar heating/cooling for home and commercial buildings and vehicles, application to solar energy conversion, aesthetically pleasing paints for home/commercial solar collectors.

N94-210 TITLE:Dynamic Simulation of High Power Machinery Systems

CATEGORY: Advanced Development

SERVICE CRITICAL TECHNOLOGY AREA: Training Systems

OBJECTIVE: Develop a computer model of the dynamic behavior of shipboard high power electrical and mechanical machinery systems. This model will produce the instantaneous electrical waveforms using information gathered from a validated reduced order simulation model.

DESCRIPTION: To simulate and model shipboard mechanical and electrical systems (main propulsion, electric power generation, electric drive, or electric guns, for example), the Navy currently must develop costly and time consuming detailed digital models and then use them to parameterize the systems. From these detailed models, reduced-order models are developed; the reduced-order models run faster and system analysis time is reduced. However, the reduced order models can only cover a limited range of parameter variations before they become inaccurate. This SBIR topic looks for methods of producing detailed waveform outputs, like those that would be produced by a detailed digital simulation, from a reduced-order model. This capability will significantly improve the current design cycle (detailed model, to reduced-order model, back to detailed model). A model like this will enhance the capabilities of the Navy to integrate future weapon systems such as electrothermal-chemical guns, electromagnetic aircraft launchers, or high energy lasers into shipboard HM&E systems.

PHASE I: Devise a technique to obtain information from an accurate reduced-order simulation of a high power machinery system and reconstruct the instantaneous steady-state waveforms, including harmonics. Prove the feasibility of this technique to provide the waveforms without performing a detailed computer simulation.

PHASE II: Apply the developed technique to several high power machinery system configurations to validate equipment models within the system and instantaneous waveform reconstruction process.

PHASE III: Navy prime contractors should require technical support.

COMMERCIAL POTENTIAL: This research provides reduced cost simulation and an in-house capability for industry to study a wide range of high power machinery systems.

N94-211 TITLE:Recycling Ships' Plastic Waste

CATEGORY: Exploratory Development

SERVICE CRITICAL TECHNOLOGY AREA: Environmental Quality and Civil Engineering

OBJECTIVE: To obtain the knowledge and understanding of recycling ship-generated plastic wastes, develop suitable technology, and to demonstrate that technology using plastic from a Navy Plastic Processor.

DESCRIPTION: Navy ships generated 0.1-0.2 lb/man/day plastic waste and must retain this waste while at sea for disposal ashore. Most Navy ships will be equipped with Plastic Processors to densify ships' plastic waste for longterm storage. This waste, in densified form, will be returned to shore for disposal. Recycling technology is needed to avoid landfilling potentially valuable plastic, thereby avoiding disposal costs and to further federal recycling goals.

PHASE I: Investigate techniques applicable to contaminated, commingled plastic waste streams.

PHASE II: Demonstrate promising technology using Plastic Processor product.

PHASE III: Transition to the Navy's Advanced Development Program.

COMMERCIAL POTENTIAL: This technology has application in the private sector in the recycling of contaminated, commingled plastic wastes.

N94-212 TITLE:Low-Energy Non-Invasive Methods for Membrane Cleaning

CATEGORY: Exploratory Development

SERVICE CRITICAL TECHNOLOGY AREA: Environmental Quality

OBJECTIVE: Obtain the knowledge and understanding of the mechanisms that cause fouling of membranes in waste-water treatment processes to permit the application or invention of reliable continuous low energy non-invasive methods which will limit membrane fouling.

DESCRIPTION: The primary disadvantage to membrane separation processes is the inevitable and repeated fouling of the membrane surface and the subsequent decline in flux. Typically, the resolution to this problem is the regular use of enzymes, chemicals, or sponge balls to clean the membrane surface and recover flux. Frequent cleanings lead to significant problems associated with logistics, safety, and cost. A continuous low energy non-invasive method which maintained near initial membrane flux would decrease the size of a treatment system as a result of increased production per square foot of membrane surface area. This method would not involve the use of additives or mechanical devices.

PHASE I: Investigate the mechanisms of membrane fouling in wastewater applications. Investigate concepts and develop techniques to continually, and in a non-invasive manner, clean the membrane surface during processing.

PHASE II: Demonstration of a low energy non-invasive method(s) for membrane cleaning on a bench-scale membrane-based wastewater treatment process.

PHASE III: Transition to the Navy's Advanced Development Program.

COMMERCIAL POTENTIAL: This technology has application in the numerous installations using membrane separation in the wastewater treatment and chemical industries.

N94-213 TITLE:Radiation Curing of Pigmented Coatings

CATEGORY: Exploratory Development

SERVICE CRITICAL TECHNOLOGY AREA: Materials and Structures

OBJECTIVE: Development of radiation-cured coatings for Naval or civilian applications which provide anticorrosive protection, and can be applied and cured quickly to both minimally and properly prepared surfaces, including cold surfaces.

DESCRIPTION: A radiation-cured coating is required which will cure at 50 degrees F or lower, and provide a minimum of 3 years service. It should meet the stringent volatile organic compound (VOC) emission standards. In addition, all components should be packaged together so the mixture can be brushed on without requiring prior mixing.

PHASE I: During phase I, different formulations will be investigated: (1) to establish which chemical compositions perform best when subjected to tests which include salt fog (e.g., 500 hrs), impact tests, pencil hardness tests, tape adherence tests; and (2) to establish which surface treatments or formulations effectively increase adhesion.

PHASE II: In-service trials will be conducted, and licensing and commercial production requirements will be developed.

PHASE III: Completion of field trials and scale-up for production.

COMMERCIAL POTENTIAL: Radiation curable coatings have a large maritime and commercial potential because they generally cure in less than one minute, and have almost no volatile organic compound emission. They can be

utilized in industrial plants, e.g., for machinery touch-up applications on non-interference basis, without requiring shutting the plant.

N94-214 TITLE:High-Current Switchgear

CATEGORY: Advanced Development

SERVICE CRITICAL TECHNOLOGY AREA: Electron Devices

OBJECTIVE: The objective of this topic is to develop switches, flexible joints, and interconnection schemes for high current (50,000 to 200,000 Amp), low voltage (less than 1000 volts) a.c. or d.c. power distribution systems. In addition, for signature and safety reasons, stray electromagnetic fields must also be controlled.

DESCRIPTION: Electric Propulsion for ships will require distributing and controlling steady state electric currents on the order of 50,000 to 200,000 amps. At these levels, sizes and stiffness of distribution systems become significant. Buswork designs are required which can accommodate shock and vibration, and resultant relative motions of equipment. Current interruption devices which can handle steady state and fault currents must also be developed. In order to protect personnel and minimize the risk of ship detection, magnetic fields from those currents must be minimized. Additionally, in order to achieve design goals, switchgear, conductors, and connectors will need to be affordable and reliable.

PHASE I: Develop designs for high current switch(es), flexible joint(s) and connectors which minimize stray magnetic fields.

PHASE II: Construct and test prototype hardware for selected design(s).

PHASE III: Develop manufacturing processes for high current components.

COMMERCIAL POTENTIAL: Electric utilities are becoming increasingly concerned about the biological effects of electromagnetic fields. Techniques developed could be transitioned to electric utility applications, albeit at higher voltage and power levels.

NAVAL SURFACE WARFARE CENTER/DAHLGREN DIVISION/WHITE OAK DETACHMENT

N94-215 TITLE:Compact Integrated Electro-Optic Information Storage and Retrieval System

CATEGORY: Exploratory Development

SERVICE CRITICAL TECHNOLOGY AREA: Sensors

OBJECTIVE: To develop and demonstrate a fast, compact, rugged, low cost, very high density optical data storage and retrieval system.

DESCRIPTION: Photopolymer and photorefractive materials provide optical memories capable of storing the equivalent of terabits of data in 1 cubic centimeter volume. However, current mechanisms for randomly accessing this data are handicapped by high cost, bulkiness, and the requirement of precise optical alignment. An improved compact, high performance data storage/retrieval system consisting of a light source, an electro-optic phase/amplitude control device or material which is monolithically interfaced to memory is sought

PHASE I: Development, analysis and/or experiments to show proof of concept.

PHASE II: Develop and deliver a fully functioning prototype compact, integrated electro-optic data storage and retrieval system, including the drive electronics.

PHASE III: Further development in support of a designated Navy application.

COMMERCIAL POTENTIAL: Exists in high speed data storage for array processors, finger print analysis, medical diagnostics and documentation archiving/retrieval.

N94-216 TITLE:Radar Tracking Improvement in Multipath and Deception Environments

CATEGORY: Exploratory Development

SERVICE CRITICAL TECHNOLOGY AREA: Sensors

OBJECTIVE: Air defense tracking radar performance can be seriously degraded by multipath reflections and deception electronic countermeasures (ECM) including repeaters and decoys. The goal of this effort is to identify and evaluate software techniques that mitigate multipath effects. New techniques can be retrofitted into existing shipboard radars to enhance ship air defense.

DESCRIPTION: While tracking radars of all types are candidates for this effort, lock-follow and track-while-scan monopulse radars are of particular interest. In this effort multipath mitigation is of more interest than deception ECM mitigation. At a minimum, software approaches using complex indicated processing will be studied to generate tracking accuracies sufficient for fire control solutions. Obvious techniques, such as track filtering, or previously tested techniques, such as adaptive nulling, are of little interest. Generic, unclassified radar and ECM parameters will be analyzed in Phase I; specific, classified parameters and equipment will be used for Phases II and III, respectively.

PHASE I: The proposed mitigation techniques will be analyzed, via computer simulation to assess improvement in tracking radar performance. Test costs and data collection requirements will be defined in the final report.

PHASE II: Feasibility demonstrations of mitigation techniques will be performed by: (a) off-line processing of field test radar tracking data or (b) on-line processing of data from a government furnished tracking radar. Hardware modifications and software programs will be deliverables from the contractor. A final report, documenting test conditions and results, will be written.

PHASE III: Successful mitigation techniques will be transitioned to retrofit of existing radars.

COMMERCIAL POTENTIAL: Potential commercial and other government applications of the techniques exist such as FAA terminal approach radars.

N94-217 TITLE:Structured Essential Model for Mine Warfare

CATEGORY: Exploratory Development

SERVICE CRITICAL TECHNOLOGY AREA: Software

OBJECTIVE: Develop an abstract, systems-independent, low-level, detailed, structured essential model of Mine Warfare using for example, the established notation of Hatley/Pirbhai, the approach of Ward/Mellor, and/or the software tool -- Cadre Technologies, Inc.'s TeamWork.

DESCRIPTION: The model will be used to determine quantitative requirements for mine countermeasures (MCM) and for mining. These quantitative requirements can then be mapped to candidate solutions (architectures) for solving littoral warfighting scenarios, for the purpose of evaluating and selecting among them. In particular, the appropriate mix and emphasis of the real-time interaction of intelligence, C^4I, precision localization, and MCM equipments can be assessed independently of the present stake-holders.

PHASE I: The chosen contractor can draw upon government material to define requirements, deficiencies, research, technology, development, fleet systems, and existing their use in models. Model notation and consistency will be used to develop a high-level/low-level abstract model of Mine Warfare. From this completed model, provide a preliminary indication of recommendations for the appropriate mix and emphasis of the real-time

interaction of intelligence, C^4I, precision localization, and MCM equipments. Select two initial promising architectures for detailed mapping in Phase II.

PHASE II: Using the two initial architectures recommended in Phase I, map the developed model to architectural models, using the Ward/Mellor or alternative approach. Evaluate each model quantitatively with respect to Structured Essential Model requirements.

PHASE III: Develop detailed designs for the best Mine Warfare architecture, using Ward/Mellor structure-chart design techniques.

COMMERCIAL POTENTIAL: This methodology can be used to demonstrate new potential markets for combining data bases of information with real-time communications and GPS systems.

NAVAL SURFACE WARFARE CENTER/DAHLGREN DIVISION/COASTAL SYSTEMS STATION

N94-218 TITLE:Quiet, Non-Magnetic Propulsion System for Small Expendable ROVs

CATEGORY: Advanced Development

SERVICE CRITICAL TECHNOLOGY AREA: Surface/Subsurface Vehicles

OBJECTIVE: Develop a quiet, non-magnetic or very low magnetic propulsion system to power a small expendable remotely operated vehicle (ROV). This system should also have a low acoustic signature and should be low cost.

DESCRIPTION: The Navy is currently developing small expendable ROVs for use in mine countermeasures. These vehicles must be extremely quiet, acoustically and magnetically, to allow close approach to active sea mines without activating the mine.

PHASE I: Develop and design a non-magnetic, quiet propulsion system. This system should be capable of powering a thirty to fifty pound vehicle at approximately six knots, for a short time period (several minutes), in ten to eighty feet of water. This system's volume should be 175 cubic inches, or less. Specifications and Level I drawings should be developed. The propulsion system should be capable of redesign for larger vehicles if desired.

PHASE II: Fabricate and test the non-magnetic, quiet propulsion system designed in Phase I. These tests will verify that the propulsion system meets the requirements stated above.

PHASE III: Produce a non-magnetic, quiet propulsion system for use in the Navy's Instride Neutralization system development.

COMMERCIAL POTENTIAL: New propulsion system can be utilized by industry in applications requiring non-magnetic propulsion.

NAVAL UNDERSEA WARFARE CENTER/NEWPORT DIVISION

N94-219 TITLE:Integrated Digital Electronic Warfare (ESM) - Communications Receiver Technology

CATEGORY: Exploratory Development

SERVICE CRITICAL TECHNOLOGY AREA: Electronic Warfare

OBJECTIVE: To identify emerging digital radio receiver technology suitable for improving electronic warfare antenna subsystem performance, with the potential for integration of communications receiver functions.

DESCRIPTION: Electronic Warfare (ESM) antenna subsystems are subject to antenna size constraints aboard submarines. The search for ways to maintain or improve signal intercept performance, while reducing antenna size, continues. The Navy needs to fully exploit digital electronic receiver technology in establishing ESM antenna size

tradeoffs. Similar tradeoffs exist in submarine communications. It is desirable to consider collocating antenna and receiver functions to jointly serve electronic warfare and communications requirements.

PHASE I: Analyze digital communications intercept techniques in conjunction with ESM antenna size tradeoffs. Identify opportunities to collocate communications receiver functions with communications intercept (ESM) functions as part of a communications antenna size tradeoff in UHF and SHF bands.

PHASE II: Develop high performance digital receiver(s) with direct application to ESM and communications functions. Demonstrate an improved digital intercept receiver with ESM and communications antennas at the Naval Undersea Warfare Center, New London.

PHASE III: Develop a prototype, dual purpose, integrated digital receiver that improves antenna subsystem performance for ESM and communications.

COMMERCIAL POTENTIAL: New equipment and methodology applicable to broadband commercial wireless communications.

SPACE AND NAVAL WARFARE SYSTEMS COMMAND

N94-220 TITLE:Standard Database User Interface

CATEGORY: Basic Research

SERVICE CRITICAL TECHNOLOGY AREA: Software

OBJECTIVE: To develop tools for visualizing and managing large and multi-media data bases using a standard GUI, making it easier for the operator to exploit ever larger information domains, independent of application or platform.

DESCRIPTION: Traditional database management technologies typically implement single, or terminal, end-user functions based on specific applications or user requirements and well defined data sets. Current database management tools, even if multi-user, implement front-end applications which are proprietary, and must be re-developed to run on top of other commercial database products. Thus the domain for data access and integration into useful, even creative, products, is still limited. As multi-media applications and databases evolve to include more data types, applications, and users, a need for a standard, open system interface to visualize and manage the data in the data base will become more and more important. It is clear that without such visualization and manipulation, the user's ability to exploit the information contained in a large multi-media data base in a timely manner will be greatly restricted and may be limited to single applications. In addition, the flexibility required to add new data management processes, such as object data management, will be limited.

PHASE I: Complete a 6 month study to identify a standard visualization/ manipulation technique suitable for large multi-media data bases which support 1D, 2D, 3D, and continuous (4D) representations. Demonstrate this on a single computer platform using a UNIX environment and a specific data type.

PHASE II: Develop and implement improvements and enhancements to the data visualization/manipulation techniques to encompass a broad range of data types with a large data volume. Demonstrate this capability on a network, across different operating systems and commercial database engines.

PHASE III: Transition this technology to a high-end government owned workstation which runs on a government owned network and has access to a large data volume.

COMMERCIAL POTENTIAL: This technology could be applied over a broad range of commercial, medical, and industrial users.

N94-221 TITLE: Controllable Take-Off Angle High Frequency Antennas

CATEGORY: Exploratory Development

SERVICE CRITICAL TECHNOLOGY: Communications

OBJECTIVE: Develop a high frequency (2-30 Mhz) antenna that will enable control of the take-off angle independent of frequency and antenna height.

DESCRIPTION: The Navy currently uses three types of high frequency transmitting antennas: vertical monopoles, horizontal monopoles, and wire fan antennas that excite the ships' structure. All these antennas exhibit variations in take-off angle resulting from the mounting position above the effective ground plane and the frequency in use. This results in changes in communications range as the frequency or antenna selected is varied. Given the requirement to maintain point-to-point communications, it is desirable to develop an antenna that will maintain a constant or controllable take-off angle throughout the high frequency spectrum. Take-off angles of interest range from low(near the horizon) for long haul propagation to high (near-vertical ionospheric incidence) for short range circuits.

PHASE I: Develop the basics of antenna characteristics and their interaction with shipboard structures. Determine characteristics of existing antenna designs that determine take-off angles, and performance penalties which are related to the requirement to control take-off angle.

PHASE II: Develop, test, and demonstrate an antenna or antennas that feature a controllable take-off angle or a take-off angle independent of frequency. The antenna(s) will be suitable for shipboard installation for test purposes. The antenna(s) shall operate across the high frequency band with a VSWR of less than 4:1, and have an omni-directional pattern in the horizontal plane and accept an input power of at least one kilowatt, preferably four kilowatts.

PHASE III: Produce an antenna for shipboard use that meets all the above criteria and is qualified for shipboard installation.

COMMERCIAL POTENTIAL: This antenna will enhance any high frequency point-to-point communications circuit by alleviating the need to consider take-off angle when adjusting operating frequency for ionospheric changes.

N94-222 TITLE:Automated Detection and Identification of Materials in Hyperspectral Images

CATEGORY: Exploratory Development

SERVICE CRITICAL TECHNOLOGY AREA: Software/Sensor

OBJECTIVE: Develop a robust technique for automatic detection and identification of target materials in hyperspectral images.

DESCRIPTION: Several techniques for detection and identification of materials in multi/hyperspectral images have been used from various types of statistical classifiers to correlation/matched filter based approaches. The statistically based classifiers are limited since they do not account for the prevalent case of mixed pixels which are pixels that contain multiple spectral classes. Existing correlation/matched filter based approaches suffer from the mixed pixel problem as well as the limitation that the output of the matched filter is non-zero and quite often large for multiple classes since the spectral signatures of materials are not orthogonal vectors. This effort is directed toward development and implementation of an improved technique that has the following characteristics:
1) Both pure and subpixel cases are addressed (e.g., each pixel can belong to multiple classes); 2) Prior knowledge of background material spectral signatures is not required;
3) The technique performs well at low Signal-to-Noise Ratios (SNRs) (e.g., 25:1 referenced to 50% reflectance); and
4) The technique has a mathematically rigorous description, and its performance as a function of SNR and other relevant parameters can be evaluated quantitatively.

PHASE I: Conduct a 6 month study to develop the theory and simulate the detection and identification technique. A theoretical performance/sensitivity analysis will be performed. Both simulated and real imaging spectrometer data sets will be processed to verify the performance of the technique.

PHASE II: After prototyping the technique will be implemented in a Government owned spectral processing workstation.

PHASE III: Demonstrate use of this technique in conjunction with existing Navy hyperspectral sensors is anticipated.

COMMERCIAL POTENTIAL: The technology has application to several problems such as agricultural monitoring, pollution control and environmental assessment.

N94-223 TITLE:Demand Assigned Multiple Access (DAMA) Network Manager

CATEGORY: Advanced Development

SERVICE CRITICAL TECHNOLOGY AREA: Command, Control, Communication

OBJECTIVE: Design, develop and demonstrate an super high frequency (SHF) DAMA network controller that will optimize SHF DAMA access utilization by allowing rapid network-wide re-configurations of circuit parameters. The controller shall permit the rapid design and automatic implementation of tailored SHF Satellite Communications (SATCOM) connection plans by fleet communicators.

DESCRIPTION: The Demand Assigned Multiple Access (DAMA) modems currently being procured for Navy SHF SATCOM are capable of limited remote control. An SHF DAMA network controller is needed to simplify the operation of these modems as a network. The controller software should be developed in a windowing environment and facilitate the integration of current PC-based modem control software. The controller shall also provide a standard interface for control signaling exchange with the Copernicus Tactical Data Information Exchange Subsystem (TADIXS) Network Manager.

PHASE I: Define the operational requirements for the SHF DAMA Network controller. Develop a Software Requirements Specification (SRS) for the controller.

PHASE II: Develop and demonstrate a prototype SHF DAMA Network Controller system.

PHASE III: The SHF DAMA network controller can be used as a basis for development of commercial Ka and Ku band network controllers.

COMMERCIAL POTENTIAL: The Copernicus TADIXS architecture specifies the use of either the defacto standard Simple Network Management Protocol (SNMP) or the International Standardization Organization (ISO) Common Management Information Protocol (CMIP) for the Network Manager control signaling interface. The use of open system standards and commercial products in the Network Manager make it directly applicable not only to commercial satellite communications systems but to most commercial telecommunications systems. state-of-the-art telecommunications equipment provides a standard Control and Management interface which complies with SNMP. New products with CMIP interfaces are appearing on the market as industry begins to adopt the ISO standard.

N94-224 TITLE:GPS Anti-Jam Antenna

CATEGORY: Exploratory Development

SERVICE CRITICAL TECHNOLOGY AREA: Command, Control, Communication

OBJECTIVE: Develop a GPS antenna with beam steering, and adaptive nulling features to aid GPS initial acquisition and track phases.

DESCRIPTION: GPS receivers used by the military and civilian communities may be forced to track and/or to perform an initial acquisition of GPS satellites in the presence of jamming. GPS anti-jam antennas with high gains and narrow beamwidths can be steered toward GPS satellites while creating nulls in other directions. This will increase the

received satellite power levels while significantly attenuating any unwanted incident jammer power levels to ensure successful GPS initial acquisition, and subsequent GPS track. The proposed GPS anti-jam antenna should not be larger than the present Fixed Reception Pattern Antenna (FRPA) currently used by Navy aircraft. The GPS anti-jam antenna shall be capable of steering toward four or more GPS satellites (sequentially or in some other optimal fashion) at a rate that will provide sufficient navigation fixes to meet the performance requirements of high dynamic fighter type aircraft.

PHASE I: Conduct a six month study to determine existing literature and software on adaptive null-forming and beam steering antennas. Determine potential requirements for external aiding systems such as Attitude and Heading Reference Systems (AHRS) or Inertial Navigation Systems (INS) which could provide azimuth and elevation steering commands. Analyze use of current almanac, ephemeris, and time from one satellite in assisting in the acquisition and track of other satellites. Prepare preliminary report on findings.

PHASE II: Develop detailed designs and build a prototype of the GPS antenna.

PHASE III: Demonstrate the prototype system under operational conditions. Produce a report and briefing containing test results.

COMMERCIAL POTENTIAL: Airlines, ships, and all potential GPS users.

N94-225 TITLE:Shallow-Water Surveillance Data Fusion

CATEGORY: Exploratory Development

SERVICE CRITICAL TECHNOLOGY AREA: Software

OBJECTIVE: Develop innovative signal processing algorithms to demonstrate the feasibility of data fusion and situation display in support of Joint Surveillance missions in shallow water for target detection (submarines, mine laying, surface ships, and swimmers) at reduced cost.

DESCRIPTION: Joint surveillance requirements exist to fuse disparate data from multiple sources, of differing resolution, timeliness, and confidence into a combined assessment of regional shallow water environments. A robust shallow water surveillance capability is important to ensure the Navy's success against targets in future regional conflicts. Accomplishment of this synthesis dictates evaluation and integration of theater, force organic, national and non-traditional sensor data. The situation display of the product must go beyond traditional contact, track, track projection, warfare area and current mission manipulation and displays. The ability to cue other collection assets under dynamic conditions and providing relevant displays is of primary concern. Proposals should offer specific algorithmic chains.

PHASE I: Conduct an analysis to determine approach for integrated algorithms and display concepts for joint surveillance situation assessment and dynamic sensor management. This analysis will include the effects of specific shallow water problems (reverberation, multipath, bottom slope, interfering noise, water clarity,etc.). Prepare an algorithmic specification and provide a technical report.

PHASE II: Design, develop and demonstrate an integrated multisensor data fusion and situation display system using existing or new algorithms/code, as appropriate. Demonstration will be conducted in a realistic environment and require an innovative concept for demonstrating the system. The Navy will support the contractor's demonstration efforts. Provide a detailed technical and test report. Update algorithmic chain and display format specifications.

PHASE III: Transition is to the Surveillance Direction System.

COMMERCIAL POTENTIAL: Law Enforcement (drug interdiction and illegal fishing vessel management). Oceanographic Research (whale and fish tracking).

N94-226 TITLE:Neural Net Temporal Pattern Signal Recognition and Classification

CATEGORY: Exploratory Development

SERVICE CRITICAL TECHNOLOGY AREA: Software

OBJECTIVE: Develop neural network techniques for detecting and recognizing weak, temporal signals of interest (SOIs) and signals not of interest (SNOIs) in the presence of interference and non-Gaussian noise.

DESCRIPTION: Neural network research has been active for some time. Its application to signal processing has many potential benefits, among them signal identification, filtering, adaptive detection, and search. Significant experience has been gained in the field of static pattern recognition, and neural nets have been particularly successful in that domain. Applying them to the difficult problem of reliably detecting and recognizing weak, temporally varying signals, however, remains a challenge, but shows promise. This effort attempts to develop new techniques to detect and recognize conventional signal types within a dense, dynamically changing, interference environment.

PHASE I: Conduct a 6 month effort to develop and validate potentially useful neural net techniques as applied to detecting and recognizing weak, temporal signals in the presence of interference. The study will involve validating the technique against a simulated environment containing a combination of signal types at varying levels of interference.

PHASE II: Develop and implement the technique in a signal processing workstation environment. Apply the technique against real data sets containing dense emitter environments.

PHASE III: Transition the technique to a government owned signal analysis workstation.

COMMERCIAL POTENTIAL: Cellular telephone industry.

N94-227 TITLE:Improved VHF Antenna System

CATEGORY: Exploratory Development

SERVICE CRITICAL TECHNOLOGY AREA: Command, Control, Communication

OBJECTIVE: Develop a hybrid VHF antenna capable of simultaneous reception of the Automatic Picture Transmission (APT) signal and the TIROS Information Package (TIP) data stream from the NOAA TIROS satellite.

DESCRIPTION: Two critical remote sensing data streams available from the NOAA TIROS satellite are currently received on separate U.S. Navy satellite receiver systems, despite the two data streams being transmitted on nearly coincident VHF carrier frequencies. The medium resolution APT satellite atmospheric imagery, transmitted at 137.50 and 137.62 Mhz, is received by the main antenna of the Mobile Oceanographic Support System (MOSS). The TIP data stream, containing "ARGOS" transmitter data, is transmitted at 136.77 and 137.77 Mhz, and is receivable only by the antenna system of the FG-7104 Local User Terminal (LUT), both operated by the Naval Oceanography Command. A hybrid antenna capable of simultaneously receiving both the APT and TIP signals would allow both signals to be received and displayed on the MOSS.

PHASE I: Assess possible designs which assure sufficient noise filtering and signal pre-amplification; perform trade-off studies.

PHASE II: Develop and build prototype antenna; test ashore on MOSS equipment to troubleshoot and finalize design; test prototype at sea to simultaneously receive both the APT and TIP signals in various weather conditions.

PHASE III: Anticipate Navy and possible other DOD sponsorship to upgrade current systems.

COMMERCIAL POTENTIAL: The hybrid antenna, working in conjunction with a dual-use VHF receiver circuit card constructed to fit in the expansion slot of a DOS- or UNIX-based notebook computer would provide a unique combination of easily received atmospheric imagery and "ARGOS" transmitter data. No such system is available today, commercial or otherwise.

N94-228 TITLE:Navigation Systems for Drifting Buoys, Autonomous Vehicles and Underwater Platforms

CATEGORY: Exploratory Development

SERVICE CRITICAL TECHNOLOGY AREA: Command, Control, Communication

OBJECTIVE: Development of accurate, durable, low power, non-magnetic navigation systems to determine position and heading for use in drifting buoys, small autonomous underwater vehicles and other underwater platforms.

DESCRIPTION: Existing navigation systems used in sonobuoys, drifting buoys and other autonomous platforms are inadequate. For example, magnetic compass engines develop long term drift, can be affected by metal objects and lack the directional accuracy required for determination of heading for some applications. In addition, all U.S. Navy drifting buoys that use the Data Collection System (DCS) of the NOAA TIROS satellite ("ARGOS" system) rely on satellite-measured doppler shift data to determine buoy position. The process of using doppler shift calculations for position fixing uses complex orbital model algorithms initialized by an extensive and costly network of fixed "ARGOS" reference transmitters. Organic navigation systems (e.g., combinations of electronics such as GPS receivers, optical compasses, etc.) could vastly improve position fixing/heading. Such systems would necessarily require low power and cost, and be extremely compact in size and weight.

PHASE I: Technology assessment of the state of the art of compass/navigation systems for small, light, low powered applications. A summary report and conceptual design/approach will be delivered.

PHASE II: Develop, test, and evaluate a prototype navigation system for use on expendable drifting buoys/autonomous vehicles and swimmer navigation systems.

PHASE III: Pending successful completion of Phase II, an Engineering Development program (6.4) will be pursued. Transition to operational use is anticipated.

COMMERCIAL POTENTIAL: A non-magnetic navigation system has a wide variety of commercial applications.

N94-229 TITLE:Increased Antenna Bandwidth at High Frequency HF and Ultra High Frequency UHF Applications

CATEGORY: Advanced Development

SERVICE CRITICAL TECHNOLOGY AREA: Command, Control, Communication

OBJECTIVE: Develop a broadband antenna design approach using Genetic Optimization Algorithm.

DESCRIPTION: The Navy currently uses trial and error techniques in providing the parameters for component selection to achieve a level of acceptable gain and impedance performance for Shipboard topside antennas.

PHASE I: Design a broadband HF antenna using the Genetic optimization algorithm. The algorithm is to be applied to the design of various low-pass and high-pass band filters operating between practical terminal conditions. The design would take into account both the antenna loading and the matching network thus achieving optimal gain and impedance performance.

PHASE II: Utilizing the Genetic Optimization Algorithm develop, test, and demonstrate a 2-30 Mhz broadband antenna. The antenna shall be operable within 2-30 Mhz and be practical for installation in a shipboard topside environment with matching network no greater in size than currently used for shipboard. Single whip dipole antennas. The antenna will have minimal EMI/EMC characteristics and an optimal power efficiency that is superior to that of the present design.

PHASE III: Produce antennas that utilize the Genetic algorithm or Produce software for use by antenna manufacturers to use in production of Navy HF and UHF antennas.

COMMERCIAL POTENTIAL: New Genetic Algorithm would be used by all antenna manufacturing requirements that have broadband commercial applications.

N94-230 TITLE:Distributed Feedback Laser for Fiber Optic Multiplexing

CATEGORY: Exploratory Development

SERVICE CRITICAL TECHNOLOGY AREA: Electron Devices/Sensors

OBJECTIVE: Develop and fabricate pressure and temperature tolerant pigtailed distributed feedback laser for wave length division multiplexing in fiber optic data links. The lasers must be capable of being fabricated to operate at specified pre-selected wavelengths in the region from 1.52 to 1.56 microns.

DESCRIPTION: The capability of undersea fiber optics system can be significantly enhanced through the use of wavelength division multiplexing. For long haul links the preferred operating wavelength region is near 1.55 microns, where fiber loss is a minimum and erbium amplifiers can be used. The use of an erbium optical amplifier coupled with this laser development could boost the power to approximately 17 dBm. The design goals are: stable output power in excess of 1 milliwatt, wavelength variation of less than 1 nanometer, small package design (maximum dimensions 1 mm X 12 mm X 30 mm), and consistent performance at pressures between 0 to 10,000 pounds per square inch (psia) and temperature from 0 to 40 degrees Celsius without active cooling.

PHASE I: Design a distributed feedback laser (or design a coupled laser/amplifier) fabrication process which allows for an emission wavelength that can be selected in the range from 1.52 to 1.56 microns. Design a single mode fiber pigtailed laser package that enables laser operation over wide pressure and temperature ranges without the use of thermoelectric coolers.

PHASE II: Fabrication of several lasers with pre-determined emission wavelengths in the 1.52 to 1.56 micron region with a precision of 2 nanometers should accomplished. Typical wavelength difference for the fabricated laser will be between 10 and 20 nanometers. The lasers should be tested with respect output power and spectral characteristics over a pressure range from 0 to 10,000 psia, and over a temperature range from 0 40 degrees Celsius.

PHASE III: Laser transmitters should be fabricated for a demonstration of a three channel multiplexed data link system. The emission wavelengths will be specified values in the 1.55 micron region. Specification capabilities of the multiplexed data link system will be provided to the All Optical Deployed Sensors prime contractor as an enhanced component/device for potential technology insertion into Advanced Distributed Systems (ADS).

COMMERCIAL POTENTIAL: Increased data capacity for undersea and land telecommunication systems per fiber by a factor of five to ten.

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

N94-231 TITLE: A Technique to Integrate Independently Developed Decision Aid Models

CATEGORY: Exploratory Development

SERVICE CRITICAL TECHNOLOGY AREA: Software

OBJECTIVE: Initially, explore the development effort to integrate disparate decision aids and demonstrate the problems. Develop working a version and then a suitable product for insertion in a major military decision support system. Show how dissimilar algorithms can contribute a greater decision capability when integrated (by this technique) into a cognitive tactical paradigm.

DESCRIPTION: This topic seeks the solution of the problem of integrating disparate processes, models and algorithms without re-writing the software. There are stand-alone Tactical Decision Aids which contribute partial solutions that are subsets of larger, more comprehensive problems and must be integrated manually by the decision-maker, into the context of his more encompassing decision process. There is no process for integrating independently developed decision aids into a single interactive, on screen display process. For instance, target managers will be aided in their decisions if the interaction of various existing target tracking algorithms can be compared and interleaved. This effort

would apply the results of academic research in Model Management Systems, to an exploratory demonstration of target tracker integration.

PHASE I: Develop a JOINT Surveillance Architectural Overview for the 1998-2003 time-frame. Bound the requirements for sensor assets and fusion with a Power Projection scenario, hypothesizing three possible integrated surveillance systems. Develop a prototype mock-up of the Model Management System technology using trackers that support the integration of surveillance information from Theater, Organic, and Non-traditional sources.

PHASE II: Create a working version of a Model Management System applying tracker algorithms in the Joint Surveillance Architecture. The successful completion of Phase II of this program will provide a stand-alone (i.e. dedicated host) Model Management System that integrates independent tactical decision aids and which can be he-hosted into Unified Build (UB) as an operating system utility.

PHASE III: Develop a Model Management System, available as an upgrade to the UB. Such an upgrade would be an integration mechanism that would allow the individual Optional Application Tapes (i.e. the models) to interact under an operator's control. This would be major breakthrough in interactive decision support technology and would be applicable to several joint surveillance programs such as the Maritime Surveillance Anchor Desk and the Advanced Deployable Surveillance with Surveillance Direction System, also command and control concept programs such as Croesus and T/R/S.

COMMERCIAL POTENTIAL: This technology will be directly applicable to integrating the operations analysis models of the Management Science discipline. Existing models such as those of Utility Theory, Product Mix, Blending, Transportation, Queuing, Game Theory, and Inventory can be directly integrated by the technology of Phase II. This success would offer the first interactive decision support tool that bridges the gap among the disparate management domains of a corporation, a very real commercial benefit.

N94-232 TITLE:Microelectronic Packaging Using Diamond Film Heat Spreaders

CATEGORY: Advanced Development

SERVICE CRITICAL TECHNOLOGY AREA: Electron Devices

OBJECTIVE: Investigate suitable combinations of microelectronic packaging materials to use with diamond film heat spreaders for optimal package performance.

DESCRIPTION: Diamond film is a new technology finding application in dissipating heat in high power microelectronic packages where thermal problems exist using current thermal management methods. The properties of diamond film make it well suited for this application, especially in military high power electronic packages. However, there are several concerns with this technology that warrant further research. First, the use of this material in combination with existing microelectronic packaging material has not been well investigated. Second, initial use of diamond film as a heat spreader in microelectronic packages has indicated that problems exist in the intermetallic bonding of diamond film to surfaces. Third, the appropriate placement of diamond film within the package for best thermal performance has not been investigated.

PHASE I: Investigate and test suitable materials to use with diamond film heat spreaders. Materials must be commonly used within microelectronic packages. Develop methods for integrating diamond film with current high power microelectronic packaging techniques.

PHASE II: Develop prototype high power microelectronic packages that use diamond film heat spreaders in conjunction with the materials identified in Phase I. The prototype packages must show optimal performance when compared to similar packages that use current materials and thermal management technology. In addition, moderate to high volume manufacture of the packages should be addressed.

PHASE III: Integrate Phase II developments into the design and manufacture of high power microelectronic package for Navy systems.

COMMERCIAL POTENTIAL: High power microelectronic packages are used in commercial communications systems; satellites, avionics, and other industrial and consumer products.

N94-233 TITLE:Encyclopedic Browsing

CATEGORY: Exploratory Development

SERVICE CRITICAL TECHNOLOGY AREA: Human System Interface

OBJECTIVE: Develop a domain-independent indexing scheme which would allow rapid and flexible encyclopedic access to large multi-domain knowledge bases.

DESCRIPTION: Current indexing schemes are inadequate for true encyclopedic browsing. They require that all possible uses of the indices and of the information being retrieved be anticipated prior to structuring the index system. In addition, they impose an artificial rigidity on the search process. Given that machine knowledge bases will continue to increase in size and complexity, that requirements to search large knowledge bases will expand, and that tactical decisions made under stressful conditions require rapid access to information, a system that provides rapid and flexible access to large multi-domain knowledge bases is necessary. In such a system an index is extracted or derived from the content of the object being indexed and used to determine whether the object is likely to be applicable in a given situation.

PHASE I: Develop the basics of a human system interface (HSI) which provides domain-independent context-sensitive encyclopedic browsing capability. The HSI must provide access to a large multi-domain knowledge base.

PHASE II: Develop, test, and operationally demonstrate an encyclopedic browsing HSI capability.

PHASE III: Produce an encyclopedic browsing HSI which implements the methods demonstrated in the Phase II SBIR effort.

COMMERCIAL POTENTIAL: A new methodology for an encyclopedic browsing HSI will be useful in any context where large knowledge bases must be accessed, e.g., medical diagnostic and support systems, business and economic systems, science and technology systems.

NAVY PERSONNEL RESEARCH AND DEVELOPMENT CENTER

N94-234 TITLE:Measuring the Effect of Drawdown Programs on Personnel Retention

CATEGORY: Exploratory Development

SERVICE CRITICAL TECHNOLOGY AREA: Personnel and Manpower

OBJECTIVE: To develop a methodology to measure the marginal impact of drawdown policies on retention behavior

DESCRIPTION: Drawdown policies have had both direct and indirect effects on the retention of officer and enlisted personnel. however, it is difficult to disentangle these effects from normal voluntary behavior. This research would develop a methodology for identifying impacts and making adjustments to retention and continuation data.

PHASE I: Develop a theoretical model to statistically isolate the retention effects of drawdown policies including VSI/SSB, SER, HYT, 15-year retirement, and others.

PHASE II: Using actual data on personnel retention during FY92-93 estimate the model.

PHASE III: Take the results from Phase II and apply adjustments to existing retention data from FY92-93. Also, using the same methodology, estimate future adjustments for FY94-97.

COMMERCIAL POTENTIAL: Methodology can be used by other services to make adjustments to attrition, retention and continuation data, to obtain estimates of "normal" rates.

N94-235 TITLE:Configuring the Total Navy Workforce under Alternative Strategic Scenarios

CATEGORY: Exploratory Development

SERVICE CRITICAL TECHNOLOGY AREA: Personnel and Manpower

OBJECTIVE: Develop new measurement and configuration methods to increase accuracy and response of force sizing models.

DESCRIPTION: With a large decrease in force levels, the size of the Navy's support structure is expected to receive disproportionate "downsizing" pressure. With a workforce of almost 800,000 military and civilian personnel, even small errors in estimating the effects of changes in force levels have large workforce consequences. Typically, "rules-of-thumb" are used to make these estimates. Improvements in both model specification and measurement would increase capability.

PHASE I: Develop new workforce estimating relationships to reduce the number of fixed ratios used in forecasting the effects of alternative force levels. Model will embed total workforce, including proximate and second order effects and include both civilian and military components.

PHASE II: Develop, test and operationally demonstrate model which implements the methods formulated under the Phase I SBIR effort. The evaluation will employ mean absolute percentage error measures as well as "cost-of-error" measures.

PHASE III: Government-sponsored, non-SBIR, follow-on R&D, as required.

COMMERCIAL POTENTIAL: Workforce management in the commercial sector can benefit from more humane and effective methods for "rightsizing" afforded by this technology.

N94-236 TITLE:Models of Test Compromise

CATEGORY: Exploratory Development

SERVICE CRITICAL TECHNOLOGY AREA: Personnel and Manpower

OBJECTIVE: To develop a procedure for decrementing the aptitude test scores of those examinees that compromise test items.

DESCRIPTION: Model-based measures have been developed to classify examinees into those who have compromised one or more test items versus those who have not compromised test items. Although this information could be used to reprimand or punish applicants that appear to have cheated, operationally this could be problematic. Any detection procedure is less than perfect, and strong administration action based on a fallible measure could be undesirable from a public relations standpoint. A preferable approach would be to incorporate a decrement into the scoring procedure which, in effect, lowers the scores of those examinees that have response patterns similar to cheaters.

PHASE I: Develop item response models of test compromise. These models should incorporate the rate of item exposure (frequency of test item usage). Items with frequent usage are more likely to be compromised.

PHASE II: Develop estimation procedures for specifying the proportion of examinees that cheat on one item, two items, three items, and so forth.

PHASE III: Use the models developed in Phases I and II to specify a posterior distribution of ability given the observed response pattern. This posterior distribution should be computed from the response models for both normal and cheating applicants.

COMMERCIAL POTENTIAL: This procedure will have important use for standardized measures of aptitudes and abilities. This procedure could be used by commercial test publishers.

N94-237 TITLE:A System for Designing Random Access Instruction for Navy Courses

CATEGORY: Exploratory Development

SERVICE CRITICAL TECHNOLOGY AREA: Training Systems

OBJECTIVE: Determine the feasibility of developing an instructional design system based on Cognitive Flexibility Theory.

DESCRIPTION: Cognitive Flexibility Theory stresses that advanced knowledge acquisition is not only complex but also non-linear. Learners' goals must shift from familiarity and memorization to mastery of concepts and applications. The learner must adapt to radical changes in situational demands. While Navy instructional design has traditionally relied heavily on linear media such as textbooks, manuals and lectures, such media are most suited to material which is well-structured and relatively simple. The most effective delivery systems for developing cognitive flexibility in trainees require capabilities for random (rather than sequential) access. Technologies such as hypermedia and videodiscs permit non-linear, multidimensional instruction. Since complex content is often situation specific, situational complexities must be taken into consideration. In ill-structured domains, inter-case variability is too large for instruction based on abstracted conceptual knowledge. Thus, a case-centered approach is needed.

PHASE I: Examine critical elements of Navy training for complex content domains, and determine the applicability of Cognitive Flexibility Theory for designing random access instruction. The approach should be sufficiently generic to be applicable to several areas of advanced instruction.

PHASE II: Develop guidelines for a prototype system which delivers nonlinear, random access instruction in an important or critical Navy training area.

PHASE III: Develop and evaluate instruction based on these guidelines.

COMMERCIAL POTENTIAL: Primary marketing potential is in public education and increased training effectiveness for complex instruction in advanced concepts.

NAVAL MEDICAL RESEARCH & DEVELOPMENT COMMAND

N94-238 TITLE:Tactile Transducer Design/Development

CATEGORY: Exploratory Development

SERVICE CRITICAL TECHNOLOGY AREA: Medical

OBJECTIVE: To design and develop a tactile transducer for vibratory stimulation of the skin.

DESCRIPTION: The use of the vibrotactile sensory system for information transfer is the subject of many perception/cognition studies, specifically, the use of a tactile interface to improve situational awareness in the aviation and diving communities. However, even in the controlled atmosphere of the laboratory, the transducers available for Often, loading by the skin and surrounding tissue provide significant damping resulting in a reduction in stimulation amplitude. A device must be designed that is small, lightweight and capable of producing a vibratory stimulus above the sensory/recognition threshold. Several means for providing the efficient transfer of energy from the transducer into kinetic energy or vibratory movement of the skin and surrounding tissue have been proposed including:

1. Piezoceramic;
2. Electromagnetic;
3. Pneumatic; and
4. Direct Electrical Stimulation.

PHASE I: Provide detailed design drawings of the components and a prototype unit capable of safely producing an adequate stimulus at low energy consumption.

PHASE II: First six months, refine and test prototype unit for proof of design. Finally, optimize the transducer unit to include manufacturability and reliability considerations.

PHASE III: Produce a marketable tactile transducer that implements the attributes demonstrated during the Phase II SBIR effort for commercial applications.

COMMERCIAL POTENTIAL: The hearing and visually impaired, commercial aviation and diving communities as well as virtual reality applications are envisioned as beneficiaries of this development effort.

N94-239 TITLE:Radiolucent Shrapnel Locator

CATEGORY: Exploratory Development

SERVICE CRITICAL TECHNOLOGY AREA: Medical/Sensor

OBJECTIVE: Develop a detection and location device for shrapnel that is undetectable with standard x-ray equipment and imaging techniques.

DESCRIPTION: Shrapnel can produce serious injuries that may not become apparent until hours or days later. However, in many cases, the patient may be at greater risk from the trauma of attempted localization and removal than from the complications of retained shrapnel. Therefore, patient care is optimized when the size and location of shrapnel is determined prior to undertaking exploratory surgery for its removal.

PHASE I: Develop all the design specifications and circuitry to construct a non-invasive device that detects, locates, and ideally images rigid, radiolucent shrapnel (e.g. plastic, wood, unleaded glass) anywhere inside an intact human. The technology selected and its application must be capable of satisfying FDA approval criteria for medical devices, and be portable for use in military field hospitals.

PHASE II: Using the design specifications and circuitry developed during the Phase I SBIR, fabricate, test, and operationally demonstrate a prototype device that detects, locates, and ideally images rigid, radiolucent shrapnel (e.g. plastic, wood, unleaded glass) anywhere inside an intact human.

PHASE III: Produce a radiolucent shrapnel detector derived from the prototype Phase II SBIR device.

COMMERCIAL POTENTIAL: High; urban violence, industrial accidents, and motor vehicle accidents commonly produce imbedded radiolucent foreign bodies.

N94-240 TITLE:Combat Swimmer Underwater Decompression Computer for Air and Nitrogen Oxygen Diving

CATEGORY: Advanced Development

SERVICE CRITICAL TECHNOLOGY AREA: Medical/Computer

OBJECTIVE: Develop a small diver carried decompression computer capable of fully implementing the NMRI Air/ Nitrogen Oxygen Probabilistic Decompression Model in real time and which will record, store and download dive profile information.

DESCRIPTION: The Naval Medical Research Institute (NMRI) has developed a probabilistic decompression model (the NMRI Decompression Model) which will form the basis of the new USN Air and Nitrogen-Oxygen Decompression Tables. NMRI has also developed a real time implementation of the decompression model (the NMRI Real Time Algorithm) which runs on 486 personal computers. Diver carried hardware is needed which will implement this algorithm in real time. Hardware must meet criteria specific to the combat swimmer mission (acoustic and magnetic signature) and be rugged enough to withstand the rigors of real life missions. The NMRI algorithm is computationally intensive and may necessitate custom chips designs.

PHASE I: Develop all design specifications and circuitry including a microprocessor capable of fully implementing the NMRI Decompression Model in real time. NMRI will provide the decompression model in a format

capable of running in real time on a 486 personal computer and will provide technical support to ensure that hardware model implementations are performing calculations correctly. Specifications must developed in close cooperation with the Navy combat swimmer community to ensure all relevant needs are met and they must approve the final set of specifications. The Navy will provide access to any in house technical expertise necessary to provide information needed to develop specifications. The hardware must be self contained, small enough to be worn on the forearm, and have sufficient internal power to remain active 24 hours and must display information in a format readily usable by the diver. It must operate down to a depth of 300 fsw. It must be usable at night without detection and be rugged enough to remain operational under severe combat swimmer mission conditions. It must be able to switch between specified breathing gases and must accurately record dive profile information. It must have an external interface for downloading stored information into a personal computer, for performing diagnostics, and for providing real time output of all displayed information to a personal computer. The entire device must be capable of having all aspects of its operation verified at the dive locker level and the pressure transducer must be able to be pressurized from a compressed gas source through a loader without the need of a pressure chamber. All software developed must be compatible with DOS based systems.

PHASE II: Using the design specifications and circuitry developed during Phase I, fabricate and test, and operationally demonstrate a prototype device that fully implements the NMRI Decompression Model and which will compute and display decompression information during operational dives. After prototype testing construct 50 units for field testing. Field testing should begin within the first 14 months of the start of Phase II. At the end of field testing (6 months) update the design specifications based on user input and produce 10 units suitable as pre-production prototypes including all supporting documentation and drawings. Also produce hardware and supporting documentation for retrieving, storing and archiving dive profile information and for performing user level maintenance and diagnostic procedures.

PHASE III: Pursue full scale commercial production of units in sufficient numbers to meet Navy needs.

COMMERCIAL POTENTIAL: High; commercial divers and sport divers utilize real time decompression procedures. Development of low power microprocessors capable of implementing complex and computationally intensive algorithms are useful for any small portable device which must implement these types of algorithms.

N94-241 TITLE:Enhancement of Protective Immunity against Malaria by Targeting DNA Immunization

CATEGORY: Exploratory Development

SERVICE CENTRAL TECHNOLOGY AREA: Medical

OBJECTIVE: Develop improved methods of plasmid DNA immunization by targeting antibody and specific T cell responses, and by targeting responses to specific organs.

DESCRIPTION: The Malaria Program, Naval Medical Research Institute has shown that immunization with plasmid DNA containing the *Plasmodium yoelii* circumsporozoite protein (PyCSP) induces high levels of antibodies and cytotoxic T lymphocytes against the PyCSP and moderative protection against challenge with infectious parasites. Focusing the immune response on specific antibody or T cell responses, or by targeting the effector antibodies or T cells to specific organs, especially the liver could have a major effect on increasing protective immunity.

PHASE I: Develop methods of constructing DNA plasmids that target antibody or specific T cell subset responses against defined epitopes. Develop methods of targeting immune responses to infected hepatoctyes, perhaps by constructing DNA plasmids that induce immunity within the liver.

PHASE II: Test these DNA plasmids in small laboratory animals and non-human primates alone and in combination for their capacity to protect against challenge with *P. yoelii* and *P. falciparum* respectively. Establish the safety of these plasmids in laboratory animals.

PHASE III: Produce cGMP material and assess it for safety, immunogenicity, and protective efficacy in human volunteers.

COMMERCIAL POTENTIAL: Development of such a method of immunization would revolutionize not only malaria vaccine development, but also the entire field of vaccinology, and thus would have enormous commercial potential.

N94-242 TITLE:Virtual Environment Training for Trauma Management

CATEGORY: Exploratory Development

SERVICE CRITICAL TECHNOLOGY AREA: Training Systems/Medical

OBJECTIVE: Develop a virtual environment device that will enable the initial and refresher training of medical personnel in the care of combat casualties.

DESCRIPTION: A high fidelity virtual environment device that contains hardware and software to simulate a variety of combat casualty patient care scenarios requiring proficient kinesthetic or eye-hand coordination. The device will simulate procedures that require using large mammals or actual patients for optimal training, such as the establishment of a surgical airway, needle thoracentesis for relief of tension pneumothorax, diagnostic paracentesis, and reduction of extremity fractures and dislocations.

PHASE I: Develop all the design specifications and circuitry to construct a prototype device described immediately above.

PHASE II: Using the products of the Phase I SBIR, fabricate, test, and operationally demonstrate a prototype high fidelity virtual environment device that simulates a variety of combat casualty patient care scenarios requiring proficient kinesthetic or eye-hand coordination.

PHASE III: Produce a high fidelity virtual environment combat casualty care trainer derived from the prototype Phase II SBIR device.

COMMERCIAL POTENTIAL: High; urban violence, industrial accidents, and motor vehicle accidents commonly produce serious trauma.

NAVAL FACILITIES ENGINEERING SERVICES CENTER

N94-243 TITLE:Monitoring Contaminant Releases in High Permeability Materials

CATEGORY: Exploratory Development

SERVICE CRITICAL TECHNOLOGY AREA: Environmental Quality and Civil Engineering

OBJECTIVE: Develop a technique to quantitatively monitor release of low volatility contaminants including fuel hydrocarbons in high permeability matrices such as sand and other backfill materials.

DESCRIPTION: Monitoring and quantification of releases from sources such as high pressure, high capacity fuel hydrant systems will ensure prompt remediation efforts. Current metering systems monitor at the point of discharge and are an order or two of magnitude insensitive to pick up low leakage rates.

PHASE I: Develop conceptual design, calibration procedures, and conduct bench-scale experiments to demonstrate concept viability.

PHASE II: Conduct prototype test and evaluation and demonstrate technical feasibility under field conditions.

PHASE III: Fabricate full scale unit for actual use by the Navy personnel at a field activity. develop unit to monitor leaks.

COMMERCIAL POTENTIAL: Accurate monitoring and quantification of contaminant has wide scale applications for dual-use. This system would be used for all long distance fuel piping systems.

N94-244 TITLE:Integrated Geotechnical-Geophysical Assessment Device for Offshore and Nearshore Sites.

CATEGORY: Exploratory Development

SERVICE CRITICAL TECHNICAL AREA: Environmental Quality and Civil Engineering

OBJECTIVE: To develop a device that will determine offshore soil properties and distributions directly by combining geophysical site stratification data with engineering parameter data from in situ geotechnical soil testing.

DESCRIPTION: There is a critical need for a capability to expeditiously assess bottom soil conditions for offshore construction and salvage and amphibious assault operations requiring deployment of mooring anchors, piles, etc. Geophysical surveys can provide stratification data but only qualitative material information. Geotechnical site investigation techniques (drilling, sampling and testing) provide quantitative soil data but have support, personnel and time penalties. A device combining both these techniques, would provide major benefits.

PHASE I: The contractor would select the most appropriate geophysical (or resistivity or electromagnetic, if appropriate) bottom scanning techniques and propose combining them with a "ground truthing" technique that provides soil parameter data. This latter technique could be a doppler penetrometer, instrumented cone, vibratory corer or other such device. A tentative design would be proposed based on available technology and current capabilities.

PHASE II: A system combining the two approaches could be designed, constructed and evaluated in the field under known conditions.

PHASE III: Develop a full scale system that could be used in expeditionary scenarios and that could also be utilized under more benign conditions of offshore petroleum exploration.

COMMERCIAL POTENTIAL: Major value for offshore industry including petroleum production.

N94-245 TITLE:Standard Reference Coating for Accelerated Testing or Weathering of Paints and Coatings

CATEGORY: Exploratory Development

SERVICE CRITICAL TECHNOLOGY AREA: Materials and Structures

OBJECTIVE: Develop reference coating system(s) to use in testing and developing high performance coatings and/or coating systems.

DESCRIPTION: The Navy must use high performance coatings to protect facilities/structures at the waterfront. Due to changes in environmental regulations, many previously acceptable coatings can no longer be used. Historical performance is not available for newer coatings manufactured to take their place. The time lag from laboratory development to manufacturing can range from 10 years to 20 years. Standard reference coatings are needed to provide a link between laboratory accelerated weathering and field or test site weathering. Also, reliable laboratory methods and statistical models must be coordinated with the reference coatings to provide accelerated weathering methods. These methods will be applied to old, new, and developing coating systems.

PHASE I: Assess current technology. Focus on at least four coating types and four coating system types to develop references on. Devise an experimental approach to test and evaluate the validity of the references and test procedure. The coatings and systems chosen should be based on usage/need. Coordinate efforts with trade group and other government organizations. Perform experimental procedure on at least one coating and one coating system. Evaluate results for Phase II.

PHASE II: Based on results from Phase I, carry out further tests on remaining coatings and coating systems chosen in Phase I. Determine best approach to supplying reference(s). Expand testing to include the remaining number of coatings and coating systems chosen in Phase I. Coordinate efforts to make the procedures

developed acceptable industry standard tests such as ASTM methods. Marketing to the paint and coating industry should begin near the end of this phase.

PHASE III: There are efforts in other Government organizations that might support Phase III efforts. Also, industry trade groups may get involved at this point. Lastly, the references should be established enough at this point to begin supporting further efforts.

COMMERCIAL POTENTIAL: New coating systems will be developed to improve existing systems as well as to replace those that are no longer acceptable due to changes in environmental regulations. The Navy does not develop coating systems but does require testing of those it purchases. If reference coatings that can establish a link between laboratory testing and field exposure can be developed, this could reduce the need for long term field testing and consequently reduce the costs of developing new coatings.

NAVAL RESEARCH LABORATORY

N94-246 TITLE:Micro-Turbojet Engine

CATEGORY: Exploratory Development

SERVICE CRITICAL TECHNOLOGY AREA: Aerospace Propulsion

OBJECTIVE: To establish a basis for the <5" diameter, low cost gas turbine engine and prepare a proposal that would detail the applicability of a micro-system to unmanned air vehicles that are either in existence, under development, or under consideration for future projects.

DESCRIPTION: A <5" gas turbine with a specific fuel consumption no greater than 1.5 Lbs (thrust)/Hr-Lb,multiple fuel use capability,and a net thrust of at least 70 Lbs would be required to meet the mission needs of unmanned air vehicles currently under development or in study for manned aircraft defense, reconnaissance, surveillance,and ship's defense scenarios. The engine should also include an engine-driven generator concept to provide on board systems power for various systems and payloads. The high power density,on board power source capability,and light weight of the micro-turbojet engine coupled with the high performance aerodynamic technology applicable to unmanned vehicles are certain to significantly lower the overall system and mission costs to the Navy in operational scenarios.

PHASE I: Feasibility study - mission specific applications for the micro-turbine engine/UAV combination within Navy requirements. Performance tradeoffs versus conventional/current engine technologies applied to UAVs. Synthesize preliminary designs of flight weight hardware systems.

PHASE II: Fabricate flightweight hardware, engine/hardware integration, and bench testing, proving the operability in replicated flight conditions.

PHASE III: Flight test hardware; possible follow-on payload integration.

COMMERCIAL POTENTIAL: New technology could produce high output, low cost micro auxiliary power units for numerous applications.

N94-247 TITLE:Image Data Mapping, Compression, Archive and Display Software

CATEGORY: Exploratory Development

SERVICE CRITICAL TECHNOLOGY AREA: Software

OBJECTIVE: To develop software tools for rapid mapping, display, and storage of high resolution digital imagery from airborne and satellite sensors.

DESCRIPTION: A new emphasis in naval oceanography on the remote sensing of coastal regions requires increased use of high resolution image data such as those from airborne ocean color sensors or from airborne or satellite synthetic aperture radars. Often, preparing such imagery for display and analysis is time consuming. Data must be earth-located, mapped to a projection, and calibrated. Data from different ground stations may be in different formats, making comparisons difficult. Image files are large (a single 100km square full-resolution ERS-l SAR scene, for instance, is 64Mb). This makes it difficult to review data for both large and small scale features at the same time. A flexible software tool is needed to: l) Read data files (Software would automatically determine format). 2) Map data (earth locate in a designated projection) using information in header or header file (user would cue program as to what fields to use), or using user supplied information. 3) Calibrate data, if necessary, again using information in header if available. 4) Store data in archived, compressed form. 5) Allow the user to mosaic image files using fields (such as date or time) in the archive data base as selection criteria. This feature would automatically assemble individual frames into strips representative of a satellite pass, or assemble multiple passes into a larger view of a region. 6) Allow the display of an entire image or mosaic at reduced resolution, with pan and zoom capabilities at various resolutions, without noticeable delay. 7) Allow the extraction (with earth location information) of displayed image regions for further analysis. Software must run on Sun and Silicon Graphics workstations. Source code must be provided.

PHASE I: Prototype system to read CEOS format SAR data files from various ground stations and provide the functions listed above.

PHASE II: Expansion to accommodate aircraft data and formats other than CEOS.

PHASE III: Add improved image compression ability.

COMMERCIAL POTENTIAL: The potential to market software as a flexible user friendly tool for injest and display is high.

N94-248 TITLE:Improved Sources for MBE (Molecular Beam Epitaxial) Growth of Nitrogen-Based Materials

CATEGORY: Exploratory Development

SERVICE CRITICAL TECHNOLOGY AREA: Sensors/Materials

OBJECTIVE: Develop Nitrogen sources for utilization in conventional III-V MBE machines. These sources should enhance the rates currently attainable for MBE growth of nitrides.

DESCRIPTION: Wide bandgap alloys based on aluminum nitride, gallium nitride and silicon carbide offer considerable promise for future optical (solar-blind detectors) and RF (high temperature, high power) applications. Although progress has been made in the growth and doping of these materials, the materials technology is still very immature. MBE is one of the most promising approaches to controlled growth and doping of this family of materials and the limited flux rate of current nitride sources is a major problem. Techniques are required to increase the ratio of atomic-to-molecular species.

PHASE I: Develop a first-generation nitrogen source for conventional III-V MBE systems.

PHASE II: Phase II will develop manufacturing techniques for the prototype source developed in Phase I. It would make the prototype compatible with the wide variety of MBE machines currently in the field.

PHASE III: Pending the results of Phase II.

COMMERCIAL POTENTIAL: Devices based on this technology are potentially useful for RF transmitters for local area networks, wireless communications and satellite broadcasting. They could also have utility in high temperature environments such as aircraft or automobile engine monitoring.

N94-249 TITLE:Simulation of Fire in a Virtual Environment

CATEGORY: Exploratory Development

SERVICE CRITICAL TECHNOLOGY AREA: Training Systems

OBJECTIVE: To develop devices for sensory feedback across user interface of fire-generated parameters, e.g., radiant heat, smoke, humidity, without harmful effects to hardware or user.

DESCRIPTION: To use the virtual environment as a training tool for Navy fire fighters, the hazardous characteristics of fire must be realistically simulated to the extent that the user feels immersed in the environment. This realism must be accomplished without compromising the fire fighter's safety but must replicate the actual environment so that the desired training effect can be achieved. Although parameters such as smoke density and radiation profiles can be displayed quite effectively in a graphical mode, still lacking understanding are what human perceptions need to be triggered to simulate the trainee choking from smoke inhalation, searing heat of steam, or being burned by the radiant heat from the flames.

PHASE I: Determine the type and amount of sensor information that should be available to the user to maximize the training effect in fire fighting environment and techniques by which this can be accomplished.

PHASE II: Develop and test sensors that will achieve the resolution and sensitivity needed to meet the informational requirements formulated under Phase I.

PHASE III: Develop prototype hardware with multisensor feedback that can be interfaced with a user to provide information progressing in time from simulated fire.

COMMERCIAL POTENTIAL: New technology will be applicable to the civilian sector in both operational and training hardware that could be integrated into the fire service