NAVY
Proposal Submission

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

Office of the Chief of Naval Research
ATTN: Mr. Vincent D. Schaper, Navy SBIR Program Manager
800 North Quincy Street, BCT #1, Room 934
Arlington, VA 22217-5000
(202) 696-4286

The Navy has identified 310 technical topics to which small R&D business may respond. A brief description of each topic is included along with the address of each originating office. This information is contained on the ensuing pages.

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

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

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

NAVY SMALL BUISNESS INOVATION RESEARCH PROGRAM
Submitting proposals on Navy Topics

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

Topics Nos. N90-001 through N90-010

Mail/Handcarry Address:
Office of Naval Research
Attn: ONR code 1131M, Room 607
SBIR Program, Topic No. 90-___
800 N. Quincy Street, BCT #1
Arlington, VA 22217-5000

Topics Nos. N90-011 through N90-020

Mail/Handcarry Address:
Office of Naval Technology
Attn: ONT Code 20T, Room 502
SBIR Program, Topic No. N90-___
800 N. Quincy Street, BCT #1
Arlington, VA 22217-5000

Topic Nos. N90-021 through N90-044

Mail Address:
Commanding Officer
MCRDAC, SBIR Program, Topic No. 90-___
Amphibious Warfare Technology Directorate
Quantico, VA 22134-5080

Handcarry Address:
MCRDAC, SBIR Program, Topic No. N90-___
Amphibious Warfare Technology Directorate
Lucas Hall, Room 9
Marine Corps Base
Quantico, VA, 22134-5080

Topics Nos. N90-045 through N90-049

Mail Address:
Commander
Space and Naval Warfare Systems Command
Department of the Navy
Attn: SPAWAR 10D, SBIR Program, topic No.N90-___
Washington, D.C., 20363-5100

Handcarry Address:
Space and Naval Warfare Systems Command
National Center #1, room 1E58
2511 Jefferson Davis Highway
Attn: SPAWAR 10D, SBIR Program, topic No. N90-___
Arlington, VA 22202

Topics Nos. N90-050 through N90-059

Mail Address:

Commander
Naval Supply Systems Command
Department of the Navy Ms. L. Whittington
Attn: PML-5505, SBIR program, Topic No. N90-___
Washington, DC, 20376-5000

Handcarry Address

Naval Supply Systems Command
Attn: Code PML-5505, SBIR Program, Topic No. N90-___
Crystal Mall #3, Room 515A
1931 Jefferson Davis Highway
Arlington, VA 22202

Topics Nos. N90-058 through N90-059

Mail Address:

Commanding Officer
Naval Medical Research and Development Command
Code 402 SBIR Program, Topic No. N90-___
Bethesda, MD 20814-5044

Handcarry Address:

Naval Medical Research & Development Command
Bldg. #1 (The Tower), Room 12147
Attn: Code 402 SBIR Program, Topic No. N90-___
Bethesda, MD 20814

Topic Nos. N90-060 through N90-118

Main Address:

Headquarters, Naval Air Systems Command
Department of the Navy
Attn: Code AIR-9303D, SBIR Program, Topic No. N90-___
Washington, DC, 20361-9301

Handcarry Address:

Headquarters, Naval Air Systems Command
Department of the Navy
Jefferson Plaza #1, Room 472
1411 Jefferson Davis Highway
Attn: Code AIR-9303D, SBIR Program, Topic No. N90-___
Arlington, VA 22202

Topic Nos. N90-119 through N90-170
Mail Address:

Commander
Naval Sea Systems Command
Department of the Navy
Attn: Code CET-4, SBIR Program, Topic No. N90-___
Washington, DC, 20362-5101

Handcarry Address:

Commander
Naval Sea Systems Command
Crystal Plaza #5, Room 924
2211 Jefferson Davis Highway
Attn: Code CET-4, SBIR Program, Topic No. N90-___
Arlington, VA 22202

Topic Nos. N90-171 through N90-211

Mail Address:

Commander
Naval Surface Warfare Center
White Oak Laboratory
Attn: Code S-02, SBIR Program, Topic No. N90-___
Silver Spring, MD, 20903-500003-5000

Handcarry Address:

Commander
Naval Surface Warfare Center
White Oak Laboratory
Bldg. #1, Reception Room
Attn: Code S-02, SBIR Program, Topic No. N90-___
Silver Spring, MD, 20910

Topic Nos. N90-212 through N90-213

Mail Address:

Commanding Officer
Naval Weapons Support Center
Attn: Code 6053, SBIR Program, Topic No. N90-___
Crane, IN 47522-5060

Handcarry Address

Commanding Officer
Naval Weapons Support Center
Bldg. 2087
Attn: 6054, SBIR Program, Topic No. N90-___
Crane, IN, 47522-5060

Topics Nos. N90-214 through N90-230

Mail Address:

Commander
Naval Weapons Center
Attn: Code 2503 SBIR Program, Topic No. N90-___
China Lake, CA 93555-6001

Handcarry Address

Commanding Officer
Naval Weapons Center
515 Blandy Avenue, Annex A1
Attn: Code 2503, SBIR Program, Topic No. N90-___
China Lake, CA, 93555-6001

Topic Nos. N90-231 through N90-242

Mail Address

Commander
Naval Air Development Center
Attn: Code094, SBIR Program, Topic No. N90-___
Warminster, PA 18974-5000

Handcarry Address

Commander
Naval Air Development Center
Bldg. #3
Attn: Code094, SBIR Program, Topic No. N90-___
Warminster, PA 18974-5000

Topic Nos. N90-243 through N90-251

Mail/Handcarry Address

Commercial Acquisition Department
Naval Underwater Systems Center
Attn: Code 0911, SBIR Program, Topic No. N90-___
Shaws Cove office Park, Bldg. #4
Howard Street
New London, CT, 06320-5594

Topic Nos. N90-252 through N90-254

Mail Address

Commanding Officer
Naval Air Engineering Center
Attn: Code 09R, SBIR Program, Topic No. N90-___
Lakehurst, NJ 08733-5000

Handcarry Address

Commanding Officer
Naval Air Engineering Center
Bldg. 562A
Attn: Code 09R, SBIR Program, Topic No. N90-___
Lakehurst, NJ 08733-5000

Topics Nos. N90-255 through N90-260

Mail Address:

Commander
Pacific Missile Test Center
Attn: Code 3121, SBIR Program, Topic No. N90-___
Point Mugu, CA 93042

Handcarry Address

Commander
Pacific Missile Test Center
Bldg. 50, Room 1100
Attn: Code 3121, SBIR Program, Topic No. N90-___
Point Mugu, CA 93042

Topic Nos. N90-261 through N90-264

Mail/Handcarry Address

Commander
Naval training Systems Center
Attn: Code 641, SBIR Program, Topic No. N90-___
Central Florida Research Park
12350 Research Parkway
Orlando, FL, 32826

Topics Nos. N90-265 through N90-266

Mail Address:

Commanding Officer
Naval Coast Systems Center
Attn: Code 20C, SBIR Program, Topic No. N90-___
Panama City, FL 32407

Handcarry Address:

Commanding Officer
Naval Coastal Systems Center
Bldg. #110 (Main Administrative Bldg.) Room 2C35
Attn: Code 20C, SBIR Program, Topic No. N90-___
Panama City, FL 32407

Topics Nos. N90-267 through N90-269

Mail/Handcarry Address:

Commanding Officer
Naval Civil Engineering Laboratory
Bldg. #560
Attn: Code L03B, SBIR Program, Topic No. N90-___
Maritime Road & Market Street
Port Hueneme, CA 93043-5000

Topics Nos. N90-270 through N90-272

Mail Address:

Commanding Officer
Naval Air Propulsion Center
Attn: Code PE31, SBIR Program, Topic No. N90-___
P.O Box 7176
Trenton, NJ 08628-0176

Handcarry Address:

Commanding Officer
Naval Air Propulsion Center
Attn: Code PE31, SBIR Program, Topic No. N90-___
1440 Parkway Avenue
Trenton, NJ 08628-0176

Topics Nos. N90-273 through N90-297

Mail Address:

Commander
Naval Ocean Systems Center
Attn: Code 0141, SBIR Program, Topic No. N90-___
San Diego, CA, 92152-5000

Handcarry Address:

Commander
Naval Ocean Systems Center
Attn: Code 0141, Bldg. 88, SBIR Program, Topic No. N90-___
San Diego, CA, 92152-5000

Topics Nos. N90-298 through N90-302

Mail Address:

Commander
David Taylor Research CenterMr. F. Halsall
Attn: Code 0113, SBIR Program, Topic No. N90-___
Bethesda, MD 20084-5000

Handcarry Address:

Commander
David Taylor Research Center
Attn: Code 0113, SBIR Program, Topic No. N90-___
Bldg. #1, Room 211
Bethesda, MD 20084-5000

Topic Nos. N90-303 through N90-305

Mail Address:

Commander
Naval Air Test Center
Attn: Code CT222, SBIR Program, Topic No. N90-___
Pautuxent River, MD 20670

Handcarry Address:

Commander
Naval Air Test Center
Bldg. #304
Attn: Code CT222, SBIR Program, Topic No. N90-___
Pautuxent River, MD 20670

Topic Nos. N90-306 through N90-310

Mail/Handcarry Address:

Commanding Officer
Naval Avionics Center
Technology Transfer Office
Attn: Code 802.3 SBIR Program Topic No. N90-___
6000 East 21st Street
Indianapolis, IN 46219-2189

INDEX
DEPARTMENT OF THE NAVY
FY 1990 SMALL BUSINESS INNOVATION RESEARCH TOPICS

OFFICE OF NAVAL RESEARCH

OFFICE OF NAVAL TECHNOLOGY

U.S MARINE CORPS

N90-041 Air and Water Vapor Permeable/Aerosol and Liquid Impermeable Shell Fabrics for Chemical Protective Garments
N90-042 Hand Held Mine Detector Imager/Discrimination
N90-043 Diversion Device/Incapacitant
N90-044 Mechanical Breaching Device

SPACE AND NAVAL WARFARE SYSTEMS COMMAND

N90-045 Force Level Analysis Tool Support and Software Module Development
N90-046 Advanced Systems and Concepts for Future Naval Warfare
N90-047 Non-Acoustic Underwater Imagining
N90-048 Non-Acoustic Submarine Tactical Communications
N90-049 Warfare Systems Architectures

NAVAL SYSTEMS COMMAND

N90-050 Artificial Intelligence System for Source Code Compliance to Data Rules
N90-051 Central Management of Multi-Site ADP Capacity Planning
N90-052 Integrated Users Support System for Shipboard Uniform Automated Data Processing System (SUADPS) Resystemization
N90-053 Automated Aid for Hazardous Material Control
N90-054 Extreme Cold Weather and Fuel Resistant Protective Handware
N90-055 Indexing of Technical Information for Computer Aided Acquisition and Logistics Support (CALS)
N90-056 Durable Press Finish for Fire Retardant Treated (FRT) Cotton Fabric
N90-057 Reverse Program Data (RPD)

NAVAL MEDICAL RESEARCH AND DEVELOPMENT COMMAND

N90-058 Recombinant DNA Cloning of Enzymes Essential for the Enzymatic removal of Carbohydrate Antigens from Human Erythrocytes for the Production of Type “O” Red Cells from Type “B” Cells
N90-059 Production of Biosensor Based Techniques and Equipment for Essential Clinical Assays for be Performed in the Military Field Environment for Combat Casualty Care

NAVAL AIR SYSTEMS COMMAND

N90-060 Coating Systems for High Temperature Titanium Alloys
N90-061 Assessment of Heat Damage in Composite Materials
N90-062 Remote ASW Sound Sources
N90-063 Anti-Jam Methods for RF Receiver
N90-064 ASW Non-Acoustic Sensors
N90-065 Low Probability of Intercept/Anti-Jam (LPI/AJ) Voice/Data Link
N90-066 Optical Fiber Compatibility with Advanced Electronic/Structural Materials
N90-067 Long Duration Performance of Aircraft Inertial Navigation System
N90-068 Impact of Using Dispersed Sensors for Navigation
N90-069 Passive Fiber Optic Components for Severe Environments
N90-070 Portable Koalas: The Knowledgeable Observation-Analysis Linked Advisory System
N90-071 Innovative Graphics Architecture Concepts for Advanced Simulators
N90-072 Detection of Wideband Radar Signals
N90-073 Passive Non-Cooperative target Recognition Sensor
N90-074 Secondary Sensor for Anti-Radiation Missiles
N90-075 Improved Infrared Search and Track (IRST) Sensor
N90-076 Electro-Optic-Infrared (EO-IR) Sensor Application in Anti-Air Warfare
N90-077 Buffet Vibration Absorber

N90-078 Operational Exploitation of Active and Passive Sensor Information by U.S Navy Tactical Aircraft Operating in a Multi-Platform Tactical Situation
N90-079 Automation of Digital Data Review and Verification
N90-080 Minimization of Environmental and Health Hazards Through the Use of Innovative Materials and Maintenance Process
N90-081 Probability of Flaw Detection for Non-Destructive Inspection of Advanced Materials
N90-082 Ferrite Choke for Cartridge/Computer Aided Design (CAD) Application
N90-083 Automated Integration of Reliability Centered maintenance (RCM) Analysis with the Logistics Support Analysis Record (LSAR)
N90-084 Automated Integration of Level of Repair Analysis (LORA) with Logistics Support Analysis Record (LSAR)
N90-085 Aircraft and Engine Preservation Techniques
N90-086 Automated Technology for Conversion of Existing Paper Manuals into a Form Suitable for Interactive Electronic Display
N90-087 Standardized Interactive Electronic Presentation of Weapon-Systems Troubleshooting
N90-088 Automatic Diagnostic Link Between Aircraft and Their Avionics Systems, and Automated Maintenance Aids
N90-089 Fretting Damage Detection Device
N90-090 Wall Thickness Measurement Technique for Turbines Blades and Fuel Nozzles
N90-091 Digital Imagery Verification System
N90-092 Interoperability of Navy Range Operations with Air Traffic Control Facilities of the Federal Aviation Administration (FAA)
N90-093 Mini-Air Surveillance Radar tracker and Identify-Friend-or-Foe System (MASURATI)
N90-094 Microminiature Filter Techniques
N90-095 Automated Feature Extraction and Pattern Recognition Algorithms
N90-096 Microwave Powered System for High Altitude Long Endurance (HALE) Aircraft
N90-097 Turbine Engine Response Design Sensitivities
N90-098 Determination of Critical Parameters in Airborne Early Warning
N90-099 Multiple Chaff Cartridge “SQUIB”
N90-100 Activated Metal Decoy for Low Infrared (IR) Signature Aircraft
N90-101 Mutlispectral Electro-Optical/Infrared Real Time Sensor
N90-102 Emission Location System for Cuing of Standoff Electro-Optical Sensor
N90-103 Electronic Soldering Quality Improvement
N90-104 Aircraft Survivability and Mission Analysis Computer Model
N90-105 Extending Tactical Sensors Through the use of Signal Enhancement
N90-106 Marine Attack Helicopter Night Targeting System Training System
N90-107 Four-Bladed Main Rotor System for Marine Attack Helicopters
N90-108 Integrated Strike Planning Systems Evolutionary Upgrade-General Purpose Explanation Capability for Knowledge-Based Support System
N90-109 Total Quality Management (TQM) Control Criteria Applied to Long Term Test Programs
N90-110 Software Maintenance Cost Estimating
N90-111 Self-Protect Weapon Seeker Enhancement
N90-112 Measurement of Airborne Surface Search Radar Performance Characteristics
N90-113 Operational Support Aircraft Management Planning System
N90-114 Sensor Fusion for Non-Cooperative Target Recognition (NCTR)
N90-115 Pulsed Power for Underwater Neutralization
N90-116 Underwater Towed System Monitor
N90-117 MV-22/HV-22 Weapons Systems Integration and Armament Control
N90-118 Ribbonized Organized Integrated Electrical Wiring Interconnect System for the V-22 Osprey

NAVAL SEA SYSTEMS COMMAND

N90-119 Gateway Processors for Information Systems
N90-120 Next generation Radiation Detection Indication and Computation Equipment (RADIAC)
N90-121 Shipboard Communications Systems Network Model
N90-122 Submarine Quiet Announcing Systems

N90-123 Shipboard Non-Detectable Portable Communications Systems
N90-124 Translation of Interface Design Specifications (ISD)/Protocols into Mathematical (Boolean) Expressions
N90-125 Development of Transducer Coatings with Low Volatile Organic Compound
N90-126 Non/Low Magnetic Signature Engines
N90-127 Acoustic Propagation Path Determination
N90-128 Azimuthal Noise Variation Effects
N90-129 MIL-STD-480B Expert System Tool Compound
N90-130 Shipboard Medical Waste Treatment System
N90-131 Non-Vapor Compression AC System
N90-132 Integrated On-Line Reliability and Maintainability (R&M) Design Program
N90-133 Rotational Propulsor Concepts for Surface Ships
N90-134 Ship Design Tools- Measures of Effectiveness
N90-135 High-Efficiency Thermoelectric Material
N90-136 Fiber Optic Current and/or Voltage Sensor
N90-137 Composite Flexible Pipe Coupling for Surface Ships
N90-138 Cavitation Suppression Technologies for Surface Ships Propulsors
N90-139 Novel Materials for Shipboard Fire Barrier Applications
N90-140 Realizing the Potential of total Platform Sensor Data Fusion
N90-141 Shipboard High Speed Optical Data Transport Network (HSODTN)-Compartment Area Network (CAN)
N90-142 Ice Phobic Coatings for Ship Antenna Applications
N90-143 Non-Corrosive Composites for Electromagnetic Interference (EMI) Shielding Applications
N90-144 Equipment Readiness Status Monitor and Recorder (RSMR)
N90-145 Microwave Monolithic Transmitter/Receiver Designs for Naval Electronic Warfare
N90-146 Versatile Signal Recognizer
N90-147 Deinterleaving Pulse trains in Severe Multipath Environments
N90-148 High Power, Short Pulse Jammers
N90-149 Radiometric Detection of Targets at Sea
N90-150 Tailoring Tool for Assuring Effective Reliability/Maintainability/Quality Assurance (R/M/QA) Clauses in Acquisition Documents
N90-151 Testing of Shipboard Electronic Warfare (EW) Equipments
N90-152 Passive Ranging with Limited Data
N90-153 The Use of Artificial Intelligence for Torpedo Detection
N90-154 Neural Networks for Torpedo Detection
N90-155 Preset Capability for Expendable Countermeasure Devices
N90-156 Automatic Radar Scan Recognizer
N90-157 High-Efficiency Low Noise Hovering Systems for Underwater Devices
N90-158 Low-Noise Microwave Receiver Using High temperature Superconductors
N90-159 Advanced Machinery Monitoring Sensors
N90-160 Undersea Fiber Optic Communications Network
N90-161 Pressure Compensation Systems for Moving Coil Projectors
N90-162 High Order Spectrum Applied to Time Delay Estimation
N90-163 Automated Groundwave Recognition for High Frequency (HF) Communication
N90-164 High Frequency, High Power Transparent Transducer
N90-165 Electronic Precision Focusing for the Type 18 Periscope
N90-166 Pulse Power Supply for Submarine Electromagnetic Launch
N90-167 Directional Hydrophone for Acoustic Towed Arrays
N90-168 Non-Electronic Shipboard Systems Diagnostic Concepts
N90-169 Wave Characterization System
N90-170 Inflatable Craft Design Developments and Improvements

NAVAL SURFACE WEAPONS CENTER/WHITE OAK

N90-171 System Design Methodology for Massively Interconnected Models
N90-172 Statistical testing of Model Hypothesis in Binomial Regression

N90-173 Improved Methods for the Manufacture of Petafluorosulfanyl Components
N90-174 Discontinuously Reinforced Magnesium for Missile Components
N90-175 Phased Array Antenna
N90-176 Detection of Hidden Corrosion Under Aircraft Skin
N90-177 Nonlinear Transforms for Optical Signal Process
N90-178 Embedded Training Capability for Afloat Cryptologic Systems
N90-179 Cryptologic Expert System Man-Machine Interfaces (MMIs)
N90-180 Distributed Operating System Design Assistant
N90-181 Modeling of the Human Decision in Support of Command/Control/Communications/Information (C^3I)
N90-182 Optical Neural Networks
N90-183 Advanced System Architecture for Target Tracking and Recognition
N90-184 High Energy Melt-Castable Explosive
N90-185 Acousto-Optic Signal Processing
N90-186 Advanced Damage Model Development
N90-187 Design Guidelines for Touch-Sensitive Screen
N90-188 High Speed Photodetector Switching to Avoid Backscatter
N90-189 Crack Detection in Explosives and Rocket Motor Propellant
N90-190 Time Resolved Radiation Diagnostics for 0.6-1.3 Mev Peak Bremsstrahlung (X-ray) Generators
N90-191 Stable Silver Oxide (AgO) Battery Electrodes
N90-192 Active Mine Batteries with Long Shelf Life
N90-193 1750A Microprocessor Optimized for Low Power Digital Signal Processing
N90-194 Development of High Energy Density, Pressure Tolerant Batteries
N90-195 Unmanned Aerial Vehicles (UAV) Compatible Sensor, Processing, and Communications Systems
N90-196 Electronic Cooling System Electrolytic Corrosion
N90-197 Development of Test Methods for Graphite Fibers
N90-198 Electronic Safe and Arming Devices
N90-199 Infrared Background/Clutter/Target Signature Model
N90-200 Advanced Automatic Target Recognition Techniques for Infrared Search and Track (IRST) Systems
N90-201 Synthesis, Chemistry and Reactions of Energetic Phosphazenes
N90-202 High Speed Launcher for Fragment Simulator
N90-203 Procedures for the Design of Software Controlling Systems
N90-204 Ruggedized Fiber Optic Switch
N90-205 High Power Fiber Optic Sources
N90-206 laser Initiation of Secondary Explosives
N90-207 Theoretical Study of “Cold Fusion” Using Quantum and Statistical Mechanics
N90-208 Development of High Power Microsecond Two-Stage Free Electron Laser Source
N90-209 Programmable Linear Digital Beamformer
N90-210 Thin-Wafer Components for Thermal Battery Cells
N90-211 Non-acoustic Underwater Influence Sensors

NAVAL WEAPONS SUPPORT CENTER (CRANE)

N90-212 Radiation Hardened Robot Positioner for Test Samples in Proton Experiments
N90-213 Instrumentation for Logic Upset Detection in Transient Environments

NAVAL WEAPONS CENTER/CHINA LAKE

N90-214 Optical Component Measurement for Multi-spectrum Guidance
N90-215 High Temperature Radome Adhesives
N90-216 Optimized Antennas for Multi-spectrum Guidance
N90-217 Infrared (IR) Background Modeling and Analysis
N90-218 Spectral Analysis of Stray Light
N90-219 Multi-spectrum Guidance Target Generators
N90-220 Passive Fuel Vapor Detector Device

N90-221 Measurement of Explosive Outputs Electronically
N90-222 Safe-Arm Indicator for In-Line Fuzes
N90-223 Electronic Retard Sensor for Bomb Fuzes
N90-224 Long Wave Infrared Non-mechanical Electronic Scan
N90-225 Solid Fuel-Air Explosive (FAE) Detonation Mechanism Model
N90-226 Compaction and Rapid Dispersion of Powdered Fuels
N90-227 Replication of Aircraft Structure for Ballistic Vulnerability Testing
N90-228 Inertial Systems Expert System
N90-229 Determine the Aggregate Heat Transfer Coefficient into Objects Within an Expanding Supersonic Rocket Plume
N90-230 Laser Brazing Ceramics to Metal

NAVAL AIR DEVELOPMENT CENTER

N90-231 Applications of Anti-Jam (AJ) Direct Sequence Spread Spectrum (DSSS) Waveforms to High Frequency (HF) Communications
N90-232 Multi-Tadil Task Force Connectivity/Communication Systems Capacity Processor
N90-233 New techniques to Enhance Anti-Jam (AJ) in Spread Spectrum Communications
N90-234 Constraints and System Primitives in Designing Operating Systems for Real Time Distributed Warfare Systems
N90-235 Global Positioning System (GPS) Specification for Shipboard TACAN Replacement
N90-236 Machinability of AF1410 High Strength Steel
N90-237 Cognitive Workload Measurement Device
N90-238 Thermo graphic Non-Destructive Evaluation
N90-239 Drag Reduction on an Ejection Seat During High Speed Ejection
N90-240 Design for Pre-tensioning Restraint Straps for Crash Protection
N90-241 Elastomeric Pitch Link Bearings for Helicopter Rotor Heads
N90-242 Airborne Low Frequency Sonar Cable

NAVAL UNDERWATER SYSTEMS CENTER

N90-243 Periscope Laser Eye Protection
N90-244 Single Sided Flextensional Transducer
N90-245 Single Sided Electrodynamic High Power, Underwater Projector
N90-246 Turbulent Boundary Layer Drag Reduction
N90-247 Live Plankton Characterization in Fluid Flow
N90-248 Multi-Line Array Retrieval and Stowage System
N90-249 Prelaunch Electric/Acoustic/Optic Communications
N90-250 Development of Miniature High Temperature, High Pressure Steam Throttle Valve
N90-251 Automated Sound Velocity Profiler

NAVAL AIR ENGINEERING CENTER

N90-252 Optical Correlator for Aircraft Recognition
N90-253 Radar Cross Section (RCS) Validation
N90-254 Derivation of Functional Testing Requirements from Weapon Systems Mission Requirements

PACIFIC MISSILE TEST CENTER

N90-255 New Emitter Sorting Techniques
N90-256 New Electronic Support Measures (ESM) Classification and ID Techniques
N90-257 Airborne Imaging Spectrometer for Measurement of Low-Observable Aircraft Infrared Signatures
N90-258 Radar Reflectivity Polarization Matrix Measurement Instrumentation
N90-259 Multi-Spectral Target Presentation for Missile Test and Evaluation
N90-260 Microwave Target Presentation for Missile Test and Evaluation

NAVAL TRAINING SYSTEMS CENTER

N90-261	Real-time Photographic based Terrain Image Generator with Capabilities for 3-D Objects
N90-262	Low Cost Reconfigurable Cockpit for Deployable Aircrew Team Trainers
N90-263	On-line Diagnostic System for Simulator Performance Monitoring
N90-264	Training Optimized Utilization Resource Scheduler

NAVAL COAST SYSTEMS CENTER

N90-265	Video Data Compression
N90-266	Underwater Covert Communications Links for Short Distances

NAVAL CIVIL ENGINEERING LABORATORY

N90-267	Heat Resistant Airfield Pavements
N90-268	Development of Wall Composite materials to Prevent Sympathetic Detonation Between Weapons Storage Cells
N90-269	Diver Installed Recoilless Propellant Embedded Anchor (RPEA)

NAVAL AIR PROPULSION CENTER

N90-270	Turbine Engine Component Deterioration Model
N90-271	Compressor Boundary Layer Control
N90-272	Fuel Atomization Analysis for Advanced Gas Turbine Combustors

NAVAL OCEAN SYSTEMS CENTER

N90-273	Sensor for the Detection of Buried Cable from a Remote Tethered Submersible
N90-274	Tools to assist in Modification and Reuse of Ada Software
N90-275	Miniaturized Radio Relay for Ultra High Frequency/Very High Frequency (UHF/VHF) Communications
N90-276	Multi-Function Shipboard Antennas
N90-277	Communication Devices and Techniques for Naval Special Warfare
N90-278	Miniaturized Antennas and radio frequency (RF) Components
N90-279	Solid State X-Band Radar Transmission
N90-280	Message Compression
N90-281	High Data Rate Satellite Communications
N90-282	Small Ship Ultra High Frequency (UHF) Antennas
N90-283	Graser Communication System
N90-284	Network Control
N90-285	Economical Environmental Performance Modifications to Commercial and Non-Development Item (NDI) Equipment for Shipboard Command and Control Functions
N90-286	Tradeoff Issues in Massively Parallel Implementations of Real Time Federated or Distributed Navy Warfare Systems
N90-287	Workstation Architecture as a Function of Open Systems Architecture in Future Warfare Systems
N90-288	Directional Communication and Electronic Counter-Counter measures (ECCM) Obtainable through Architecture in Future Warfare Systems
N90-289	Adaptive Diversity Reception at High Frequency (HF)
N90-290	Natural Operator Input Techniques for Undersea Surveillance Systems
N90-291	A Prototype Ada Repository for Command and Control Software Components
N90-292	Survivable Adaptable Fiber Optic Embedded Network (SAFENET) Performance Evaluation
N90-293	Advanced Receiver Technology
N90-294	Advanced Passive Radio Frequency (RF) Surveillance/Targeting Assessment Methodology
N90-295	Protective Coatings on Aluminum for High-Efficiency Heat-Transfer Applications
N90-296	A Tethered Floating Fiber Optic Periscope for Submarines
N90-297	Voice Messaging and Response for Naval Ashore and Afloat Operations

DAVID TAYLOR RESEARCH CENTER

N90-298	Marine Paints with Ice phobic Properties
N90-299	Composite Gear cases for Ship Main Propulsion Gears
N90-300	Optical Fiber Inspection System for Composite Propulsion Shafting
N90-301	Composite Acoustic Enclosure for Intercooled Recuperated (ICR) Gas Turbine Engine
N90-302	Atomized Liquid Filtration for Air Contamination Control

NAVAL AIR TEST CENTER

N90-303	Programmed Control of Seaborne Targets
N90-304	Solid State Digital Voice/Data Recorder
N90-305	Synthetic Rope for Helicopter Rescue Hoists

NAVAL AVIONICS CENTER

N90-306	Threat Missile Simulator Technology
N90-307	High Effective Radiated power (ERP)
N90-308	Integral Circuit Board/Frame/Heat Sink
N90-309	Generic Configurable Microprocessor Simulation Methodology
N90-310	Aircraft Store loader

DEPARTMENT OF THE NAVY
FY 1990 TOPIC DISCRIPTIONS

OFFICE OF NAVAL RESEARCH

N90-001 TITLE: Signal Processing Using Artificial Neural Networks (ANN)

CATEGORY: Research

OBJECTIVE: To develop new artificial neural networks for use in real time automatic target recognition.

DESCRIPTION: Artificial Neural Networks (ANN) are signal processing and computing architectures that are motivated by our understanding of the organizing and computational principles of the central nervous system. These ANN architectures offer great promise for increasing the information processing capabilities of Navy/DoD systems, as encountered in pattern recognition, image/target recognition, associative computer memories, robotic and telerobotic control, and radar/sonar signal processing.

Various technologies can be used to implement these ANN architectures, including silicon VLSI, GaAs, integrated optoelectronics, and optics. The goal of this program is to analyze and develop new ANN architectures and learning algorithms and to increase their implementation using state-of-the-art technologies.

During the Phase I program, research will address (1) new ANN architectural concepts and learning algorithms; and (2) materials, devices, and circuit architectures that are necessary to ultimately achiever the 10(12) interconnects/second for application to target recognition using multidimensional inputs.

During the Phase II effort, the Phase I concepts will be further developed to the point of feasibility demonstration for real time automatic target recognition.

N90-002 TITLE: Image Compression

CATEGORY: Research

OBJECTIVE: To accomplish image compression using the mathematics of affine transformations

DESCRIPTION: recent advances have combined the mathematics of fractals with the concept of a dynamical attractor to achieve highly compressed images of natural pictures, e.g. landscapes, faces, etc. Iterated function systems comprised of the affine transformations are derived which produce sets which are in the form of images. Upon iteration, the proper transformations cause the image to play the role of an attracting set. Compression is achieved because the amount of bits needed to describe the affine transformation are orders of magnitude less than the number of pixels in the image. The goal of this program is to automate this image compression scheme and apply it to systems of Navy interest, including satellite receiving, storing and transmission of pictures (e.g. of the ocean surface.) Inherent in this procedure is the task of pattern recognition as one picture can contain many images. A further objective is to develop algorithms which can pick man made objects out of natural backgrounds.

N90-003 TITLE: Ground Based Remote Sensors

CATEGORY: Research

OBJECTIVE: To develop new techniques for real time, remote sensing observation and display of profiles of temperature, moisture and/or wind in the Marine Atmospheric Boundary Layer and/or ocean surface values of those parameters.

DESCRIPTION: Temperature, moisture, and wind profiles in the Marine Atmospheric Boundary Layer (MABL) strongly influence ocean and marine atmospheric processes and Naval operations. Examples of the former include

ocean waves, and fluxes. Examples of the latter include surface ship operations and the use of electromagnetic and electro-optical weapons. Emerging techniques to remotely measure temperature, moisture and/or wind profiles from the surface include the use of optical, microwave, radar and or acoustic frequencies in a single and/or multiple configurations. The techniques should show promise for application at sea. Dominant features of interest include MABL parameters, mesoscale atmospheric features and/or synoptic scale features including tropical cyclones. Important operational features include high vertical resolution, long operating life, and low unit cost.

N90-004 TITLE: Compact Underwater Autonomous Laser Doppler Velocimeters for use in Shallow Water Environments

CATEGORY: Research

OBJECTIVE: To develop a compact laser Doppler velocimeter package capable of measuring turbulence in dynamic shallow water environments

DESCRIPTION: Increased Naval operations emphasis on shallow water shelves has spurred the need for systems capable of measuring environmental parameters in these difficult, highly dynamic regions. Recent breakthroughs in the use of sea floor laser velocimetry to measure near bottom velocities has provided the opportunity to characterize the small scale turbulence in continental shelf regions. Therefore, the need exists for small autonomous underwater laser Doppler velocimeters for use in a variety of ocean environments, including the Arctic's shallow seas. The instruments will be used to observe sediment movement, under ice/water interaction and air-sea transport process. The system would have to be small and programmable with internal processing of signals. Two components of velocity would have to be recorded along with a solid-state memory and semiconductor diode lasers for reduced battery consumption. It is hoped that the eventual combination of these sensors into a package of sensor arrays easily deployable in shallow water high-energy environments will be possible.

N90-005 TITLE: Expendable Particle Sensor

CATEGORY: Research

OBJECTIVE: To develop an expendable means of rapidly quantifying the suspended particle concentrations is natural marine environments.

DESCRIPTION: An ubiquitous and major component of ocean surface water is suspended particles. In coastal waters this component is comprised of terrestrial and shelf sentiments, aeolian transported material and biogenic particles. In the central ocean the particulate component is predominately biological in origin. Characterization of the spatial and temporal variance in distribution of suspended particles is a critical factor in every discipline with oceanography. Marine particles are indicators of geological, chemical, and biological processes (e.g., primary production, copreciation and scavenging, and benthic resuspension.) and also serve as quasi-conservative tracers of physical dynamics in the sea (e.g. off shelf transport). Nevertheless, currently there exists a very limited number of commercially available techniques for in-situ characterization of the marine suspended particle load. The available instrumentation is expensive and time consuming in its deployment at sea. Synoptic coverage of the particulate distribution requires that there be an ability to rapidly access the three-dimensional particulate distributions at sea in a manner similar to that presently used for characterization of the temperature structure, where expendable bathythermographs are deployed. A capability to define the synoptic particle structure should not be dependant on the solar light field for illumination, but should be applicable regardless of ambient lighting conditions or sea state.

N90-006 TITLE: Ferroelectric Nonvolatile Radiation Hard Memories

CATEGORY: Research

OBJECTIVE: Devise innovative methods to deposit thin films of ferroelectric materials integrated with semiconductor circuitry to produce a nonvolatile radiation hard digital memory.

DESCRIPTION: The combat effectiveness of ships, planes, and missiles relies increasingly on electronic signal processing. A critical component is such signal processing chains is a memory that retains data throughout loss of power in high radiation environments. Recent advances suggest that semiconductor memories using thin films of ferroelectrics, either as capacitors or FET gate dielectrics, offer a solution to this critical defense need. Research issues remain in identifying the appropriate material system, deposition technique, and pattering methodology, as well as in understanding the origins of switching fatigue that limits the lifetime. The purpose of this program is to address these issues related to the ferroelectric film deposition. While the research focus lies on preparing the ferroelectric film of sufficient quality, an important constraint on any solution is compatibility with semiconductor processing technologies, as this will be critical to commercialization.

N90-007 TITLE: Sacrificial Electrodes

CATEGORY: Research

OBJECTIVE: To develop sacrificial electrodes to enhance the conductivity of seawater to improve the efficiency of electromagnetic thrusters for underwater propulsion.

DESCRIPTION: In an electromagnetic thruster (EMT), the power developed is proportional to the conductivity of the flowing fluid. In applying the EMT concept for seawater propulsion, high magnetic fields are required due to the low conductivity of seawater. However, by using a sacrificial electrode, the conductivity can be increased, resulting in acceleration of the submersible. This concept is particularly suited for torpedo propulsion using EMT. The goal of this program is to conduct research on electrode materials, coatings and/or capping, and particle discharge during conduction, to acquire the understanding required to develop controlled time delayed sacrificial electrodes in a continuous electrode configuration for use in electromagnetic thrusters. The parametric study for the electrode will involve onset of particle ejection, ejection rate, resulting conductivity of the flow field, conductivity distribution, selective discharge, and signatures.

N90-008 TITLE: Neural Networks for Autonomous Motor Control

CATEGORY: Research

OBJECTIVE: To develop neural network techniques that can provide adaptive control of robotic systems.

DESCRIPTION: Current adaptive control theories have difficulty with dynamic interactions across many links during robotic movement in real time. To be useful, an autonomous controller must learn and maintain its own calibration. Currently, autonomous robots are controlled by either direct program control, inverse kinematics or classical adaptive control techniques. Neither of the first two methods are adaptive, and classical adaptive control techniques require a model of the robot plant and actuators which may be difficult to obtain beforehand. Also, multi-joint inverse kinematic computations are computationally intensive, which considerably slows down the control process. Many of the above problems can be solved through the application of neural network algorithms and approaches. Neural network techniques should allow a controller to generate accurate stable motor control of multi-joint robot arm links without information about the link mass, link length, direction of gravity, and with fuzzy information about payload and actuator limits. A “neural controller” should be able to move a multi-joint arm carrying a unforeseen payload from any staring joint angle to any ending point without end point oscillations. Ultimately, these devices should prove of great utility whenever autonomous robotic devices are required.

N90-009 TITLE: Metal Ion Selective Sensors

CATEGORY: Research

OBJECTIVE: To develop sensors for metal ions based on a biomimetic approach.

DESCRIPTION: The goal of this research is to develop a working prototype of an electrochemical sensor which is based either upon an electrochemical model of the molecular mechanisms of the transmembrane ion transport or an ion-dependant enzymatic reaction. The proposed studies could be carried out by functional transfer of ion sensitive molecules into artificial bimolecular membranes, monolayer, and multilayer. This configuration may present advantages of enhanced selectivity and stability over conventional liquid junction membrane electrodes. The electrical and optical properties of multilayer could be selectively modified and controlled. The structure of the multiplayer and the nature of the layer-by-layer deposition could allow the construction of films of controlled architecture. Chemically sensitive electronic devices as a substrate for the sensitized monolayer or multilayer could also be used.

N90-010 TITLE: Focused Ion Implantation for Optoelectronic Integrated Circuits

CATEGORY: Research

OBJECTIVE: To develop a viable focused ion beam technology to fabricated optoelectronic integrated circuits for use in signal processing systems.

DESCRIPTION: The submicron focused ion beam (FIB) process has recently received a great deal of attention as a technique for a micro fabrication of semiconductor devices. The most promising use of the technique is for maskless ion implantation. Maskless ion implantation in conjunction with various crystal growth and device processing technologies will open up new possibilities for fabricating the integrated device structures for optoelectronic integrated circuits (OEICs).The goal of this program is to develop a viable focused ion beam technology to fabricate the various optoelectronic components (e.g. lasers, waveguides, mirrors, detractors, etc.) and to pursue their on chip integration. Specific research objectives include (1) development of proof of concept integrated optoelectronic circuits; (2) fabrication of quantum well lasers by prevention or induction of chemical disordering; (3) investigation of FIB fabrication parameters for optimum laser fabrication and their effect on laser operation; (4) fabrication of optical waveguides and mirrors using FIB induced changes in index of refraction.

Phase I of the program should provide the proof of concept demonstration of OEICs by FIB technology with fabrication of selected devices and device combinations.

Fabrication and optimization of actual device structures envisioned in specific research objectives above will be pursued in Phase II.

OFFICE OF NAVAL TECHNOLOGY

N90-011 TITLE: Noise Reduction System for Shipboard Spaces

CATEGORY: Exploratory Development

OBJECTIVE: The objective of this project is to develop techniques for active noise cancellation applicable to manned spaces aboard ships allowing personnel to work safely and effectively in high noise environments.

DESCRIPTION: High noise environments in shipboard spaces represents potential personnel hazards which seriously limit the ability to operate and maintain Fleet equipment while underway. Conventional noise reduction techniques are expensive and heavy. Passive hearing protection is not very effective. An improved active cancellation system would allow personnel to hear alarms, communication with the bridge, and move freely about the space. Development must be suitable for retrofit to ships already in the fleet. Installation concepts should be part of the proposal. The innovative research should result in a demonstration of improved capacities. The navy's operational surface effects ship (IX-515) is available for evaluation of the system. Factors of cost, feasibility and applicability to Naval combatant vessels should receive careful consideration in development of proposed techniques.

N90-012 TITLE: Tactical Data Quality

CATEGORY: Exploratory Development

OBJECTIVE: Develop a method to characterize tactical data quality that can be used to determine the degree of relevancy and importance of the data for the tactical decision maker.

DESCRIPTION: There is a need to establish the quality of tactical data presented to the decision maker in order to: 1) reduce the date overload problem resulting from multiple target, multiple sensor tracking, 2) reduce the need to transmit large volumes of data over limited bandwidth circuits, and 3) enable time-critical decisions to be made in a timely manner. A metric for determining data quality would be useful for screening available information so that only pertinent data that are immediately at hand are presented to the decision maker. The quality of tactical data should reflect the following features:

Source: Where did the data originate?
Latency: How old is the data? Is it overtaken by events?
Priority: Is the data sufficiently important to present for the decision at hand?
Relevance: Is the data relevant to the decision at hand?
Validation: Does the data require confirmation from independent sources?
Security: What is the security level of the data?

The method for establishing tactical data quality should be implementable on an automated, real time decision aid for the tactical decision maker. It should be sufficiently generic so that all command and control mission applications at different command levels and platforms are possible.

N90-013 TITLE: Efficiency Enhancement of IMPATT Diodes

CATEGORY: Exploratory development

OBJECTIVE: Conduct investigations (i.e. theoretical analysis, material growth, fabrication, testing and evaluation) to determine the feasibility of developing high conversion efficiency Impact Avalanche and Transit Time Devices (IMPATTs) in ka-band. The goal at 35 GHz is discrete pulsed power IMPATT diodes capable of 15 watts peak; 5 watts average with 32 or greater efficiency; and pulse, 500 nS.

DESCRIPTION: IMPATT diodes are used in Navy weapons and are proposed in the implementation in high power solid-state missile seeker transmitters. Present IMPATT state of the art technology using Gallium Arsenide (GaAs) in Ka-band offers 7 watts of peak power (3 watts average) with 16 per cent (maximum) energy. Recent advances in semiconductor material growth technology indicate that it should be possible to realize 32 percent or greater DC to RF conversion efficiency in Ka-band by using new heterojunction IMPATT structures with low band gap material for the avalanche zone and a large band gap material for the drift zone (references available from Defense Technical Information Center). To achieve the specified goals, the research for this program shall include: 1) theoretical investigations, including computer simulations, to identify potentially promising IMPATT structures and semiconductor materials; 2) Material growth of the selected IMPATT structures; 3) Characterization of the growth materials; 4) Fabrication of discrete and packaged IMPATTs using appropriate heat sinking technology and bonding techniques; and 5) Testing and evaluation of the IMPATTs using an appropriate test oscillator and a biasing pulse modulator. The deliverable items shall include: 1) Ten discrete and packaged IMPATT diodes; and 2) a technical report detailing the development of these heterojunction enhanced efficiency IMPATTS.

N90-014 TITLE: Integrated Planar Magnetics for High Power Density Electronic Power Supplies

CATEGORY: Exploratory Development

OBJECTIVE: To explore the technical feasibility of magnetic device planar construction, improved power line efficiency, higher energy density and low cost simplicity for megahertz operation in power density power supplies.

A base line for improvement is 5 to 10 megahertz frequency, transformer power rating of 100 watts @99% efficiency, with a volume not to exceed one-tenth cubic inch. Inductor base line is 300 volt amperes @ 5 to 10 megahertz, with a power factor not to exceed 0.003 and a volume not to exceed one-tenth cubic inch using a profile (i.e. height divided by the product of length times width) of no more than 3/100.

DESCRIPTION: there is a need to simplify the design and construction of low voltage electronic power supplies. The Navy and Air Force are presently contracting for development of higher efficiency and higher power density power supplies to provide reliable power to very high speed, high density integrated circuit systems. Excessive size would result with the use of the best available modern commercial low voltage power supplies. Presently available power supplies would exceed the remaining volume of the systems; a rule of thumb is for the power supply's volume not to exceed 25% of the volume of the system. A major problem in power supply packaging and circuit assembly is presently design mandated (i.e. near cubical) shapes of their components. Magnetic devices do not lend themselves to easily conform to high density solid planar structures; rather, they are commonly built as separate coil/core structures which, when assembled, are space-wise inefficient and will not easily conform to the printed circuit layout used for system integrated circuits. Either circuit card spacing must be increased or added components are required in conventional approaches to this problem. Low profile, high performance magnetic components are highly valued.

Phase I should explore the technical feasibility of low profile, highly efficient magnetic devices, evaluation samples and their characteristics and design principles are required.

Phase II should explore ways and means for low cost production of high reliability components, culminating in a pilot run to prove the production concept.

N90-015 TITLE: Advanced Materials Technology for Electronic Component Applications

CATEGORY: Exploratory Development

OBJECTIVE: Demonstrate the effectiveness of new materials technology applied to electronic components.

DESCRIPTION: New innovations in materials technology are appearing in composites, intermetallics, polymers and ceramics. This solicitation requires the application of such innovations to electronic component technologies. Further requirements for components include improved reliability, reduced weight and cost, miniaturization, and heat removal. Opportunities for improvements exist in dielectrics, heat sinks, solder, thermal vials, etc. Electronic packaging is limiting to system performance. The offeror should show the application of the innovation to a specific navy device and should project the impact on system capability, reliability and/or survivability.

N90-016 TITLE: Naval Applications of Massively Parallel Processing

CATEGORY: Exploratory Development

OBJECTIVE: Define and show feasibility for the selection of an optimum computer architecture(s) best suited to solving signal/data processing problem types (e.g. unimodal, multimodal, or combinatorial) inherent to the performance of Navy missions.

DESCRIPTION: In the past 5 years, the field of U.S high performance computing has been fundamentally transformed by the variety of commercial and experimental non-Von Neumann multiprocessor architectures with various connectivity strategies now available for naval applications. Anecdotal evidence shows that computer time can be dramatically decreased in some cases by converting existing programs from scalar to parallel structures. Types of Parallel processing include, but are not limited to, 1) vector processing; 2) multiple instruction stream, multiple data stream(MIMD); or 3) single instruction stream, multiple data stream (SIDM). Key features of signal and data processing problems common to anti-air warfare, anti-submarine warfare and anti-surface warfare need to be identified and subsequently related to the computer architectural characteristics most likely to yield efficient, real-time solutions.

N90-017 TITLE: Low Cost Underwater Acoustic Sensors

CATEGORY: Exploratory Development

OBJECTIVE: Develop low cost underwater receivers for future Navy air, sea and surveillance applications.

DESCRIPTION: Proposed future underwater surveillance systems will cost too much to be affordable, unless innovative technology can be used to reduce total costs of such systems. The types and designs of acoustic sensor components affect a large portion of such costs. This task would identify and develop low cost alternative acoustic sensors for future underwater applications. Security clearances at the SECRET level are required.

N90-018 TITLE: Automated Lithium Liquid Metal Handling Station

CATEGORY: Exploratory Development

OBJECTIVE: Develop a liquid metal handling station for use in refining lithium and economically placing it in specified containers.

DESCRIPTION: Systems presently under development by the U.S Navy makes use of vessels that are pre-filled with lithium; normally, the metal is melted, poured as a liquid and allowed to solidify. The process must be carried out in an inert environment to promote safety and insure the purity of lithium placed in the containers. A system is sought to perform this function for a series of cylindrical containers from one to several feet in diameter. The system developed should be safe, automated, and able to achieve the filling process at minimum cost. It is also desirable to design the apparatus so that heavier impurities are separated from the lithium during the filling process.

N90-019 TITLE: Seismic Detection of Buried Mines

CATEGORY: Exploratory Development

OBJECTIVE: Develop a method of detecting mines buried in the ocean bottom.

DESCRIPTION: Investigation of seismic techniques developed by the oil exploration industry is desired for the purpose of evaluating the effectiveness of these techniques in detecting buried mines at depths of 3 to 4 meters below the sea floor.

Phase I investigations would be theoretical in nature with demonstration and documentation of the processing techniques or simulated data. Successful completion and reporting of this primary investigation would lead to Phase II demonstration detecting mines during field test in areas prepared by the U.S Navy.

N90-020 TITLE: Coated Boron Particles

CATEGORY: Exploratory Development

OBJECTIVE: Prepare magnesium and aluminum coated boron particles and measure reaction rates with air and water vapor.

DESCRIPTION: Ignition delays during metal combustion are detrimental to metal fuel performance. Ignition of uncoated boron particles in inhibited by the formation of a boron oxide layer which places a physical barrier between the metal and the oxidizer. It is postulated that two-stage ignition occurs with boron, because the rate of oxidization is slowed by the oxide formation, with subsequent evaporation of the oxide layer and reheating. Coating boron particles will permit the coating metal to react first, which may provide the heat necessary to raise the temperature of the underlying boron above the boron oxide volatilization temperature; therefore, it is important to

obtain uniformity and quality of coating while also maintaining a thin coating. The need for pure, dense, spherical and small-size particles (diameters less than 5 microns) is also important, and it is known that impurities in boron reduce volumetric heat release.

Phase I research should address the technology of depositing thin (micron or less) reactive magnesium and aluminum coatings onto pure boron particles including and understanding of the preferential coating process, particle size effects, metal coating concentration effects and temperature effects on the rate of coating and thickness. Preliminary experiments should be set up to measure reaction rates of coated particles with air and water vapor. Phase I experiments may be conducted on 94% purity boron provided the metal coating is of high quality.

Phase II research should focus on the ability to control and scale-up the coating process. Quarter pound to one-pound samples of the coated boron should be supplied for evaluation. A major part of the Phase II research should be devoted to studying the reaction rates of the coated boron particles with air and water vapor, with comparisons made to uncoated particles.

U.S. MARINE CORPS

N90-021 TITLE: Application of Neural Networks to Amphibious Command and Control

CATEGORY: Exploratory Development

OBJECTIVE: The objective of this topic will be to convert state of the art work that has been completed in Neural Networks to software, which can be used for information processing and decision making in a command and control network in the Marine Corps operating environment.

DESCRIPTION: Command and control on the battlefield of the future- i.e. 2000 and beyond- will require extremely fast reaction times and handling vast amounts of information. In amphibious operations, this problem is complicated by the transition from sea to beach to land operations. Neural network have promise for providing significant improvements in reaction times by providing quantum leaps in the ability to quickly process information and perform decision aid tasks.

Phase I would be the development of a systemized plan and limited demonstration software for applying neural networks to the Marine Corps command and control systems.

Phase II would be the development and testing in a field environment of working software, which could be used in Non Development Item (NDI) hardware procured for the Marine Corps command and control system.

N90-022 TITLE: Joint Operations Interoperability System for Marine Corps C^3I System

CATEGORY: Exploratory Development

OBJECTIVE: The objective of this topic is to develop software and hardware for interface between Marine Corps communications/information/command and control systems and other service/foreign country and commercial systems.

DESCRIPTION: The Marines Corps has developed a protocol system, the Marine Corps Tactical System (MTS) which is the standard for the interface of communications, information and command and control systems. Although much work is being done to implement Joint intra-operability standards and the MTS is to conform to these standards, many systems developed by other services cannot operate in the Marine Corps environment without modifications to hardware/software. In a commercial environment, there are programmable systems, which can be adapted to allow various systems to interoperate. There is a need for a similar system designed for the Marine Corps, which can be inserted internally to other service systems and programmed to allow integration of these systems into the Marine Corps MTS and also allow interoperability during joint operations.

Phase I would be development of a demonstration system for one demonstration system and proof of the ability to develop an adaptable programmable system.

Phase II would be the development and field-testing of an adaptable programmable system, which could be integrated internally in any hardware.

N90-023 TITLE: Multi-level Security System for Amphibious Operation Command and Control

CATEGORY: Exploratory Development

OBJECTIVE: The objective of this topic is to develop software which would allow the Marine Corps to process information with various levels of classification in a battlefield command and control system.

DESCRIPTION: On the battlefield of the future i.e. 2000 and beyond, the intelligence will be critical for planning and decision-making. The command and control system must be able to interface with the intelligence staff in real time without the screening that is presently required due to the risk of compromising sources and revealing intelligence capability to the enemy. In addition there are various requirements for classified information on the battlefield, but there is a risk to compromising information due to the lack of security techniques in central processing units (CPUs) and local area networks (LANs). This problem is complicated in an amphibious operations environment, where the information requirements change during the transition from sea to beach to land.

Phase I would review work performed by DOD agencies, such as NSA and DIA, development of a proposed software system and proof of concept for providing multilevel security for intelligence information in the Marine Corps command and control system. Phase I selectees will require the ability to obtain security clearances at the Top Secret level and access to compartmented information. Prior experience working with the NSA and DIA will be helpful.

Phase II would be the development of a multilevel security software and field testing in a field environment or Non Developmental Item (NDI) equipment projected for the Marine Corps command and control system.

N90-024 TITLE: Integral Electric Motor/Waterjets for High Speed Amphibians

CATEGORY: Exploratory Development

OBJECTIVE: This effort will be directed at the development of feasibility designs to show packaging, layout, system requirements, efficiencies, weight and volume requirements for high speed amphibian integral electric motor/water jets.

DESCRIPTION: Current water jets that propel high speed and low speed amphibious vehicles utilize separate drive motors and water jets located in a stern mounted transom flap coupled together to make up the propulsive output section of the drive train. This provides a heavy arrangement with duplicative components that could be combined to save weight and volume.

The proposed effort would be for the development of an integral water jet with an electric motor internally contained in the water jet hub/shaft assembly. Technical requirements are: thrust of 4000 pounds, diameter not to exceed 16 inches, length not to exceed 60 inches (including inlet and exhaust nozzles). A system voltage of less than 1000 volts is desired.

Phase I would be the development and delivery of proposed alternative layout drawings and engineering calculations to demonstrate feasibility and show packaging layout, system requirements, efficiencies, weight and volume requirements for the proposed system.

Phase II would be refinement of the design and the delivery of a prototype design with engineering calculations and breadboard test results to support selection of the design.

N90-025 TITLE: Interchangeable Motor and Alternator Electrical Rotating Groups for High Speed Advanced Assault Amphibians Vehicles (AAAV)

CATEGORY: Exploratory Development

OBJECTIVE: This effort will be directed at the development of feasibility designs to show packaging, layout, system requirement, efficiencies, weight and volume requirements for a high speed advanced amphibian interchangeable motor and alternator electrical group.

DESCRIPTION: If a future high-speed amphibian utilizes engine driven alternators to power transom flap mounted motors that drive water jets, commonality of electric components offer the possibility of reduced initial procurement costs and operating costs. This will provide a reduction in the numbers of components, and a reduced component cost as the motor and alternator will utilize a common electrical rotating assembly.

During high-speed waterborne operation for the AAAV, most operation will be a steady state power setting where the speed of the water jet motor is matching the speed of the engine driven alternator. A separate motor and alternator for each alternator is described so that failure of one motor/alternator/water jet system will not affect the others. Since motor output power, speed and speed-range closely match alternator input power, speed and speed range, utilization of common rotating groups for the motor and alternator provide logistics cost savings.

Technical requirements are: a high efficiency system, motor output levels of 400-450 horsepower, diameter not to exceed 16 inches, lengths not to exceed 18 inches. System voltage levels of less than 1000 volts are desired, using moderate risk technology.

Phase I will be the proposed alternative layout drawings and engineering calculations for the hardware systems to demonstrate feasibility and show the proposed alternative packaging layout, system requirements, efficiencies, weight and volume requirements.

Phase II will be the refinement of the design and delivery of final drawings with breadboard test data and calculations to support the selection of the design.

N90-026 TITLE: Compressible Fluid Strut for Wheeled Vehicles

CATEGORY: Exploratory Development

OBJECTIVE: The development of designs to demonstrate packaging, layout, system requirements, proper operation, efficiencies, weight and volume requirements for a compressible fluid strut for wheeled vehicles.

DESCRIPTION: With the myriad of cargos that wheeled vehicles carry and the many vehicle variants that evolve (each with their unique loaded weights), heavier than normal vehicles used in the Marine Corps must accept reduced performance that limits mobility because vehicle suspension system designs are tuned for only one weight. Conventional torsion bars, coil springs and shock absorbers are also designed for one weight.

A suspension that can be tuned and readily adjusted for different vehicle weights (springing force) and different ride characteristics (dampering) will enhance the mobility and survivability of the vehicle. Linear struts that utilize a compressible fluid for both springing and dampering have potential to offer performance gains at production level costs comparable to conventional systems.

Phase I would be the development of layout drawings and engineering calculations to demonstrate feasibility and low packaging, layout, system requirements, efficiencies, weight and volume requirements. The baseline configuration would be for an eight wheeled USMC LAV-25 vehicle with a wheel loading of 4000 pounds each, jounce travel of 7.28 inches, rebound of 6.1 inches and variable dampening rates.

Phase II will be the delivery and testing of a prototype with data from test results to demonstrate successful operation.

N90-027 TITLE: Engine Cylinder Bank Deactivation

CATEGORY: Exploratory Development

OBJECTIVE: The objective is the development of a feasibility design to show packaging, layout, system requirements, proper operation, efficiencies, weight, and volume requirements for an engine cylinder bank deactivation system, which might be used in a new system or adapted to an existing system.

DESCRIPTION: Future tracked amphibious vehicles may have large power mismatches between the level of power required to propel the vehicle in the water versus the level of power required while the vehicle is on land. In order to achieve 20+-knot water speed, a 30-ton vehicle must have a power pack capable of delivering 2200 horsepower (HP). On land only 750 HP is required. If a single high-powered diesel engine is used (in order to minimize installed volume, fuel consumption, etc.), it will efficiently provide the necessary power for marine mode. When used for Land mode, however, the engine must be debated considerably, since only a fraction of the marine mode horsepower is necessary to drive the vehicle. Thus the engine is not efficient for land use.

If the number of cylinders could be reduced in the transition from sea to land operation, a potential gain in efficiency would improve fuel consumption. A method to decouple a number of the cylinders is one approach to this problem.

Phase I is the development of a method to decouple the cylinders and providing alternative drawings and engineering calculations for decoupling systems to demonstrate feasibility with packaging, layout, system requirements, efficiencies, weight and volume requirements.

Phase II is refinement of the design and selection of the best alternative with engineering drawings, results of tests and calculations to support the design.

N90-028 TITLE: Lightweight Cooling Component Development

CATEGORY: Exploratory Development

OBJECTIVE: The objective is to develop lightweight cooling components for military combat vehicles to replace components provided by OEM suppliers, which are not designated for military applications.

DESCRIPTION: Military combat vehicles operate over a range of different terrains, temperature ranges and at varying power levels. The vehicles also must power numerous auxiliary systems that are located away from the vehicles prime mover.

Most modern land combat vehicles utilize air-to-liquid heat exchangers during water operation. The source of supply of components to date have been over-the-road OEM equipment suppliers, where weight is not as critical as in a combat vehicle.

Lighter weight, higher efficiency cooling systems and components are required for both land and water operation of military vehicles. Anticipated land rated horsepower (HP) of the prime mover is 750 HP, 500 HP of which goes to the transmission (with its losses) and the remainder to hydraulic and electrical systems. In the water, a 2200-2300 HP prime mover will be utilized, 2000 HP of which will go to the transmission and the remainder to hydraulic and electrical systems.

Phase I will be development of drawings and engineering calculations for lightweight components that demonstrate feasibility and include packaging, layout, system requirements, efficiencies, operation, weight and volume requirements.

Phase II will be delivery of test articles and test results of laboratory tests designed to measure performance and efficiency.

N90-029 TITLE: Lightweight/High Power Density Engines

CATEGORY: Exploratory Development

OBJECTIVE: The objective is to develop a proposed design for a lightweight/high power density engine for a high water speed amphibious vehicle.

DESCRIPTION: The Marine Corps is developing a high water speed vehicle that may utilize up to 2300 HP during water operations, but will require only 750 HP during land operations. The forward mounted engine will provide power during water operations through a transmission (hydraulic, electric or mechanical) to aft mounted water jets to propel the vehicle. During land operation, only partial power will be required.

Current diesel engines are heavier and larger than desired, partly due to their anticipated extended use. Military vehicles see far less use. Therefore, a smaller and lighter diesel burning engine system could be designed to direct power aft mounted water jets, if the engine were small enough to fit on an aft mounted transom flap or in the rear of the vehicle without reducing troop carrying space.

Phase I is the development of alternative designs with drawings and engineering calculations, which demonstrate feasibility and show packaging, layout, system requirements, efficiencies, mode of operation, heat rejection rates and methods, weight and volume requirements.

Phase II is the selection of the best alternative and refinement of design with final engineering drawings and support calculations and laboratory test results to support the design selection.

N90-030 TITLE: Lightweight Air Compressors

CATEGORY: Exploratory Development

OBJECTIVE: The objective is the development of a feasible design for a lightweight Air Compressor for an in-water propulsion system, the Water Piston Propulser.

DESCRIPTION: The Marine Corps is involved in the development of a revolutionary in-water propulsion system named the Water Piston Propulser for propelling future high water speed amphibian vehicles. This system also has application to other high speed naval and commercial vehicles. This system also has application to other high speed naval and commercial vehicles. The system works on the principal of compressed air igniting with diesel fuel in a combustion chamber to produce a high temperature, high pressure exhaust gas that is reacted against a continually supplied column of water. The combustor and rotor (the rotating member that supplies the water column) are located external to the vehicle. Inside the vehicle is the engine driving an air compressor and the fuel supply that feed the combustor. By directly generating thrust, vice using an internal combustion engine with a transmission and water jet system, higher efficiencies are theoretically attainable.

Phase I would be the development of alternative designs for the air compression system that would be driven by the vehicle's prime mover. The requirements are for a lightweight, saltwater environment capable compressor that can produce 18.5 pounds per second of air at 225 psi. Input horsepower will be between 750 and 1000 SHP at 3000 rpm.

Phase II will be the selection of a final design, and delivery of drawings and engineering calculations that demonstrate feasibility and show packaging, layout system requirements, efficiencies, mode of operation, weight and volume requirements.

N90-031 TITLE: Mobile Water Production by Extraction of Atmospheric Moisture in Desiccant

CATEGORY: Exploratory Development

OBJECTIVE: Investigate and demonstrate feasibility of concepts to produce potable water from atmospheric sources independent of surface or ground water sources.

DESCRIPTION: USMC missions require support of highly mobile expeditionary forces in arctic, desert, and tropical climatic conditions. These forces must have potable water for consumption and medical care and uncontaminated water for personal sanitation and vehicle support. Recent advances in desiccant technology provides opportunity for efficiently extracting water from the atmosphere, eliminating the need for ground feed water sources. System characteristics of a USMC Atmospheric Moisture Collection System (AMCS) include extracting moisture from air with relative humidity's as low as 5% and production of 7-10 gallons of water per gallon of fuel consumed. Overall AMCS constraints include a ISO 8x8x20 envelope enclosing a capability to produce several hundred gallons of water per hour. AMCS design considerations should focus upon minimum Logistics burden, operator skill level and maximum reliability.

Phase I: Development of drawings and engineering calculations for components that demonstrate feasibility of this technology to include packaging, layout, system requirements, efficiencies, operations, weight and volume. Conduct market survey to determine likely contractors, which may have the potential to produce the AMCS.
Phase II: Procurement or fabrication of test AMCS, delivery of test articles, and results of AMCS evaluation designed to measure performance and efficiency against Phase I projections.

N90-032 TITLE: Polymeric Cartridge Cases

CATEGORY: Advanced Development

OBJECTIVE: Development and demonstration of a 5.56 mm round with a polymeric cartridge case that is equivalent to the current M855 round.

DESCRIPTION: Small caliber handgun ammunition using a "plastic" cartridge case has been marketed commercially for a number of years. The feasibility of developing the 5.56 mm service round has been demonstrated with the M193 round (to be phased out). This program will provide the means to develop a functionally equivalent M855 round. When developed, this cartridge could potentially offer cost savings of 30% and weight savings of 50%. It is estimated that 190 million rounds of this cartridge will be procured annually. That would translate into a 15 million dollar annual savings in tri-service use, not counting the logistical savings due to the lighter weight. The Marine Corps will benefit directly from this technology in cost savings, reduction of the individual Marine's load and increased mobility.
Phase I would include material selection, part design, mold design and fabrication, production of 200 cartridges, ballistics testing and a functional demonstration in the M16A2 and M249 rifles.
Phase II will consist of a scale up production to demonstrate the economic feasibility of the technology developed in Phase I. During this phase 20,000 units will be produced with processing parameters and quality control measures identified. A complete ballistics testing and full-scale functional demonstration will be performed.

N90-033 TITLE: Standoff Minefield Marking for Very Shallow Water (VSW) Surf Zone, and Beach

CATEGORY: Exploratory Development

OBJECTIVE: Investigate and demonstrate the feasibility of developing a minefield marking system capable of marking cleared lanes in very shallow water, in the surf zone, and across the beach from a standoff of at least equal distance to minefield neutralization systems.

DESCRIPTION: Soviet and Warsaw Pact forces possess a formidable capability to mine the very shallow water, surf zone and beach area. Successfully breaching these minefields and moving assault forces without loss of

momentum across the beach with acceptable losses is critical to a successful amphibious operation. Currently, there are breaching systems in full-scale development, which will provide a capability to clear lanes. However, no means exist to mark these lanes, so that assault vehicles and landing craft may be guided safely to the beach. Hence, a standoff marking capability is a necessity. This system should visibly mark the approximate center of the breached lane location, be identifiable in both day and night operations and provide identification of the cleared lane for approximately two hours.

In Phase I, drawings and engineering calculations for components that demonstrate feasibility of the technology to include packaging, layout, system requirements, operations, weight and volume will be developed.
In Phase II, equipment will be procured and fabricated for a demonstration system, which will be delivered and tested against the Phase I projections for performance and efficiency.

N90-034 TITLE: Use of Neural Nets in Predicting Personnel Attrition

CATEGORY: Exploratory Development

OBJECTIVE: The objective is to develop a manpower planning loss-forecasting tool with an accuracy superior to conventional forecasting techniques.

DESCRIPTION: The greatest challenge in military strength planning lies in forecasting losses, the state of the economy, unemployment rates, civilian vs. military job renumeration, etc. A number of traditional methods have been employed in the forecasting routines built into the major manpower planning computer programs. These include time series forecasts, econometric motels, "bootstrapping" methods involving yearly iterative adjustment of loss parameters, and a few others. None of these methods has emerged as the "preferred" approach to forecasting for manpower planning.

Phase I will involve a study/proof of concept to test the applicability of the neural net approach to personnel loss forecasting for manpower planning. Operationally, the study will entail training a neural net on thousands of records pulled from a base file of personnel records and developing a system to make forecasts, comparing results to actual historical events and forecasts by current manpower planning programs in order to determine the efficiency and validity of the method.

Phase II will be the development of a usable personnel loss forecasting system for the Marine Corps. The system should be able to input a variety of parameters (such as, but not limited to, length of service, pay grade, demographic group and time remaining on contract) and predict, for each individual the probability of attriting within a year and/or failing to reenlist at the end of a contract. Much of the research would be geared toward identifying the variables, which have an impact on the reenlistment decision and it is anticipated that reduced time for processing and analysis with a neural network approach will allow the trial of many data sets to prioritize the use of different variables in this type of forecasting. Once successful with individual forecasting, the system should be usable for analyzing the entire Marine Corps structure to provide aggregate loss forecasts.

N90-035 TITLE: Focal Place Filters for IR Detector Array

CATEGORY: Exploratory Development

OBJECTIVE: Develop an innovative low cost solution to multi-band filtering of FLIR images and demonstrate an IR Detector Array Filter in common module FLIRs and thermal images.

DESCRIPTION: The Focal Plane Filters for IR Detector Array concept will provide spectral sensitivity on a custom FLIR detector array. A small window with discrete band pass filters applied would be mounted directly above the detector chips.

Phase I will demonstrate feasibility by fabrication of at least two different narrow band pass (0.5 micron FWHM bandwidth) filters within the 8-12 um region to the dimension listed below on a thin suitable window material. The

individual filters will be of the same appropriate size as the detector chips (700 x 63 microns) with a commensurate spacing (10 microns) to that between chip elements. Window materials must be transparent in the detector dewar and thus must be capable of operation at 80 K and storage at 300 K. Temperature cycling from room to liquid nitrogen temperatures will be performed to test filter/window assembly thermal stability.

Phase II will serve to optimize the concept of focal plane filters for use in agent detection and demonstrate practicality of integration in common module FLIRs and thermal images.

N90-036 TITLE: Study to Obtain a Stimulant for Testing VX Conversion Filters

CATEGORY: Exploratory Development

OBJECTIVE: To find a stimulant to replace VX when testing VX conversion filter reactivity after storage under various conditions.

DESCRIPTION: This project if successful will lead to safer, less costly, screening of conversion filter materials for application in agent sensors. Phase I will involve experimental work to find a stimulant to replace agent VX for testing VX conversion filter reactivity after storage. Fluorinating reagents will be tested with potential stimulants of VX after storage on various substrates. The reagent testing results will be compared with actual live agent testing for verification of stimulant utility. Phase II work will continue with stimulant identification work with primary focus on establishing agent/stimulant test correlation data.

N90-037 TITLE: Test Kit Development for Agents of Biological Origin

CATEGORY: Exploratory Development

OBJECTIVE: The objective of this project is to exploit presently available commercial immunoassay technology for the development of a field detection/identification system for agents of biological origin.

DESCRIPTION: Within the past few years, new immunoassay formats have emerged, which are very rapid (several minutes), require a minimum of reagents and handling, and are very sensitive. These formats typically use an antibody which is immobilized to a porous membrane to trap the antigen, while an antibody conjugated to an indicator molecule (enzyme, dye, etc.) is used to visualize the reaction. This type of system could be used as a field detection/identification kit for pathogens or toxins in environmental samples.
Attempts at such a device were made through the Identification System, Biological Agent, Rapid, Field (DSBARF) Program initiated by the U.S. Army Medical Research and Development Command during the mid 1980's; however, this program failed to yield a fielded product. A new approach has been taken by MRDC, whereby commercially available technology will be utilized for medical diagnostic tests and not for environmental field samples. This project will help to fill the void for environmental samples. These kits can be readily developed for reconnaissance and hazardous area demarcation and as a means of identifying samples in the forward area. The kits could be integrated into the forward area NBC laboratory program, which has been initiated by the Marine Corps. This project has a high probability of success. There are already several commercially available test kits for pathogens available to the chemical diagnostic market. These products have undergone rigorous screening by the Food and Drug Administration for safety and efficacy. It is only necessary to evaluate them for agents, which are of interest to the Marine Corps and other military services.

Phase I would be "Proof of Principle" type work to demonstrate the technology to detect two agents using government furnished reagents.

In Phase II the testing will be expanded to 7 agents. If successful, the kit could be transitioned into a development program or production.

N90-038 TITLE: Study of Stability of Fluorinating Reagents on Various Membranes/Filters

CATEGORY: Exploratory Development

OBJECTIVE: Determine the stability, in air of various fluorinating reagents on different membranes exposed to a variety of conditions.

DESCRIPTION: This work will decrease the time required to determine the best reagent/membrane combination for the VX conversion filter, which is being developed under the Marine Corps Chemical/Biological Defense Technology program.

Phase I experimental work will focus on determination of stability for a range of filter materials coated with fluorinating reagents. Laboratory tests will be used to determine the reactivity of different fluorinating reagents after storage under several different climatic conditions. Initial testing will use some method, e.g. ion specific electrodes, to determine the amount of active reagent still available. Actual fluorination of a stimulant will be used as a confirmatory test.

Phase II work will optimize selected filler materials/reagents and demonstrate applicability to improving sensitivity and response time for electrochemical agent sensors.

N90-039 TITLE: Fiber Optic Weapons Sight

CATEGORY: Exploratory Development

OBJECTIVE: To demonstrate a rugged optical sight for use on individual and crew served weapons that would be simpler, cheaper, and lighter than existing optical sights and more effective than existing iron sights.

DESCRIPTION: Sighting a weapon with iron sights requires that the eye focus in three objects – the rear sight, the front sight, and the target. Simultaneous focusing in three planes is impossible and must be supplanted by scan focusing in each of the three planes in rapid succession – a task that requires a young eye and substantial training. Telescopic sights (scopes) are optical instruments which solve this problem by making the target and the aiming reference coincide with the plane of the shooter's retina. A precise complex achieves this, and relatively fragile system of lenses, reticles and adjustment controls mounted in a fairly large tube.

Emerging fiber optic (FO) technology involving monolithic bundles of multiple fiber optic cables (FOC) extruded to variable diameter permits image magnification without the use of lenses. Further, it permits off-axis viewing by bending the FOC conduits without the use of prisms and mirrors; end permits erecting an inverted image by twisting the FOC bundle, without the use of erector lenses. This approach should make it feasible to design a simple, tough, inexpensive sight consisting of just one lens, a monolithic FOC bundle of appropriate shape, and a housing. This sight could have all the performance advantages of a telescopic sight and the cost/durability advantages of iron sights.

Phase I will develop engineering calculations and drawings for the FO weapons sight and will fabricate six test items that will be mounted on the M16A2 rifle. This design will ensure interface compatibility with the rifle and a ballistic match with the M855 5.56 mm service ammunition. Phase I will test a representative shooting regime to gather data pertinent to feasibility assessment.

Phase II will fabricate 50-second generation sights for use in an extensive troop test under quasi-operational conditions for comparison with existing baseline sights. Phase II will further optimize size/weight/man print related designs and will propose a cost-efficient manufacturing process.

N90-040 TITLE: Air Permeable Sorbent Fabric Systems Based on Adhered Sorbent Particle

CATEGORY: Exploratory Development

OBJECTIVE: The objective of this effort is to produce an improved air permeable sorbent fabric system for use in chemical protective garments.

DESCRIPTION: This new material will be used in lieu of the current active carbon powder impregnated polyurethane foam laminate currently used as a sorbent liner in standard chemical protective over garments. These improvements will include reduced weight and thickness; greater comfort based on reduced physiological heat stress; and greater durability after wear and laundering.

Material systems have been marketed internationally based on proprietary technology using adhered hydrophobic active carbon spheres in an air permeable sorbent fabric systems. These material systems show promise, but have present the following problems:

1. The use of such proprietary technology can result in excessive procurement costs because normal competition is not in effect.

2. There have been problems with inadequate adhesion of carbon spheres on these fabric systems.

Other hydrophobic sorbent particles, such as active carbon granules or carbonaceous sorbent beads, should be considered for adhesion to fabrics. However, particular attention should be given to avoidance of particle encapsulation or poisoning by adhesives.

The Phase I effort should demonstrate the feasibility of employing hydrophobic sorbent particles and existing adhesion technology through the production of laboratory demonstration samples with test results which demonstrate that the materials have the physical properties necessary for garment fabrication and are capable of providing protection in a chemical agent contaminated battlefield.

Phase II would focus on optimizing the properties of the most promising Phase I materials and the production of pilot quantities to be used in test uniform fabrication.

N90-041 TITLE: Air and Water Vapor Permeable/Aerosol and Liquid Impermeable Shell Fabrics for Chemical Protective Garments

CATEGORY: Exploratory Development

OBJECTIVE: The objective of this effort is to develop a shell fabric system which introduces the new feature of aerosol penetration resistance in addition to the previously available features of air and water vapor permeability and resistance to penetration of liquid water and liquid toxic military agents.

DESCRIPTION: Military Specification, MIL-C-44031C, Class 2, dated 2 September 1987, describes a water and oil repellent treated, nylon and cotton, twill fabric used as the outer shell for chemical protective over garments. This fabric is permeable to air and water vapor and thereby provides for heat stress relief by means of warm air convection and evaporate cooling. Furthermore, it resists the penetration of liquid water and liquid toxic military agents. Unfortunately, this material does not resist penetration of small aerosol particles.

New approaches to aerosol filtration in permeable fabrics should be considered. These include incorporation of micro fibers, fibers with electrical (static) charges, and other potential techniques for trapping particles.

The Phase I effort should demonstrate the feasibility of a given technique for aerosol filtration in an otherwise satisfactory shell fabric.

The Phase II effort would focus on optimizing the properties of the most promising Phase I materials and the production of pilot quantities to be used in test uniform fabrication. Awardees must have appropriate security clearances to work in this area.

N90-042 TITLE: Hand Held Mine Detector Imager/Discrimination

CATEGORY: Exploratory Development

OBJECTIVE: Investigate and demonstrate a proof of concept model of a mine detector imaging/discrimination system using commercial/Government hand held landmine detectors.

DESCRIPTION: A serious deficiency exists in the ability to detect buried mines. Current technology developments and capabilities have been developed that should greatly enhance the ability to detect mines (both metallic and non-metallic) and reduce the false alarm rates. Development of a proof of concept demonstration model will greatly benefit the Marine Corps in its attempts to improve mine detection capability.

Phase I is a practical examination of existing documentation concerning all facets associated with mine detection and classification, metal detection, anomaly detection, soil densities and compaction characteristics, interfaces between man-made and natural objects, signals return rates and radiated variables. Those technologies most compatible leading toward in-ground imaging/discrimination will be reduced to their mathematical components for further statistical analysis using probability curves. A feasibility model will project likelihood of a successful system.

Phase II will develop a prototype system and determine through experimentation the system's physical characteristics, refine hardware and software requirements and develop the power source. A field test will be conducted to provide the basis for a potential Phase III through development and production.

N90-043 TITLE: Diversion Device/Incapacitate

CATEGORY: Exploratory Development

OBJECTIVE: Develop the ability to temporarily stun or incapacitate an opponent without injuring nearby innocent personnel.

DESCRIPTION: This effect can be attained by flash blinding, concussion by overpressure or rendering the individual unconscious rapidly with noxious gas. Diversion device should not have pyrotechnic characteristics. Previous devices, such as the L610 diversion device propel the internal M218 Bouchon fuse at ballistic speed. The fuse has injured Marines. New generation devices use a small initial detonation to propel a sub munition out of the grenade's body. This sub munition detonates separately with almost no fragmentation. The by-product of the L610 is Antimony-Sulfide, which is quite toxic and can produce significant physical problems later.

Phase I would be proof of concept and or development of a prototype. Respondents should have experience in the development of special operations equipment and the ability to obtain Top Secret clearance. Phase II would be refinement of design and field-testing of a number of units to be designated by the Marine Corps.

N90-044 TITLE: Mechanical Breaching Device

CATEGORY: Exploratory Development

OBJECTIVE: The development of non-explosive, positive breaching equipment, which does not emulate currently available tools or pneumatic devices, is man portable, capable of breaching doors/windows/walls/roofs and floors, can be set up quickly and requires little or no user maintenance.

DESCRIPTION: Currently available breaching devices tend to be large and unwieldy. They have limited application to specific targets. A separate device may be required for each type of breach. All of the current devices, rabbit tools, TOHO breaches, Halligan bars and battering rams have specific problems in use.

Phase I would be proof of concept and or development of a prototype. Respondents should have experience in development of special operations equipment and the ability to obtain a Top Secret clearance. Phase Ii would be refinement of the design and field-testing of a number of units to be determined by the Marine Corps.

SPACE AND NAVAL WARFARE SYSTEMS COMMAND

N90-045 TITLE: Force Level Analysis Tool Support and Software Module Development

CATEGORY: Advanced Development

OBJECTIVE: Develop modeling tools for multi-warfare, multi-platform warfare.

DESCRIPTION: The Space and Naval Warfare Systems Command (SPAWAR) is currently developing methodologies and tools for assessing force performance. Due to the evolving threat advancing rapidly in scope and capability, it is critical that SPAWAR move forward to develop a set of modeling "tools" capable of assessing the integrated capabilities of U.S. Naval battle forces while they are participating in multi-warfare, multi-platform warfare.

For this multi-warfare problem, SPAWAR is evaluating a simulation/modeling development environment. The modeling environment should support the use of a wide variety of computer languages (FORTRAN, Pascal, C, LISP, etc.) and operating systems (VMS, DOS, UNIX, etc.). The simulation architecture is based upon a modular object oriented approach to modeling. Since the simulation format has been developed, elements of this matrix (algorithms and computer code) for a wide variety of naval warfare systems ranging for C***, ASW, AAW, STW, LOG, etc., need to be developed. All source codes must meet specified requirements addressing user needs, equipment, software coding, modeling environment, system security, and configuration management. All source codes which are developed would become property of SPAWAR.

N90-046 TITLE: Advanced Systems and Concepts for Future Naval Warfare

CATEGORY: Exploratory Development

OBJECTIVE: To enhance Navy's future Battle Force Warfare capabilities in CI, Undersea Surveillance and ASW.

DESCRIPTION: Navy is seeking new, innovative, high risk/high payoff ideas in technologies and/or advanced systems concepts in support of C3I, Undersea Surveillance and ASW. The new technologies and systems concepts must address Battle Force Warfare (both low intensity conflict and full power projection) for the years 2005 and beyond. Imaginative, realistic ideas are encouraged. Offerors may submit as many proposals as deemed appropriate to cover their varied ideas.

The Phase I proposal should address: a. the systems concept and technology being proposed; b. the operational utility of the system; c. the scientific principal(s) involved (show quantitative formulation where appropriate); d. the adequacy or maturity of the technical discipline to realize the system; and e. the work planned to demonstrate technical feasibility.

Development of the requisite sub-system and/or new technology to demonstrate the proposed system concept will be addressed in Phase II, if technical feasibility warrants.

N90-047 TITLE: Non-Acoustic Underwater Imaging

CATEGORY: Exploratory Development

OBJECTIVE: To provide the Navy with the capability to covertly detect, classify and identify, in real-time, potential threat submarines.

DESCRIPTION: The Navy is seeking innovative Exploratory Development of non-acoustic underwater imaging techniques to covertly image, in real-time, potentially hostile submarines. (Navy is also interested, in non-acoustic techniques covertly determine range-only of threat submarines). The imaging systems will be installed aboard submarines, surface ships, helicopters and fixed-wing aircraft. Offerors may want to consider a single technique suitable for all platforms or more than one technique, each being unique to a specific platform. A capability to covertly image underwater ranges of 6000 yards is being sought.

The Phase I proposal should address: a. the scientific principal(s) involved that supports the underwater imaging technique being proposed (show quantitative formulation where warranted); b. the system concept; c. the adequacy of maturity of the technical discipline to realize the system concept; d. the operational utility; and e. the work planned to demonstrate technical feasibility. Development of the requisite subsystems and/or new technology to demonstrate the proposed imaging technique will be addressed in Phase II, if technical feasibility warrants. (Note: Offerors proposing more than one imaging technique should submit separate proposal for each. Classified proposals are acceptable.)

N90-048 TITLE: Non-Acoustic Submarine Tactical Communications

CATEGORY: Exploratory Development

OBJECTIVE: To provide the Navy a capability for covert, real-time, tactical information exchange between submarines and surface combatants.

DESCRIPTION: Navy is seeking innovative Exploratory Development of non-acoustic underwater communications techniques that provide for real-time, covert data communications between surface combatants and submarines at operating depths. Data and modulation rates should be commensurate with operational and tactical needs. Covert inter-platform data exchanges to ranges of 6000 yards is being sought.

The Phase I proposal should address: a. the scientific principal(s) involved that supports the non-acoustic underwater communications technique being proposed (show quantitative formulation where warranted); b. the system concept; c. the adequacy of maturity of the technical discipline to realize the system concept; d. the operational utility; and e. the work planned to demonstrate technical feasibility. Development of the requisite subsystems and/or new technology to demonstrate the proposed imaging technique will be addressed in Phase II, if technical feasibility warrants. (Note: Offerors proposing more than one imaging technique should submit separate proposal for each. Classified proposals are acceptable.)

N90-049 TITLE: Warfare Systems Architectures

CATEGORY: Exploratory Development

OBJECTIVE: To promote innovative concepts for future Naval Warfare Systems.

DESCRIPTION: Naval warfare strategies and system acquisition are undergoing deliberate changes in the Navy. Stand-alone system, interoperability issues and adverse programming actions are a few of the reasons giving rise to these deliberations. The Navy is presently examining a top-down approach to R7D and acquisition decisions, guided by Top Level Warfare Requirements (TLWRs). The Warfare Systems Architectures focus on TLWR compliance. Rigorous mission analysis, force level perspectives and systems architectures are the end products. They address 12 warfare mission areas; Command (communications), C***, Strike Warfare (SW), Anti-Surface Warfare (ASUW), Mine Warfare (MIW), Electronic Warfare (EW), Special Warfare (SW), Amphibious Warfare (AMW), Anti-Air Warfare (AAW), Anti-Submarine Warfare (ASW), Space, and Logistics. The force structures to implement these warfare missions include the Carrier Battle Force (CVBF), Battleship Battle Group (BBBG), Amphibious Task Force (ATF), Area ASW Force and SLOC Protection Force.
The architectural process involves four steps. 1. Functional decomposition of the mission which entails decomposing the mission into tiers, establishing Required Operational Function (ROF), devising flow diagrams and

building a complete data base. 2. Physical analysis of the current force, e.g., complete understanding of the platforms, systems architecture, establishing functional shortfalls of the baseline architecture and adding Fiscal Year Development Plan programs. 3. Identifies shortfall resolutions, such as systems upgrades, notional platforms, etc. This step is reiterated and refined. 4. Architecture Options, which establish WSA&E products such as Force Level Architectures and TLWR compliant options (costs, performance, schedule, risk, technology, payoff).
Proposals for innovative systems architectures should address a single mission area; multiple proposals are acceptable.
Phase I should focus on architecture and a means to show feasibility of the architecture relative to the four steps of the architectural process discussed above.
Phase II will involve continued analysis (via the 4 step process) to begin realization of the architecture(s).

NAVAL SUPPLY SYSTEMS COMMAND

N90-050 TITLE: Artificial Intelligence System for Source Code Compliance to Data Rules

CATEGORY: Advanced Development

OBJECTIVE: Development of a prototype software system, which will analyze software source code for compliance with format rules.

DESCRIPTION: An Artificial Intelligent (AI) System is needed to analyze a program's source code to determine compliance to data rules. Rules would include data validation code, restriction of update to data owners, and naming conventions. The AI system would need to automatically adjust itself as the rules changed.
Phase I would produce a software specification. Phase II would produce a prototype software system.

N90-051 TITLE: Central Management of Multi-Site ADP Capacity Planning

CATEGORY: Advanced Development

OBJECTIVE: Development of a prototype cooperative processing software system for implementation at Naval Supply Systems Command (NAVSUP) activities.

DESCRIPTION: Capacity planning requires expertise in the use of several software packages in addition to knowledge in collecting manually prepared forecast data. The software packages include modeling tools, CPU event reporting tools, disk management software, configuration management software, and a resource management system. In addition, once the basic data has been collected, management analysis must be performed to develop a capacity plan that covers many computer sites. The plan must include information for fine tuning forecasting techniques, identification of performance problems through review of key indicators, determination or reallocation of current resources, and decision on future capacity requirements. An expert system consisting of mainframe components and personal computer cooperative processes is required to facilitate capacity planning. The cooperative processing subsystem would teach capacity planning skills, walk users through the accomplishment of site specific procedures, and interview users for forecast data. The remote site mainframe components would extract data to be sent to the central site. The central mainframe site would provide a data respiratory for the management analysis component.
Phase I would produce a specification for the prototype expert system.
Phase II would result in a prototype expert system

N90-052 TITLE: Integrated Users Support System for Shipboard Uniform Automated Data Processing System (SUADPS) Resystemization

CATEGORY: Exploratory Development

OBJECTIVE: The project will involve the development of a shipboard training approach, which integrates initial, refreshment, and referential training.

DESCRIPTION: The SUADPS Resystemization project is undertaking a zero based redesign of the supply and financial management systems afloat. The objective is to develop a standard hardware and software interface to the sailor aboard ship. An essential ingredient for the system is the integration of training. Although there are plans to ensure classroom training will be available when the new systems I ready to be implemented, as well as implementation training, areas that have not been addressed are as follows: 1. Training of sailors as they come aboard ship, the turnover of crews aboard ship is extremely high, and not every sailor has the change to go through training ashore. There is a requirement to train these sailors on the various aspects of the system once they get aboard. 2. Refresher training aboard ship, as sailors move from assignment to assignment aboard ship there is a need to provide a mechanism for them to receive refresher training while onboard. This would have to vary in detail and difficulty depending on the individual subject area, as well as the sailor and 3. Referential training. As part of the onboard training requirement it is necessary to give the sailor access to the reference material needed to properly do his job. The system has to be robust enough to support detailed review of standard reference publications, as well as the use of "expert system" to guide him through various problems and questions. The project will involve a review of the training area to determine the mix of hardware and software than can be brought to bear to meet these requirements. Phase I will specify the "training" approach and the system requirements for implementation. Phase II will provide a prototype of the system demonstrating how it can be integrated into the re-systemized system.

N90-053 TITLE: Automated Aid for Hazardous Material Control

CATEGORY: Advanced Development

OBJECTIVE: To create a turnkey device to aid in controlling and properly documenting Hazardous Material.

DESCRIPTION: Development of a micro-type hand carried system with update capability of all changes to NAVSUP 505 (AFR 71-4) to allow quick up to date knowledge by Navy and Air Force (AF) loadmasters concerning critical rules concerning compatible/incompatible cargo etc. Navy C-9 aircraft loadmasters have a definite need and even AF loadmasters must now scramble to have updates and own copies of regulations which change often-mobile nature of missions to possible isolated areas makes this critical. A belt type flip out type unit would be best (i.e., ergo metrically designed) or stow able in A-4 bags (duffel bags). Phase I will provide a proposed mock-up of the model. Phase II will provide a prototype of the device.

N90-054 TITLE: Extreme Cold Weather and Fuel Resistant Protective Hardware

CATEGORY: Exploratory Development

OBJECTIVE: To develop a fire resistant, cold weather glove which provide for warmth and dexterity at temperatures down to –40 F.

DESCRIPTION: The navy has a need for a cold weather glove which provides for warmth and dexterity at temperatures down to –40 F. The gloves must be fire retardant, water impermeable and exhibit chemical resistance to all classes to liquid fuels. Simultaneously, the glove must allow for rapid transmission of moisture vapor from the skin to the outer surface. The component materials and specific design of the glove must component materials and specific design of the glove must allow for good dexterity/tactility and minimize hand/finger fatigue. The use of novel polymer technology is encouraged. Phase I will be aimed at developing suitable materials for fabrication into gloves. Phase II will produce at least two suitable prototypes.

N90-055 TITLE: Indexing of Technical Information for Computer Aided Acquisition and Logistics Support (CALS)

CATEGORY: Exploratory Development

OBJECTIVE: To develop and test an indexing and data structure methodology for CALS database design to achieved configuration management of technical information in integrated databases.

DESCRIPTION: Each functional group of technical information possesses its own unique index. These include part numbers, stock numbers, drawing numbers, logistics control numbers, as well as many others. However, the indices for each group are not 100% compatible and therefore cannot translate successfully at all times. Automation of the entire technical information system which is mandated by the Department of Defense under the Computer-aided Acquisition Logistics Support (CALS) initiative, requires development of a universal indexing and data structure in order that all information can be managed under one compatible system.

N90-056 TITLE: Durable Press Finish for Fire Retardant Treated (FRT) Cotton Fabric

CATEGORY: Exploratory Development

OBJECTIVE: To develop a durable press finish for fire retardant treated (FRT) cotton fabrics.

DESCRIPTION: The Navy has a need for a durable press finish for FRT cotton fabrics in finished weights up to 6.0-oz/sq yd. The finish shall not adversely affect the material's physical and/or fire retardant characteristics by more than 10%, and the finished fabric shall have a soft hand. The finished fabric shall demonstrate a minimum durable press rating of "3" when tested in accordance with AATCC Method 124-1984. The finish must be durable to multiple laundering cycles. A fiver-yard sample, minimum 45" cloth width is required for Phase I. One hundred yards of material, finished on standard commercial production equipment is requirement for Phase II.

N90-057 TITLE: Reverse Program Data (RPD)

CATEGORY: Exploratory Development

OBJECTIVE: Explore the feasibility of the Navy Inventory Control Points (ICPs) obtaining timely information of declining programs due to equipment modifications and phase out. Development of a pilot program to reduce the potential for ordering obsolete spare/repair parts.

DESCRIPTION: Notification of a configuration change is normally accomplished through the receipt of Design Change Notices (DCN). DCN's may notify the Inventory Control Parts (ICPs) that a stocked item is obsolete, will become obsolete or is superseded by a higher reliability interchangeable part. Program support data is another vehicle for notifying the ICPs. However, program support data is not at the part level and, if provided would apply to field changes, ordnance alterations, ship alternations. Although program support data is required for all significant changes, program support data sheet generally apply to major changes only. An effective formal procedure to ensure against the procurement of obsolete items does not exist. Program change data is integrated with all provisioning backlog and not segregated. All of these conditions contribute to a significant probability of procurement of obsolete items.
Phase I should focus on the feasibility of a system to forecast the impact of declining programs on spare/repair material requirements, identify the most feasible long term system along with the major policy/ADP programs organization and resource changes needed to affect it, and consider a short term pilot program with an actual declining program to demonstrate the proposed system, including a detailed POA&M (Plan of Actions and Milestones).
Phase II is to be a test of the pilot program with a declining program selected by the Navy.

NAVAL MEDICAL RESAERCH AND DEVELOPMENT COMMAND

N90-058 TITLE: Recombinant DNA Cloning of Enzymes Essential for the Enzymatic Removal of Carbohydrate Antigens from Human Erythrocytes for the Production of Type "O" Red Cells from Type "B" Cells

CATEGORY: Advanced Development

OBJECTIVE: Demonstrate ability to clone, express and isolate recombinant produced enzymes and scale-up for large quantity production.

DESCRIPTION: A requirement exists for the genetic cloning, expression, and isolation of an alpha galactosidase present in green coffee beans. The enzyme is used for the cleavage of the B carbohydrate surface antigen present on human B erythrocytes for the enzymatic conversion and production of type O red cells from type B erythrocytes. The enzyme has been isolated and purified by conventional techniques from green coffee beans and subsequently used for the enzymatic conversion of type B red cells to type O with successful transfusion of the converted red cells into type A human volunteers. To proceed, expertise is necessary in enzyme eventual large-scale production according to FDA GMP requirements. The Navy has an interest in obtaining an FDA approved red blood cell enzymatic conversion capability to produce type O erythrocytes from any donor red cell units in order that transfusions can be performed without the need for typing and cross matching. Additional reference material can be obtained in the scientific literature.

N90-059 TITLE: Production of Biosensor Based Techniques and Equipment for Essential Clinical Assays to be Performed in the Military Field Environment for Combat Casualty Care

CATEGORY: Exploratory Development

OBJECTIVE: Demonstrate feasibility of employing advanced technologies (biosensors, etc.) to determine important medically diagnostic values in the combat environment. The goal is technology implementation that is battlefield durable, reliable and rapid.

DESCRIPTION: The Navy and Marine Corps have the need for the development of clinical diagnostic capabilities in the field based on noninvasive or blood sample assays which utilize biosensors or other advanced technologies that can provide essential clinical assay evaluations for combat casualty care. These devices must be small, rugged, operational in environmental extremes, and independent of reagents that require refrigeration, freezing, or carefully controlled storage conditions. Ideally, devices and techniques should reagent independent and easily used by medical support personnel in field and shipboard environments. The essential diagnostic assays required to be performed by one or several clinical devices include blood gases, hematocrit, hemoglobin, serum electrolytes, glucose, BUN, and creatinine. Offerors need not address all assay requirements to be considered. The best technical approach for military needs in a field environment will be evaluated for each assay and not simply by instrumentation that performs the most assays in a single unit. Assay speed, reproducibility, and accuracy, as well as the ability to perform tests in close proximity to the casualty, are important considerations.

NAVAL AIR SYSTEMS COMMAND

N90-060 TITLE: Coating System for High Temperature Titanium Alloys

CATEGORY: Exploratory Development

OBJECTIVE: Development of a coating or coating system applicable to titanium base alloys for operation above 1200 degree F in the oxidizing environment of a gas turbine engine.

DESCRIPTION: Future generations of gas turbine engines for naval aircraft and missile application have strong requirements for high specific thrust ratios and low specific fuel consumption. In order to meet these goals, gas turbine engines must operate at higher temperatures, pressures and speeds using advanced high temperature, lightweight materials. The primary materials candidates, particularly for compressor applications, are advanced

titanium alloys and titanium intermetallics, especially titanium aluminide. Nevertheless, evaluation of these materials has shown that significant deterioration in mechanical properties and structural integrity can result from exposure to aggressive, high temperature environments.
An innovative coatings development effort is required to address the problems of rapid oxidation, hot corrosion and hot-salt-induced stress-corrosion cracking of high temperature titanium alloys. This coating system should be applicable to titanium alloys operating up to 1300 F in a gas turbine engine environment, to titanium aluminides operating up to 1800 F in the same environment or to both.

The Phase I effort should demonstrate the feasibility of one on more coating system on at least one appropriate titanium alloy.

Phase II would extend coating development and include characterization of a coated system through materials testing over the temperature regime interest. Specific alloy or intermetallic selection is to be made by the offeror.

N90-061 TITLE: Assessment of Heat Damage in Composite Materials

CATEGORY: Exploratory Development

OBJECTIVE: Characterize the effects of heat on resin-matrix composite materials and develop nondestructive inspecting techniques capable of detection heat damage at the operational level.

DESCRIPTION: The effects of heat damage on resin-matrix composite materials of the type used in naval aircraft have not been fully characterized. Nevertheless, these materials may be exposed to damaging levels of heat as a result of fire or operations. Furthermore, it is desirable that the damage of a severity relevant to the mechanical performance of composites be assessable at the operational level of Navy small fleet aircraft via a simple inspection procedure. Early studies have shown that current carbon-epoxy aircraft composites exhibit degraded mechanical properties following exposures at 300 C for short periods. Under carefully controlled conditions it was possible to correlate discoloration of standard paint coatings with the decrease in mechanical properties.
An innovative development project is required that include characterization of heat damage in appropriate aircraft carbon-epoxy laminates and the exploratory of nondestructive inspection (NDI) techniques that can identify and assess this damage in the field. The baseline composite material should be Hercules/Fiberite IM6/3501-6. Additional characterization of at least one other fiber-epoxy system during Phase Ii would be required. The simplicity and field applicability of any developed NDI equipment will be placed at a premium.

N90-062 TITLE: Remote ASW Sound Sources

CATEGORY: Exploratory Development

OBJECTIVE: Develop method for a low flying aircraft to beam sound into ocean water without the use of expendables or mechanical contact with the seawater.

DESCRIPTION: P-3 anti-submarine warfare aircraft, drop passive sonobuoys over large tracks of the ocean and monitor returning RF signals for the presence of submarines. Active sound sources, such as sonar pingers or explosive charges are sometimes dropping in the water and used in conjunction with sonobuoys to actively search for submarines. Both sonar pingers and explosive charges are expendable which must be replenished after use. To save cost and payload weight the Navy is therefore interested in reusable methods of remotely producing sound in ocean water by a low flying aircraft. The method may rely on lasers or other means of projecting energy to the ocean surface where a means must be found to convert the energy to sound in the frequency band of interest.

N90-063 TITLE: Anti-Jam Methods for RF Receiver

CATEGORY: Exploratory Development

OBJECTIVE: Develop a method of extracting low-level RF signals from high level background noise and jamming.

DESCRIPTION: Sonobuoys are air-dropped in the ocean in great numbers in anti-submarine warfare operations to detect submarines by means of underwater acoustic signals. The signals are telemetered to aircraft by means of batter-generated RF signals. These signals are susceptible to interference by relatively unsophisticated submarine-deployed RF jamming devices. An anti-jam technique is sought which is capable of distinguishing a signal strength 20 Db below the background RF interference. The technique must not require modification of the sonobuoy transmitter and cannot be modulation dependent. The proposed Phase I study and/or demonstration methodology must be capable of incorporation in an airborne receiver/antenna system. The proposal should also include an outline for a proposed Phase II demonstration of the concept.

N90-064 TITLE: ASW Non-Acoustic Sensors

CATEGORY: Exploratory Development

OBJECTIVE: To devise an inexpensive non-acoustic, non-magnetic, passive, air-dropped buoy for the detection of submarines.

DESCRIPTION: The Navy Anti-Submarine Warfare program currently uses air-dropped buoys to detect and track the position and course of submerged submarines. Recent advances in technology have reduced both the noise emissions produced by submarines and their influence on the Earth's magnetic field, thus reducing the range that passive buoys can detect a passing submarine. New methods of passively detecting submarines are, therefore, sought that do not depend on the acoustic emissions made by the submarine or by changes in the Earth's local magnetic field caused by the submarine's passage. The proposed detector of submarines is restricted to deployment within the standard 5 inch diameter buoy housing and must be inexpensive to mass produce. The proposed study and/or demonstration must address feasibility and all technical risk factors. Phase II should demonstrate the concept outlined in Phase I utilizing prototype hardware.

N90-065 TITLE: Low Probability of Intercept/Anti-Jam (LPI/AJ) Voice/Data Link

CATEGORY: Exploratory Development

OBJECTIVE: To develop a LPI/AJ communications link concept and design implementation suitable for covert communication with and between U.S. military aircraft.

DESCRIPTION: Navy aircraft are being designed to reduce their detectability by the enemy. In addition, they have to perform their missions in an environment where communications must be resistant to jamming. What is needed is a jam resistant, covert communication capability to support Naval aviation requirements for attack, fighter, and early warning/force coordination missions.
Phase I should consist of a study outlining a systems concept and basic systems performance tradeoffs.
Phase II should expand on the concepts presented in Phase I to provide detailed tradeoffs resulting in design implementation, with quantification of expected performance.

N90-066 TITLE: Optical Fiber Compatibility with Advanced Electronic/Structural Materials

CATEGORY: Exploratory Development

OBJECTIVE: To investigate optical fibers embedded in various materials for distributing optical signals.

DESCRIPTION: Optical Fibers can provide an advanced data transmission, diagnostic and sensing capability for future aircraft. Most optical fibers are currently utilized in a cable or ribbon wiring harness. There is a need to provide a monolithic materials capability for distributing fiber optic signals in computer backplanes as well as an aircraft skins and engine/aircraft structures. The thermal, structural, and optical transmission properties of

promising ceramic, thermoplastic, composite and/or metal matrix materials require investigation. These investigations should lead to next generation of optical computer signal distribution backplanes as well as new capabilities for “smart structures” for aerospace applications.

N90-067 TITLE: Long Duration Performance of Aircraft Inertial Navigation System

CATEGORY: Exploratory Development

OBJECTIVE: To investigate the damping of inertial systems

DESCRIPTION: Currently, naval aircraft mission are of relatively short duration (a-10 hours) with the onboard Inertial Navigation System (INS) operating in a free inertial mode. Future applications, however, include missions of long duration requiring the aircraft to be on station for several days (e.g. UAV High Altitude Long Endurance (HALE) Airship, etc.).
The Phase I study is to address a) determining feasibility/necessity of damping a strap down inertial system; b) methods of damping; and c) proposed mechanizations with associated tradeoffs in complexity cost, performance, etc.

N90-068 TITLE: Impact of Using Dispersed Sensors for Navigation

CATEGORY: Exploratory Development

OBJECTIVE: To investigate the sharing of inertial sensors between navigation systems

DESCRIPTION: Currently, aircraft having more than one inertial navigation system do not share sensors between those systems. Sharing sensors would increase the redundancy level and the reliability of the navigation suite. The study is to address a. methods of synthesizing a Fall-Op (or better) navigation solution using dispersed sensors; b. assessment of performance degradation resulting from sharing of dispersed sensors; and c. an assessment of inertial sensor accuracy requirements to allow failure isolation to the accuracy level needed to meet basic mission requirements.

N90-069 TITLE: Passive Fiber Optic Components for Severe Environments

CATEGORY: Exploratory Development

OBJECTIVE: To develop fiber optic components capable of withstanding severe aircraft environments.

DESCRIPTION: The application of fiber optic components to military aircraft will require a family of components capable of withstanding environmental extremes. Development of fibers, cables, connectors and couplers capable of withstanding the high temperature and vibration of the aircraft engine environment is required. In addition, high-density multi-channel connector and cabling concepts are required for computer interconnects and aircraft interconnection. Lens connectors, silicon V-groove technology, ceramic or composite back shells and other naval materials or design concepts capable of providing hermetic and semi-hermetic interfaces for multiple fiber to electro-optic components or sensors are solicited.
Phase I should outline the specific design for each component including environmental analysis for the aircraft/engine application. Prototype hardware should be included if available.
Phase II should be the final design and analysis and delivery of multiple units to demonstrate reproducibility of the design and environmental capability.

N90-070 TITLE: Portable Koalas; The Knowledgeable Observation Analysis Linked Advisory System

CATEGORY: Exploratory Development

OBJECTIVE: Develop tools for implementing a portable version of the KOALAS architecture for use on microprocessor-based workstations.

DESCRIPTION: The KOALAS architecture is being developed under an ongoing coordinated R&D program between US Navy and Los Alamos National Laboratory. The KOALAS architecture provides a generic system design for a broad range of tactical decision-making systems and is described in technical reports available in the public domain. The architecture comprises two subsystems: 1. a situation assessment subsystem; and 2. a conventional rule-based advice generator. The heart of KOALAS is an embedded simulation system that comprises the situation hypothesis upon which the tactics advice generator operates. Human performance advantages of KOALAS in the anti-air warfare application include 1. Reduced manpower required for surveillance, resource allocation decisions, and intercept control; 2. Increased situational awareness; and 3. Optimal combat resource fusion systems; Engineering advantages of the KOALAS approach include: 1. Minimized information processing load on sensor fusion systems; 2. Constrains on backtracking in multi-sensor correlation algorithms; 3. Common adapt structures for training and deployed systems; and 4. robust performance against deception. The project will focus on air warfare, but results will encompass both air and surface platform applications.

The Phase I objective is: Identify specific tools to be developed, such as an interface development tool, an embedded simulation tool, and a frame-based or rule based advice representation tool; establish potential market for tool set; collect available technical data regarding KOALAS architecture; plan development; establish close collaborative relationship with user community.

Phase II objective is to develop, document, and produce a basic KOALAS tool set.

N90-071 TITLE: Innovative Graphics Architecture Concepts for Advanced Simulators

CATEGORY: Exploratory Development

OBJECTIVE: To design and fabricate a low cost, high performance graphics architecture capable of supporting high resolution simulation. If successful, mission training, mission rehearsal and mission review would be accessible to many more people, on smaller simulator systems, for greater lengths of time, at a reduced cost.

DESCRIPTION: The use of visual simulators during training, mission rehearsal, and post mission debriefing can greatly increase aircrew performance and mission effectiveness. The size and cost of current simulation systems, however, makes the proliferation and tactical deployment of simulators infeasible. A low cost, small footprint simulation system is needed to support tactical operations. The purpose of this effort is to develop such a system by utilizing recent advances in parallel processing hardware to attain performance/cost improvements. The system will be a desktop simulator capable of real time generation of visual, infrared, and radar scenes of terrain, cartographic and man made features. A parallel architecture is envisioned using commercially available processing elements. Key design problems include defining an optimal processor topology, interfacing the processor to high speed disk subsystems, and interfacing the processor to display memory. Another major design hurdle will be the development of a small display device capable of providing the level of realism necessary to support successful mission simulation, while at the same time not sacrificing portability and ease of use. The possible inclusion of innovative display concepts, like helmet mounted displays and fiber optic bundles, should be possible targets for evaluation.

Phase I work will involve the identification of the necessary hardware and software components for this simulator, as well as defining the operational requirements for the prototype system.

Phase II will involve the creation of an advanced development prototype to demonstrate the feasibility of the simulator system. Offerors may submit proposals addressing any or all of the items embodied above.

N90-072 TITLE: Detection of Wideband Radar Signals

CATEGORY: Exploratory Development

OBJECTIVE: Devise a receiver architecture capable of receiving wideband low power radar transmissions suitable for installation in tactical aircraft.

DESCRIPTION: Radar transmitter and signal processing technologies now permit wideband modulation f continuous wave transmissions. These modulations can take a variety of forms. From an electronic warfare point of view, a very difficult modulation is one which appears random, such as pseudo noise sequence of phase reversals of the carrier frequency. The effect of this radar transmission format is a low peak power compared to traditional pulsed radar signals, broad band across which the power is spread, and a signal format which has no obvious identification characteristics. Used in missile seeker radars, these transmissions cannot be detected by current tactical EW systems such as super heterodyne, IFM or channelizer receivers.

An architecture for a realizable EW receiving system which will reliably intercept modulated and other low power, wideband radar signals is needed. The system must be capable of instantaneous bandwidths of 10 to 20% of the carrier frequency, of detection of signal levels well below the noise power level of the signal bandwidth and must be able to test for known modulations of high priority and threat signals. The system must simultaneously retain the sensitivity and selectivity of current EW systems against traditional pulsed radars, be capable of intercept of frequency diversity radars such as pulse to pulse frequency hopping and FM on pulse and must be capable of extremely high sensitivities against threat signals whose parameters are precisely know. The system must be capable of reconfiguration to meet varying search and signal bandwidth requirements and must be programmable to intercept new signals as they emerge.

Phase I should specify the receiver system architecture, including the processing scheme, verify that the system is realizable using commercially available hardware and software and provide a program plan for Phase II proof of principle breadboard development and test.

N90-073 TITLE: Passive Non-Cooperative Target Recognition Sensor

CATEGORY: Exploratory Development

OBJECTIVE: Device as passive non cooperative target recognition sensor for installation in aircraft and/or missiles.

DESCRIPTION: A proof of concept is sought that demonstrates a new method of identifying threat target platforms, as opposed to friendly or neutral platforms. Cooperative systems are limited in usefulness due to their overt nature, the tendency of operators to avoid using them and their vulnerability to exploitation, decoy and spoofing. Non-cooperative systems require no cooperative answer from the suspect platform. Non-cooperative target recognition (NCTR) systems can be active, as in radar modulation techniques, or passive, as in infrared images or infrared signature detectors. A passive NCTR technique is needed that is both robust and implementable in aircraft and/or missiles. A combination of sensors is acceptable if it can be shown that fusion at the sensor level is clearly advantageous. Delivery of theoretical proof of concept computations is sought for Phase I, which should be supported by breadboard demonstration in Phase II.

N90-074 TITLE: Secondary Sensor for Anti-Radiation Missiles

CATEGORY: Exploratory Development

OBJECTIVE: Devise sensor method of targeting critical ground-based radar components. Sensor can not rely on electro-magnetic (EM) emission from targets.

DESCRIPTION: Anti-radiation Missiles (ARMs) are effective when homing on a radiating electro magnetic source. However, when the threat EM source is shut off for countermeasures purpose, the ARM must depend on a predetermined course, without additional guidance information from the radiating source. A secondary sensor or shared aperture concept is needed, preferably passive, to supply guidance information during the blackout period. Infrared detection co-axial with the primary radiation detection sensors are currently being considered by the Navy.

Novel proposals are sought which do not utilize conventional IR or visible light detection methods. Contractors should consider sensor candidates that could be housed in a missile with a typical diameter of five inches. Total sensor weight, including power supply, should not exceed 15 pounds.

Phase I – perform investigation study of proposed secondary sensor system that provides proof-of-concept using computer simulations and models and/or a partial breadboard system.

Phase II – construct a brass board system that demonstrates the sensor concept and prepare a documentation package that is suitable for taking the concept to Engineering Development.

N90-075 TITLE: Improved IRST Sensor

CATEGORY: Exploratory Development

OBJECTIVE: Devise improved IRST sensor which eliminates clutter and false targets.

DESCRIPTION: Airborne Infrared Search and Track (IRST) sensors are desired to perform non-imaging infrared missile searches of the horizon to detect incoming low altitude aircraft target missiles. The field of view (FOV) extending from 20,000 – 30,000 feet down to a few milliradians above the horizon is of greatest interest in designing detectors to detect aircraft and missiles that may be traveling within ten feet of the ocean surface. This gradient has the effect of magnifying image motion caused by small movements of the platform resulting in another source of false IRST target identifications. An improved design concept is sought which eliminates clutter and false targets from scanning IRST detectors.

Phase I should provide an analysis which demonstrates the new concept and presents a proposed IRST sensor design.

Phase II should include a breadboard demonstration of the concept.

N90-076 TITLE: EO-IR Sensor Application in Anti-Air Warfare

CATEGORY: Exploratory Development

OBJECTIVE: Research application of evolving EO-IR technology to meet anti-air requirements.

DESCRIPTION: EO-IR technology has evolved in detectors and materials that promise to offer significant improvement in sensitivity and inherent angular discrimination. These features coupled with high capacity processing to reject background and countermeasures will offer low false alarm and high performance tracking of airborne targets. Utility of these emerging technologies will depend on the operational environmental conditions and any countermeasure degradations. Research is sought to investigate the application of modern EO-IR sensors in the previously described environmental areas using environmental data and projected countermeasures to assess performance effects.

Phase I will be a study/report/algorithm investigation.

Phase II will be algorithm application (software/hardware).

N90-077 TITLE: Buffet Vibration Absorber

CATEGORY: Exploratory Development

OBJECTIVE: To suppress the buffeting vibrations of aircraft aerodynamic surfaces. Demonstration of the feasibility such a device would lead to flight evaluation and eventual incorporation into fleet aircraft such as F/A-18 that currently experience problems, including structural fatigue, due to buffet.

DESCRIPTION: Tactical aircraft maneuvering at high angles of attack induce the formation of unsteady and vortex flows that, in turn, excite the aft aerodynamic surfaces of the aircraft, causing the vibrations known as buffet. Contemporary fighter aircraft such as F-14, F-15, and F-18 have all been subject to destructive vibrations of their twin vertical tails. Control considerations dictate that this type of configuration is likely to remain in flavor; that is, the source of the excitations will probably not go away. Therefore, the surfaces will have to be designed to survive in their environment. As an alternative to beefing up the structure to withstand the vibratory stresses, the application of vibration absorber technology is suggested.

Vibration absorbers typically consist of a spring mass system with a natural frequency that corresponds to the unwanted excitation. In this case, the excitation is broad band, and significant responses are at the natural frequencies of the structure.

Phase I should consist of a study to characterize the potential performance of such a device, including an assessment of its energy absorbing potential and frequency requirements.

Phase II should develop and deliver to the government for testing a prototype model tailored for a particular aircraft application.

N90-078 TITLE: Operational Exploitation of Active and Passive Sensor Information by U.S. Navy Tactical Aircraft Operating in a Multi-Platform Tactical Situation

CATEGORY: Exploratory Development

OBJECTIVE: To design an active and passive sensor information processing and display architecture that enables aircrews to detect and classify targets beyond active sensor range and engage targets at the maximum range of their missile systems. If successful, this system architecture (or components of it) could be integrated into current fighter aircraft and included in the design specifications for future generation fighter aircraft.

DESCRIPTION: Fleet defense and fighter escort operations require aircrews to assimilate a variety of active and passive sensor information, to commit weapons, and to engage prospective enemy targets rapidly. The processing and display of this sensor information (such as information from non-cooperative tactical data links) may provide aircrews with longer detection ranges, longer reaction time intervals, enhanced situational awareness, improved weapon effectiveness, and increased survivability. Phase I should analyze a U.S. Navy fighter aircraft versus a current generation threat using the following approach:

- Identify a scenario that would include both sides participating in the control of modern fighter/interceptor aircraft, using airborne warning and control system aircraft, or a similar system. Each side would also employ state-of-the-art automated control systems.
- Identify all sensors (existing and proposed) and the types of information provided by each sensor.
- Analyze the characteristics of the information provided by each sensor.
- Evaluate alternative information processing and display concepts to optimize fighter weapons systems employment in a real world operational environment.
- Provide simulations of this architecture and alternative displays on a computer. Specifically, this would include the simulation and display of data from selected sensors, such as non-cooperative data link. Phase II would expand the processing and display architectural concepts for Engineering Development.

N90-079 TITLE: Automation of Digital Data Review and Verification

CATEGORY: Engineering Development

OBJECTIVE: To take advantage of near future Computer-Aided Design (CAD) and Engineering Data Management and Information Control System (EDMICS) capability so as to enable on line verification of aircraft hardware vendor's Technical Data Packages (TDPs) submitted in digital format per Department of Defense (DOD) initiatives. If successful, automated data verification would slash administrative overhead, dramatically increase the accuracy and speed of the Government's verification process, and efficiently focus senior industrial specialists' effort on complex producibility, capability and competitiveness issues.

DESCRIPTION: Government review of vendor TDP's is now a labor intensive, manual operation requiring direct handling of tens of thousands of paper blueprints or aperture cards for each significant aircraft or component program. The DOD is requiring digital format delivery of TDPs for 1990's new production programs, promising enormous cost savings to vendors, space savings at Government repositories, and vastly broader while better controlled dissemination to Government engineering drawer users. CAD and EDMICS systems, to be implemented for Engineering Development and repository storage/retrieval operations, respectively, could also automate data verification. However, this potential will not be realized without specialized software and possibly minor peripheral hardware. Order of Magnitude productivity improvements appear feasible by automating database entries, and by eliminating card-by-card review for completeness and for mat discrepancies. Process automation would also help enforce rigorous statistical sampling, to generate a strong case for Government lawyers should analysts and contracting officers persuasion fail to enforce Government data rights – again, without requiring data review specialists to examine each data element (the labor cost of which review could easily exceed potential benefits to be derived from successful prosecution).

Phase I should consist of a study to determine which data objects may be transferred on line from either raster vector data representations, and which data review process elements lend themselves to full automation on the projected CAD and EDMICSs systems.

Phase II should develop pilot software (with or without minor hardware add-ons), delivering the resulting package to the Government for testing on CAD and/or EDMICS systems.

N90-080 TITLE: Minimization of Environmental and Health Hazards Through the Use of Innovative Materials and Maintenance Process

CATEGORY: Engineering Development

OBJECTIVE: Provide technology to eliminate or significantly reduce the generation of physical, chemical biological pollutants, generated during naval aviation maintenance, that adversely affect human health or welfare, and to ensure compliance with environmental laws.

DESCRIPTION: The elimination or minimization of hazardous and toxic materials during day to day aircraft maintenance has become one of the Navy's top priorities. Developing EPA compliant maintenance materials and processes will enable the naval aviation community to maintain readiness through realistic and unimpaired operations and to deploy new weapons systems without violation of environmental laws. Because environmental laws are becoming increasingly strict, research is required to identify new maintenance materials and process for both in service and advanced tactical aircraft.

Phase I should evaluate existing technology to determine the Navy's ability to meet EPA laws through the year 2000.

Phase II should identify the maintenance processes that will violate EPA laws through the year 2000 and address research required to develop new processes to meet EPA laws.

N90-081 TITLE: Probability of Flaw Detection for Non-Destructive Inspection of Advanced Materials

CATEGORY: Advanced Development

OBJECTIVE: Develop non-destructive inspection (NDI) techniques and processes to increase the NDI technicians' probability of detecting, isolating and assessing flaws in advanced materials.

DESCRIPTION: The probability of detection initiative is to improve the capability of fault detection in aircraft structures and components. It provides technical support of the age exploration statistic based sampling concept. The program will test both flawed and unflawed material specimens to identify confidence levels when detecting crack size and crack growth in advanced metallic structures and critical size and growth of composite delaminations.

Phase I will require identifying and Phase II demonstrated increased fault detection capability through new NDI procedures and development of confidence level factors based on NDI technician techniques and equipment. Knowledge of probability of detecting a crack will increase statistical confidence levels used in sampling inspection programs, thus defining more accurately sample size requirements.

N90-082 TITLE: Ferrite Choke for Cartridge/CAD Application

CATEGORY: Engineering Development

OBJECTIVE: Develop a ferrite choke for cartridge/CAD application that provides broadband nonresonant protection against electromagnetic radiation. Development of this choke will ensure meeting the HERO safety requirements of MIL-STD-1385B and will alleviate hampering restrictions imposed upon cartridge devices in the operational environment. If successful, the technology can be transitioned for use in many of the Navy cartridge/CAD hardware.

DESCRIPTION: A substantial number of electrically initiated cartridges are classified as "HERO SUSCEPTIBLE" and require special procedures in the operational environment. The restrictions imposed by these items on fleet operations are considered substantial and undesirable. The purpose of this project is to develop a ferrite choke that will provide a broadband nonresonant protection against electromagnetic radiation with minimum attenuation of the D.C. firing pulse. The technology developed will be suitable to meet long term requirements, of low cost, and be compatible with high volume cartridge assembly lines. Use of this technology would eliminate special handling procedure for cartridge/CAD systems, and would eliminate shut down of electromagnetic emitters during susceptible cartridge use. The technology would also provide for replacement of existing cartridges with little increase of cost and improved safety margins. An additional advantage of this item would be that it provides attenuation of an EMP signal.

Phase II should consist of development of the ferrite choke with specified physical and electrical parameters and include models and test results of electromagnetic attenuation.

N90-083 TITLE: Automated Integration of Reliability Centered Maintenance (RCM) Analysis with the Logistics Support Analysis Record (LSAR)

CATEGORY: Engineering Development

OBJECTIVE: Develop a computer program to link the data contained in the automated RCM worksheets with the automated LSAR. Cost savings will be attained by automatically and electronically transferring the results of RCM into the LSAR.

DESCRIPTION: NAVAIR currently follows the RCM preventive maintenance (PM) decision logic contained in MIL-STD-2173 (AS) for new procurements and for in service applications. The MIL-STD-2173 (AS) worksheets have been computer automated to ease RCM documentation requirements. RCM data is also required to be input into the LSA process in accordance with MIL-STD-1388-2A. Currently, during weapons systems acquisitions, RCM is manually entered into RDM worksheets and manually transferred to the LSAR database. This results in duplication of effort and is not cost effective. An automated link between these two databases would reduce costs and make PM analysis more efficient. The resultant RCM/PM data in the LSAR would be used during the

acquisition phase to determine initial PM requirements, and throughout the life cycle to identify changes or additional PM tasks as equipment modifications occur.

Phase I would be a concept report and Phase II would be the delivered tested software.

N90-084 TITLE: Automated Integration of Level of Repair Analysis (LORA) with Logistics Support Analysis Record (LSAR)

CATEGORY: Engineering Development

OBJECTIVE: Compare MIL-STD-1388-2A LSAR Data elements with data elements contained in MIL-STD-1390C LORA models, and develop common data element definitions. Develop a computer software link that will allow for the iterative exchange of data between the LSAR and LORA models.

DESCRIPTION: Currently, LORA Is performed independently of the LSA process. Data required for input into the LORA is resident in the LSAR and the results of LORA are input back into the LSAR. This is an iterative process that continues as system design matures. The data transfer is accomplished manually and is labor intensive. The automated computer link between LSA and LORA will reduce acquisition program costs and improve the overall quality of weapons system maintenance planning. Automated LORA reports will be extended from the LSAR database. This will eliminate the need for separate LORA deliverables and further reduce acquisition costs. Phase I would be a concept report and Phase II would be the delivered tested software.

N90-085 TITLE: Aircraft and Engine Preservation Techniques

CATEGORY: Research

OBJECTIVE: To research and analyze aeronautical weapon system preservation techniques.

DESCRIPTION: Prevention of deterioration to aeronautical weapon systems is one of the more important features of the Naval Aircraft Maintenance Program. Current processes call for using spraylat, bags and cans to store operational assets. Proved to be inefficient, the U.S. Army is using a method called “Shrink-wrap” for short term storage or overseas shipment. This process is being applied and studied at Naval Aviation North Island, San Diego. However, application of this relatively new process has not been proven to be cost effective and requires further analysis, particularly for long term storage. Current techniques, policies and procedures are outdated and costly. Some operational assets stored for long duration are frequently degraded beyond economical repair for service use and are consequently scraped.

Phase I should consist of investigating alternative preservation methods. It should develop and deliver a cost effective and efficient aircraft and engine preservation program, focused on identifying equipment requirements, innovative preservation treatment techniques, maintenance requirements and depreservation requirements.

Phase II should emphasize delivering the hardware and procedures identified in Phase I to the Fleet and NAVAVNDEPS for application.

N90-086 TITLE: Automated Technology for Conversion of Existing Paper Technical Manuals into a Form Suitable for Interactive Electronic Display

CATEGORY: Engineering Development

OBJECTIVE: To develop an efficient approach for conversion of existing paper based technical manuals to a digitally based form capable of interactive electronic presentation. If successful, a system (hardware and software) capable of effectively performing this function would be used for conversion of many millions of current manual pages to render their technical information (IT) commensurate with newly acquired digital TI.

DESCRIPTION: Navy's technical manuals are currently acquired and provided to maintenance technicians as collections of text and graphics on paper pages. Technology for acquisition and distribution of such TI in digital form, and its interactive electronic presentation, is now available; and tests have shown both logistics and maintenance effectiveness advantages of such approaches. In essentially all new Navy weapon systems, the acquisition of automated technical manual systems is being evaluated. But even with new weapons systems, a very large fraction of the technical manuals needed for system support is already in existence in paper form and will require conversion to digital interactive form. However, manual conversion of text and graphic from existing page oriented paper manuals to a form which could be integrated with the newer approaches would be prohibitively expensive and time consuming with existing approaches. An organized automated approach toward performance of such conversions is badly needed, involving "intelligent scanning" of existing paper manuals into digital form, and modification of existing page oriented presentations to the required frame oriented presentations by auto recognition and automated accomplished of required changes. Integration of software and hardware technology would be required so that a series of test could be carried out to determined the production effectiveness of such an approach. Phase I would be a study report explaining the approach to accomplish the above. Phase II would be the development of the above.

N90-087 TITLE: Standardized Interactive Electronic Presentation of Weapon System Troubleshooting

CATEGORY: Engineering Development

OBJECTIVE: To improve maintenance performance and reduce incidence of false component removals in weapon system maintenance through provisions of interactive electronically presented troubleshooting technical information. If successful, such an approach would be integrated into the maintenance planning and technical manual design of all new Navy systems of medium and high complexity.

DESCRIPTION: Recent tests in operational maintenance environments have shown that the use of computer driven interactive presentation of weapon system troubleshooting procedure can significantly improve performance of minimally trained personnel, and greatly reduce maintenance errors made by both experienced and inexperienced personnel. However, algorithms leading to the most effective logic for fault isolation of a wide variety of systems remains to be developed. Similarly, optimal modes of presentation of test sequences and test procedures, to assure the highest efficiency of information access and greatest comprehensibility, are still unclear. The Navy needs standardized guidelines so that weapon system contractors can produce high quality interactive troubleshooting technical information in a uniform manner, which may be acquired and tested by many different system acquisition managers, and which may be presented to fleet technicians in a uniform manner, using a single type of fleet delivery device.

Phase I would be a study report explaining the approach to accomplish the above.

Phase II would be the development of the above.

N90-088 TITLE: Automatic Diagnostic Link Between Aircraft and Their Avionics Systems, and Automated Maintenance Aids

CATEGORY: Exploratory Development

OBJECTIVE: To reduce aircraft turnaround times and improve aircraft/avionics maintenance efficiency by automatically linking on board diagnostic information directly to the technician's maintenance information presentation system. If successful, such an approach would be incorporated in all future aircraft and avionic systems.

DESCRIPTION: Currently, fault isolation for aircraft and avionics malfunctions require a sequence of processes involving pilot and crew debriefing, fault verification, and the use of technical manuals and prescribed test sequences for identification of the faulty component. Automation of the fault isolation procedure by use of

electronically presented interactive technical information has been shown to greatly reduce technician error and improve performance. The establishment of a direct, automated link between on board aircraft/avionics diagnostic equipment to a portable maintenance aid which may be brought to the aircraft, would significantly streamline the troubleshooting process through elimination of wasted effort, and provision of system performance data as a direct entry to the fault isolation system logic of the maintenance aid. Currently, however, the feasibility of such an approach remains to be established in terms of present day technological potentials as well as in terms of cost benefit analysis. Both software and hardware needed for a standardized approach require definition to permit establishment of design approaches, system demonstration and test, and incorporation into aircraft developments where shown to be warranted. Phase I would be study report explaining the approach to accomplish the above. Phase II would be the development of the above.

N90-089 TITLE: Fretting Damage Detection Device

CATEGORY: Exploratory Development

OBJECTIVE: Develop a device to track and quantify fretting damage. This technology would be used to identify design deficiencies during the Engineering Development of jet engines.

DESCRIPTION: Fretting damage in compressor components is often a precursor to fatigue cracking. Relative motion between the making surfaces of pinned holes, dovetail attachments and bolted structure produced micro surface damage during normal engine operation. Damage accumulation leads to fatigue crack initiation. There is now an urgent need for a non destructive inspection device that could assess this fretting damage following finite engine running and predict fatigue crack initiation probability. Such a computer aided engineering tool would permit enlightened decision making by government and engine contracting personnel in assessing needs for anti-fret coatings or cold working the surfaces to avoid reduced service life. Current procedures are trial and error with fretting problems always being discovered in the field well after production has commenced. The proposed device/approach would also be useful for studying new designs and aerodynamic motions relative to fretting potential.

In Phase I specimens would be used to test the principle behind the approach selected; followed by design, development and test of a production prototype model to evaluate engine components from the field in Phase II.

N90-090 TITLE: Wall Thickness Measurement Technique for Turbine Blades and Fuel Nozzles

CATEGORY: Engineering Development

OBJECTIVE: Develop a reliable and accurate method for measuring wall thickness in complex thin walled cast turbine components. If successful this method would eliminate infant mortality in field components due to inspection errors at the foundry.

DESCRIPTION: Current non-destructive inspection methods are allowing thin wall acceptance to continue. An applied method that “call out” thin walled blades is urgently needed. Furthermore, future engine designs will require thinner, tapered walls with smaller tolerances under the new Integrated High Performance Turbine Engine Test program.

Phase I would demonstrate the feasibility of the principle involved for accurately and repeatedly determining the true thickness geometries of cooled turbine blades.

Phase II would involve reducing the principle to foundry practice e.g. automation, ruggedness, full field capability, low cost per part, adaptability to varying geometries and computer integration for statistical process control. Phase III would involve foundry implementation at the commercial level.

N90-091 TITLE: Digital Imagery Verification System

CATEGORY: Engineering Development

OBJECTIVE: To develop a low cost system which will receive ultra high resolution imagery in a digital format, and display and print the imagery at lower resolution. The system is to verify reconnaissance imagery which has been recorded on tape.

DESCRIPTION: A reconnaissance imagery system is being developed for the fleet. This system will provide digital imagery to a ground exploitation station. It is highly desirable to be able to independently verify the imagery generation and recording system separately from the ground station, and prior to the integration of the airborne system with ground station. This can be done by developing a system which can read the imagery tapes and produce imagery output compatible with commercial displays and printers.

Phase I should develop a preliminary design for the system, and begin the detailed design process. The preliminary design should be used to drive the detailed design process directly.

Phase II should continue the detailed design process and produce and deliver to the government a prototype system. The system should include complete information necessary to produce, operate, and maintain the system.

N90-092 TITLE: Digital Imagery Verification System

CATEGORY: Engineering Development

OBJECTIVE: To transfer data automatically between Navy range facilities and FAA Air Traffic Control Facilities which manage the National Airspace shared between military and civilian users.

DESCRIPTION: Navy Fleet Area Control and Surveillance Facilities, such as at NAS Fallon, manage Navy Special Use Airspace. Controllers at displays of aircraft tracks from surveillance radars, such as the ASR-8, and of secondary radar tracks processed through the TPX-42, monitor the air traffic in the Special Use Airspace. Due to growing congestion of National Airspace, the FAA is considering Dynamic Special Use Airspace Management. This will require the Navy and other services of the Department of Defense to be prepared to justify use of training areas at short notice every day. Required are schemes to exchange real time information of aircraft flights in Special Use Airspace and information regarding scheduling. Real time information must not be classified. Scheduling information exchanged may involve compatibility between the Military Airspace Management Systems and the FAA's Traffic Management System.

Phase I should consist of a study outlining the approach which will be undertaken to pursue the requirements addressed above with sufficient data to demonstrate feasibility.

Phase II should use the approach outlined in Phase I to develop and deliver to the government for testing a prototype model of conversion software and communications links or processors.

N90-093 TITLE: Mini Air Surveillance Radar Tracker and Identify-Friend-or-Foe System (MASURATI)

CATEGORY: Advanced Development

OBJECTIVE: Design a complete air search radar and Identify Friend or Foe (IFF) beacon system that can be used as a low cost, air traffic control (ATC) system to fill the gap in existing sensor coverage at an air station.

DESCRIPTION: The need exists for a relocatable low cost ATC system that can be used for non-tactical air surveillance and ground controlled approach at Navy and Marine Corps air stations. As a gap filling sensor the system should have a range of 15 to 20 nautical miles at altitude down to range zero at sea level. The primary sensor should have a consistently high probability of detection of a non-cooperative, small airframe sized target. It

should be highly user selectable and adaptable in terms of tracking performance, clutter processing, weather and map display, external data source display and data fusion, on screen menu presentation and data management, computer generated graphic display, and on line maintenance monitoring and fault detection and correction. Ease of integration into a region of existing electromagnetic sensor coverage may mean alternate physical principles of operation to the standard L-Band and S-Band ASR radars of the Federal Aviation Administration (FAA). The system should be modular in design and compatible with existing external ATC equipment where necessary, Mode-S, Common Digitizer-2 format, etc.

Phase I consists of a characterization of requirements and operations, a market survey to apply the latest computer and ATC advances, and a preliminary design and interface study with tradeoff analyses culminating in a detailed technical report and decision briefing emphasizing issues of cost, risk, technology, and schedule.

If successful, Phase II will complete the design specifications in preparation for full scale development.

N90-094 TITLE: Microminiature Filter Techniques

CATEGORY: Exploratory Development

OBJECTIVE: To explore High Q filtering methods and techniques that will be compatible with RF and microwave microcircuit technology.

DESCRIPTION: Miniature subsystems for Navy applications are being developed in the tri service MIMIC program. However, filters continue to be fabricated using older technologies. Virtually ever communication system requires filtering for pre-selection, spur reduction, frequency spectrum reduction and channelization, but unfortunately MMIC's have no adequately met the filter need, thus subsystem size and weight are determined by filter technology. If a significant improvement in RF and microwave subsystem size is to occur, major advancements in filtering techniques must be achieved.
Phase I should explore new microminiaturize filtering techniques that will provide high Q band pass filtering integrated with MMIC chips. The results of Phase I should show by analysis that one or more feasible techniques could be implemented in Phase II with a good chance of success.

N90-095 TITLE: Automated Feature Extraction and Pattern Recognition Algorithms

CATEGORY: Exploratory Development

OBJECTIVE: To develop algorithm products for the automatic extraction and recognition of natural and man made features from selected aircraft sensor inputs. If successful, this would significantly reduce the cognitive load carried by pilot and weapons officers in the performance of their respective in flight tasks. It would enable the real time update of situation displays, and support automated situation awareness tools as well as provide navigation capabilities.

DESCRIPTION: Future avionics systems will rely heavily on digital terrain, threat and target data to perform or improve aircrew functions that include navigation, target acquisition, threat avoidance, and situation assessment. The ability to automatically recognize and extract man made and natural features from imaging data plays a key role in the generation and maintenance of databases to support these avionics systems. This effort is to develop algorithms for the automated extraction and mensuration of cartographic tactical features from digital imaging data. These algorithms would be used to generate geographic databases from tactical imaging assets and for real time update from sensors carried on strike aircraft. The imaging sensors to be studied include infrared, visual and radar. Offerors should consider both traditional algorithmic and neural net approaches to feature recognition, multi sensor fusion, and the use of the existing cartographic database to improve recognition accuracy.

Phase I work will involve the identification and collection of advanced algorithms for automated feature extraction and pattern recognition.

Phase II will address the development of a prototype to demonstrate the successful application of the algorithms identified during Phase I.

N90-096 TITLE: Microwave Powered System for High Altitude Long Endurance (HALE) Aircraft

CATEGORY: Exploratory Development

OBJECTIVE: To make a detailed feasibility study and preliminary design of a complete ship based microwave power system for a HALE aircraft.

DESCRIPTION: Previous efforts in this area have focused on MW frequencies below 10 GHz. Recent technology advances appear to make high power MW generation and transmission at much higher frequencies feasible. If true, this may allow a reduction in antenna size to the point that ship based MW power systems fro HALE aircraft are operationally feasible.

Phase I of this effort will consist of two parts. Part 1 is a study to determine if current technologies will theoretically support higher frequency ship based MW generation transmission, reception and conversion at power levels sufficient to power a HALE aircraft. If the concept does not appear technologically feasible, part 2 will identify the area(s) where technology is not sufficiently advanced and propose, in the form of a proposal for Phase II, development effort(s) to advance the deficient technologies to the required level. If the concept does appear technologically feasible, part 2 will consist of a description, in the form of a proposal for Phase II, of the methodology planned and issues to be addressed in making a preliminary design of a complete ship compatible HALE aircraft MW power system including a rechargeable backup power system capable of providing power to the aircraft propulsion and mission systems for NLT two continuous hours. When alternative subsystems approaches appear feasible during Phase II, tradeoff studies will be conducted for the two most promising alternatives. Shipboard electromagnetic environment issues will be addressed.

Phase II will consist of one of the two efforts described above, depending on the results of part 1 of Phase I.

N90-097 TITLE: Turbine Engine Response Design Sensitivities

CATEGORY: Engineering Development

OBJECTIVE: Define, analyze and quantify by sensitivity analysis the effect of key engine internal design characteristics on engine transient power response. Results of this effort can be incorporated in USN aircraft performance assessments to determine, either analytically or by simulating the adequacy of aircraft system power response characteristics during carrier operation.

DESCRIPTION: Carrier suitability of USN aircraft is an extremely critical requirement in determining system viability for fleet service. A key factor in carrier suitability assessments is aircraft power responses during carrier approach and wave off. Internal engine design characteristics are a major contributor to this response issue. The purpose of this project is to identify sensitivities in engine design that impact aircraft power response during carrier operation and then to assess the degree of impact of each sensitivity.

Phase I should consist of a study identifying such internal engine design criteria and should include an initial response sensitivity analysis of design, etc. and should include an initial response sensitivity analysis of design practices within each criterion.

Phase II should expand the Phase I sensitivity analyses by comparing criteria and then develop software models compatible with USN simulators to validate sensitivity analysis results.

N90-098 TITLE: Determination of Critical Parameters in Airborne Early Warning

CATEGORY: Engineering Development

OBJECTIVE: To determine the critical objectives of and parameters affecting the Navy Airborne Early Warning and Battle Management mission.

DESCRIPTION: The E-2C, the current Navy early warning aircraft, is approaching the end of its service life. The definition of a follow on aircraft is in process. Many of the perceived requirements identify opposite system requirements. In order to provide a means to quantitatively express the merits of alternatives, it is proposed that the Airborne Earlier Warning and Battle Management mission be defined by a matrix of individual components expressed in the form of a Hierchic Vaulted State Space (HVSS) and normalizing function. This scoring would result in a method of making direct comparisons of candidate configurations and system to determine the most appropriate course of action to meet the threat; and listings of remaining shortfalls and deficiencies not resolved by competing solutions.

Phase I effort will be a final report outlining the design/structure of the intended approach.

Phase II will be a complete study detailing the scoring, comparisons, and any shortfalls or deficiencies.

N90-099 TITLE: Multiple Chaff Cartridge "SQUIB"

CATEGORY: Advanced Development

OBJECTIVE: Development of a pyrotechnic delay squib for use by the multiple cartridge chaff. Requires a 40-60 msec sequential delay.

DESCRIPTION: This development program would explore the manufacturing and packaging processes and equipment required to produce a squib which can eject chaff from a compartmentalized chaff container with a 40-60 msec sequential delay.

Phase I – the squib would be tested for repeatable sequential delays.
Phase II – Facilitate and demonstrate the processes and equipment required for quantity 5,000/month production followed by test and evaluation leading to full production decision.

N90-100 TITLE: Activated Metal Decoy for Low IR Signature Aircraft

CATEGORY: Advanced Development

OBJECTIVE: Development of an activated metal decoy for use by an advanced aircraft with a low IR signature.

DESCRIPTION: This development program would explore the manufacturing and packaging processes and equipment required to produce an activated metal decoy in quantities.

Upon completion of Phase I – The decoy will be tested for IR signature and effectiveness.

Phase II – Facilitate and demonstrate the processes and equipment required for quantity 5,000/month production followed by test and evaluation leading to full production decision.

N90-101 TITLE: Multi-spectral Electro-Optical/Infrared Real Time Sensor

CATEGORY: Advanced Development

OBJECTIVE: A design exercise which would assist in developing a specification for the topic sensor.

DESCRIPTION: Existing reconnaissance sensors provide imagery using either electro-optical (EO) or Infrared (IR) spectral bands. In order to optimize their intelligence value, these images must be brought to a common video screen from separate files and indexed before being compared. EO/IR imagery, if taken with one sensor would be physically together and indexed when presented in real time for exploitation. Many interpretation questions could be answered on initial screening before the time value of the information is lost. Penetration of many camouflage schemes would be one application of such an EO/IR image capability. A nominal sensor would have a wide field of view, be capable of operating at 200 ft. and 600 kts, and have a digital output of 130 megabits per second.

Phase I should consist of a study which identifies the technical problems associated with the topic sensor and the various technologies which could be employed in its design.

In Phase II, trade studies should be identified and conducted followed by a design exercise which details potential sensor performance parameters.

N90-102 TITLE: Emission Location System for Cuing of Standoff Electro-Optical Sensor

CATEGORY: Engineering Development

OBJECTIVE: Develop specification parameters and identify interface problems associated with a combined ELS and EO sensor.

DESCRIPTION: Existing Emission Location Systems (ELS) provide an indication of the area in which an emitting object is sited. That indicated location will be in error if the ELS platform Inertial Navigation Systems (INS) has drifted. The indicated area must then be correlated with other intelligence to project the actual site. However, where an ELS cues a standoff sensor on the same platform, a correlation process is accomplished and the location is accurate relative to the platform. For a multi-mission platform, a reaction effort can be commenced in near real time.

Phase I indicates an analysis of threat systems (based on open literature) and a study to define the necessary frequency coverage, estimate the size of such an ELS system, and assess accuracy potential, assuming antennas are a pod of 300 gal size.

Phase II consists of a design exercise which includes functionality of each element of the ELS, interface definition with the existing system to provide target overlay, and both timeliness and relative accuracy of the output. Data should be adequate for use in a system specification.

N90-103 TITLE: Electronic Soldering Quality Improvement

CATEGORY: Engineering Development

OBJECTIVE: Reduce soldering defects/nonconformance's, required visual inspection time, and associated production cost of electronic printed wiring boards (PWB) used in Navy air launched guided weapon systems. Develop automated cost effective factory equipment using the latest statistical process control techniques with wide application to high volume quality manufacture of military and/or commercial electronics.

DESCRIPTION: Develop an approach as part of a Phase I study to enhance flow solder PWB manufacture by automating the quality process with statistical sampling techniques, associated feedback control of production equipment and automated solder inspection in accordance with current Navy and/or the DOD MIL-STD 2000 specification requirements. These specifications apply to most Navy air launched guided missiles and associated aircraft avionics. An automated/robotic process is desired to incorporate flow solder process feedback control, reduce current manual inspection time, and increase product quality by minimizing then umber of undetected nonconforming solder connections. Proposed factory equipment should take maximum advantage of available

commercial equipment and adopted industry standards to insure acceptable investment cost and wide DOD/industry application. Due to the typically high number of solder connections and throughput requirements, automated visual inspection should be investigated to assess soldering quality. Phase II should use the approach outlined in Phase I to develop and deliver to the government for test and evaluation prototype factory test equipment.

N90-104 TITLE: Aircraft Survivability and Mission Analysis Computer Model

CATEGORY: Engineering Development

OBJECTIVE: Develop a high fidelity computer model for survivability and mission effectiveness analysis of a single aircraft flight line mission into a high threat environment. This model can be used for engineering design and systems refinement of candidate concepts for a specific mission.

DESCRIPTION: A mission analysis is needed the properly incorporates vehicle observability, flight path with terrain following, threat sensors, threat vehicle dynamics and guidance, threat system employment and engagement doctrine, and terrain features including clutter. The radar portions of this model should include propagation phenomenon such as multi-path, diffraction, and biostatic for both primary receivers and transmitters, and weapon seekers. Terrain following must include vehicle dynamics. Published government threat data would be the input parameters for threat systems.

Phase I of this effort would define overall architecture and identify component models to be used in subroutines.

Phase II would construct and demonstrate the actual survivability and mission effectiveness model. The final model needs to output overall and specific mission effectiveness. This output would include an overall success parameter, relative probability of survival, time in lethal envelopes, threat interceptor engagements, time in ground controlled intercept tracks, miss distances and/or kill by threat weapons. This model could then be used to refine aircraft designs by exercising and comparing relative survivability and mission effectiveness of candidate designs of variations in design.

N90-105 TITLE: Extending Tactical Sensors Through the Use of Signal Enhancement

CATEGORY: Advanced Development

OBJECTIVE: To improve frequency analysis and unfolding algorithms by enhancing sensor quality from 15 to 50%. If successful, sensor fusing performed by existing combat aircraft will be greatly extended. Aircraft produced under the ATA, ATF and LHX programs will also benefit from such signal enhancements.

DESCRIPTION: Active as well as passive sensor fusion is constrained by the quality of received signals. The purpose of this project is to improve the quality of received signals by introducing a digital filter which extracts additional features. The additional features increase the resolution of subsequent analysis. The digital filtering technique is applied to individual sensors before fusion takes place. Under such conditions the differences between two or more sensors detecting the same event assumes great tactical importance. A new level of tactical interpretation is thought to be possible.

Phase I should demonstrate the power of digital filtering to extract additional features from actual data received by tactical sensors.

Phase II extend the techniques developed under Phase I to as many sensors as possible. The initial signals studied under Phase I are Radar Frequencies. Extensions to Infrared should be attempted in Phase II.

N90-106 TITLE: Marine Attack Helicopter Night Targeting System Training System

CATEGORY: Engineering Development

OBJECTIVE: To develop a training system that will provide Marine AH-1W aircrews and maintenance personnel with the necessary training for effective combat operations utilizing the Night Targeting System (NTS) currently under development.

DESCRIPTION: The U.S. Government and the Government of Israel are currently embarked on a joint program to develop and produce an NTS for U.S Marine Corps and Israel Air Force attack helicopters. The concept involves modifying the existing daylight sight of the TOW anti-armor missile system with infrared imaging and laser rangefinder/designator. This system is planned to become operational in the 1994 time frame.

Phase I would involve a detailed study of the additional operator and maintenance training requirements generated as a result of incorporation of the NTS in the AII-1W.

Phase II would result in full definition of the training system to include identification of training materials and aids and the creation of design specifications for required operator and maintenance training equipment. This effort would further include definitization of the interfaces and/or modifications required to the AH-1W's existing training system.

N90-107 TITLE: Four-Bladed Main Rotor System for Marine Attack Helicopters

CATEGORY: Engineering Development

OBJECTIVE: To provide increased combat capability for Marine AH-1W attack helicopters through development of a four bladed main rotor system.

DESCRIPTION: The U.S. Marine Corps, through new procurement and by block upgrade, will achieve an all AH-1W attack helicopter fleet by the early 1990's. This aircraft must be capable of meeting the threat well into the 21st century. Because of its currently configured semi-rigid, teetering, two-bladed main rotor, the AH-1W has certain maneuvering limitations. The prime contractor has proposed incorporation of a four bladed system to provide increased lift capability, better maneuvering and reduced noise, to mention but a few of the expected benefits.

Phase I would provide an independent analysis of cost benefits associated with such a development program.

Phase II would require the development of appropriate computer models to substantiate those performance related estimates derived during Phase I and would define the total impact of such incorporation on the aircraft's structure and overall dynamics system.

N90-108 TITLE: Integrated Strike Planning System Evolutionary Upgrade-General Purpose Explanation Capability for Knowledge Based Support Systems

CATEGORY: Exploratory Development

OBJECTIVE: Development of a general purpose explanation capability to support the Navy's Integrated Strike Planning System (ISPS). This capability, if demonstrated to be feasible, will be incorporated into the ISPS as an evolutionary upgrade.

DESCRIPTION: The Integrated Strike Planning System, a computer based man in the loop decision support system, will support the Battle Group Strike Warfare Commander by integrating the strike warfare capabilities of tactical aircraft, major caliber guns, and cruise missiles to provide strike plans which will maximize the probability of success while minimizing the probability of aircraft attrition. It will be procured via an evolutionary acquisition strategy in which an initial core capability will be developed and fielded in the first quarter Fiscal Year 1993 and improved thereafter through regularly scheduled evolutionary upgrades. The initial core capability will support the strike planners through target analysis, weapon analysis, and several decision aid models. It will be a knowledge

based decision support system which will use rule based, spatial and statistical, and evidential reasoning methodologies to support mission planning.

This effort will support the strike mission planners through the development of a general purpose explanation capability which will enable the planner to critique the analyses and recommendations provided by the ISPS. This capability, which will be developed and demonstrated by the contractor, will provide the planner with a coherent rationale, in a language understandable to the strike planner, for the recommendations obtained via each or a combination of all three of the reasoning methodologies mentioned above.

The contractor will provide the following at the completion of Phase II: a system description of the general purpose explanation capability to include its interfaces with the ISPS; a limited demonstration of this capability in order to provide proof of concept; the software which supports the demonstration; software documentation to the level support analysis and dissection of the demonstration software by the ISPS prime contractor.

To support this effort, the Government will provide as government furnished information, the ISPS Specification, and limited planning data bases to support the contractor's limited demonstration of the general purpose explanation capability. All software will be coded in ADA.

N90-109 TITLE: Total Quality Management (TQM) Control Criteria Applied to Long Term Test Programs

CATEGORY: Engineering Development

OBJECTIVE: To develop a quantitative methodology which will identify the long term test program process in terms of technical and quality parameters or indicators, and permit trade off analysis of various test alternatives, test approaches, and achievement of systems or process objective. If successful, this methodology would permit the structuring of programs which would improve testing quality, provide for more effective use of resources and increase the test process cost effectiveness.

DESCRIPTION: The Tomahawk Operational Test Launch (OTL) program offers a means of exercising the entire Tomahawk Weapon System under a variety of operational conditions. The high cost associated with each launch requires that wide variety of tests be considered on each mission and that advanced planning and strict safety criteria be observed. Test requirements are generated from numerous sources including routine inventory sampling, performance envelope verification, planned product improvement validations and flight software performance demonstration. The purpose of this project is to develop a methodology which will permit the quantitative evaluation of the test program process and compare against defined measures of effectiveness.

Phase I should consist of describing the conceptual test process, accommodating requirements generation and priority, sequential events, evaluation or decision points, and feedback to take advantage of historical "lessons learned."

Phase II should use the test process identified in Phase I to develop and deliver a prototype computer model to the government for testing.

N90-110 TITLE: Software Maintenance Cost Estimating

CATEGORY: Exploratory Development

OBJECTIVE: To produce a computer model which will estimate all costs associated with modifying and testing weapon system software.

DESCRIPTION: Tomahawk Weapon System software requires correction of operationally identified deficiencies, upgrades, or substitution of more efficient algorithms through its operational life. While any particular change may only affect a limited number of lines of code, there may be substantial validation and verification to ensure that no adverse impact is produced in other areas of the system software. Furthermore, software modifications which may

improve the system performance envelope may require operational testing, including live missile firing tests, under the auspices of the Commander, Operational Test and Evaluation Force.

Phase I should consist of describing the Tomahawk Weapon System software modification process and testing requirements and the methodology of developing cost estimates.

Phase II should consist of developing and testing a prototype computer model for estimating the cost of any Tomahawk Weapon System software modification.

N90-111 TITLE: Self-Protect Weapon Seeker Enhancement

CATEGORY: Exploratory Development

OBJECTIVE: To explore the feasibility of enhancing the capabilities of single-channel self protect weapon seekers with mechanical scan.

DESCRIPTION: Presently available Self-Protect Weapon (SPW) Anti-Radiation Missile (ARM) weapons use mechanically scanning antennas to develop angular guidance information. These antenna structures, such as employed in the SIDEARM I Missile, have inherent limitations in terms of the frequency band over which their antenna patterns provide useful guidance, the instantaneous field of view within which reliable guidance is available and the rate at which guidance data are generated. Solutions to these problems have been found in complex multiple channel monopulse systems, which have wide bandwidths, wide fields of view, and the ability to develop angle of arrival information on every pulse. Relative to monopulse systems the mechanically scanning systems have a number of virtues, however, because of the simplicity of their single channel receiver design, and the fact that they are currently in the military inventory because they perform well. Techniques are needed to enhance the capabilities of single channel SPW seekers with mechanical angular scan. The current 1.5:1 frequency band must be extended to 3:1, the field of view in which reliable guidance is developed must be extended by a factor of two and methods must be found so reliable guidance information can be generated on intermittent signals and in signal environments in which more than one signal are within the seeker receiver pass band. The antenna enhancement techniques must be capable of implementation as simple modifications to the existing feed and antenna structures and must be mounted on the existing mechanical scan assemblies. The guidance modifications may be implemented in commercially available digital processors suitable for an airborne missile environment, but must be capable of mounting within the physical envelope of the existing SPW guidance circuitry.

Phase I should specify the RF and processing modifications, provide analytical evidence, such as antenna range measurements and guidance simulations, that the proposed techniques will yield the desired performance, and provide a program plan for a Phase II breadboard seeker development and test.

N90-112 TITLE: Measurement of Airborne Surface Search Radar Performance Characteristics

CATEGORY: Exploratory Development

OBJECTIVE: To enhance the operational effectiveness of airborne surface search radars, the operator needs to know the performance characteristics of the system under varying environment and flight conditions. This project will establish a comprehensive standardized test and evaluation methodology and develop a means for correlation of environmental conditions with system operating characteristics for the purpose measurement against operational and contract specification requirements.

DESCRIPTION: The performance of the radar relative to aircraft flight conditions, sea state, atmospheric conditions and the effects of multi-path phenomena must be known for the operator to accurately interpret data displayed by the system. Current evaluation methods are neither comprehensive nor standardized.

In Phase I, standard evaluation criteria, critical factors and a system concept incorporating test methodology and correlation or environmental factors will be developed.

During Phase II, an Engineering Development model will be provided and evaluated utilizing radar hosted on a similar configuration. Performance measurement capability should be sufficient to evaluate the capability to detect a standardized one square meter target in sea state three at a range of fifteen nautical miles from an altitude of fifteen hundred feet under any atmospheric condition.

N90-113 TITLE: Operational Support Aircraft Management Planning System

CATEGORY: Engineering Development

OBJECTIVE: To develop a system of data collection and a model for use in the management and planning of support aircraft utilization and force structure. Based on utilization history and projected demands for both peacetime and wartime, the system will enable planning for more efficient procurement, basing, support and employment of limited operational support aircraft assets.

DESCRIPTION: Effective management of the support aircraft force structure requires an accurate assessment of historic, current and projected cargo and passenger airlift demands for both wartime and peacetime utilization and the ability to evaluate the effectiveness of individual aircraft types in efficiently satisfying the demand requirements.

For Phase I, an aircraft utilization data collection system will be devised and relevant data elements identified for aircraft cost, performance capacity/capability and the critical demand model considerations. Algorithms will then be developed for their evaluation. In Phase II a prototype model will be prepared and the data collection system formalized for trail application. The system designed should be capable of modeling demand profiles on a daily mission basis for periods of up to six months, be capable of factoring out of service periods, manpower requirements, basing concepts, aircraft parameters including cost, performance factors and availability and identifying the most efficient aircraft available under either specified or defaulted inventory conditions. The system will be evaluated. The system will be evaluated for data collection efficiency, reliability, sensitivity, and transportability.

N90-114 TITLE: Sensor Fusion for Non-Cooperative Target Recognition (NCTR)

CATEGORY: Research

OBJECTIVE: Identify air targets by fusing sensor information on Navy F-14.

DESCRIPTION: The Navy F-14 fighter currently has a number of onboard sensors which may be used to identify unknown air targets. Among these are the AWG-9 fire control radar, the television camera system (TCS), 1970s radar signal modulation, and various ESM sensors. Currently the data from these systems is presented independently, and any fusion which takes place is done manually by the pilot and weapons officer.

Proposals are sought for a means to fuse some or all of these sensors in order to identify unknown aircraft more reliably and at greater ranges that is now possible. Of particular interest are systems approaches which integrate rule based architectures, connectionist architectures, and conventional computational methods.

Phase I proposals should include a detailed description of the technique proposed, and an explanation of how realistic data will be simulated in order to test the performance of the proposed technique.

The Government will provide actual real world data for Phase II demonstration.

N90-115 TITLE: Pulsed Power for Underwater Neutralization

CATEGORY: Exploratory Development

OBJECTIVE: To explore the development of pulsed power sources and how different energy levels react with structural materials immersed in water.

DESCRIPTION: Pulsed power sources at high energy levels have shown capabilities of producing shock wave sufficient to damage underwater equipment. Innovative concepts are sought for neutralization of underwater sea mines.

Phase I should consist of a study to support feasibility of the concept.

Phase II should fabricate a prototype to demonstrate feasibility.

N90-116 TITLE: Underwater Towed System Monitor

CATEGORY: Exploratory Development

OBJECTIVE: Determine the feasibility of a system to interactively monitor the position of underwater towed Airborne Mine Defense systems.

DESCRIPTION: There is a need to monitor the relative position of existing airborne mine defense equipment to determine the depth and offset of the equipment. The equipment is a helicopter-towed, minesweeping system that uses sweep wires armed with explosive cutters to sever mine moorings. Four electromechanical otters divert a pair of two segment sweep wires and control depth of its mid and aft portions. A single electromechanical depressor, located near the sweepwire apex, maintains depth at the forward end of the sweep. The system must be operable without physical connection between the towed underwater body and the towing helicopter.

Phase I should consist of a study showing the feasibility of developing the monitor. The study must consider the deployability of the system with relationship to existing gear.

Phase II should use the Phase I approach to fabricate a prototype system for feasibility testing.

N90-117 TITLE: MV-22/HV-22 Weapons Systems Integration and Armament Control

CATEGORY: Engineering Development

OBJECTIVE: To develop an architecture for integrating defensive weapons with helmet mounted display/sight in the V-22.

DESCRIPTION: There exists an outstanding operational requirement to incorporate defensive armament on the V-22. Currently the projected armament includes the following: turret mounted 50 caliber machine gun; two to four Stinger missiles; two Sidewinder and/or Sidearm missiles in any combination; two to four Sparrow missiles. The weapons should be integrated into the aircraft to maximize the aircraft's capabilities, the weapons capabilities and minimize pilot work load. The aircraft will be equipped with helmet mounted display/sight, a Forward Looking Infrared (FLIR) and threat warning equipment that must be integrated with the weapons. The weapons control features must be compatible with MIL-1553B. Maneuvering and deviation from preplanned flight path will be minimized while still allowing the pilot to meet the threat. This is particularly important when approaching a landing zone or a strike rescue pickup.

After a successful architecture is defined in Phase I, an engineering Development model would be built and flight tested on the V-22 in Phase II. After successful flight demonstration, the system could be incorporated in to the aircraft.

N90-118 TITLE: Ribbonized Organized Integrated (ROI) Electrical Wiring Interconnect system for the V-22 Osprey

CATEGORY: Engineering Development

OBJECTIVE: To develop, install and test an ROI wiring system in certain major components of the V-22 OSPREY tilt rotor aircraft to demonstrate the advantages of ROI over conventional electrical wiring. ROI has the potential to significantly increase reliability, improve maintainability, and simplify logistics. It is inherently resistive to electromagnetic interference and readily adaptable to reprogramming for aircraft modifications.

DESCRIPTION: The current conventional aircraft wiring interconnect system has been identified by the navy as a major contributor to aircraft reliability and maintainability issues, safety of flight issues, and weight issues. The current systems cannot meet the rigorous demands of the Navy's operational environments. The purpose of this project is to consider converting the present conventional wiring system on selected major components of the V-22 OSPREY tilt rotor aircraft, which is currently in full scale development, to a ROI wire interconnect system. The aircraft wiring under consideration for modification includes that between the fuselage, wing, and the rotating wingtip nacelles.

Phase I should consist of engineering study/analysis of the feasibility of installing the ROI wiring and interface components.

Phase II would consist of design, fabrication, installation and test of ROI wiring in a V-22 prototype aircraft at the Naval Air Test Center, Patuxent River, MD as proof of concept. A particularly attractive advantage of the ROI wiring is the potential for weight reduction in the V-22 OSPREY.

NAVAL SEA SYSTEMS COMMAND

N90-119 TITLE: Gateway Processors for Information Systems

CATEGORY: Advanced Development

OBJECTIVE: To provide a data directory service and user request translation among multi-vendor data bases.

DESCRIPTION: Data bases and information systems are by nature highly distributed. Applications are created by individuals and organizations requiring the information in the performance of mission functions in a multiplicity of environments. These environments are affected by the methodologies, architectures, design and specific vendor products used in the development and implementation of a specific system or application. The distribution of data in a highly decentralized organization, such as the Navy, creates significant problems and inefficiencies in management, operations and human resources.

Under this topic, a set gateway product, consisting of hardware and software, which would have as its main function to provide interfaces between users/applications and targeted data bases. In concept, a user should be able to generate an English language type query of command, using decision support/expert system techniques. The gateway would determine the location of the data; the attributes of the target networks, systems and data bases; establish necessary connections and accesses; and provide the necessary translation of the request to the appropriate data base command. Upon receipt of messages from the targeted data base, translation back to the original user/application presentation software would occur, and the session(s) would be terminated.

Software and hardware developed must conform to Federal Information Processing Standards and must be portable among multiple vendor product lines. User access will be via PC based workstations and terminals. Applications and data bases may be resident on personal computers, distributed processors and central corporate processors. Networks will consist of direct connections, local area networks, and local and long distance remote connections.

Phase I would include detail planning with respect to the technical specifications, assumptions and constraints imposed on the design, hardware and software requirements and a plan for follow on prototype and demonstration.

Phase II will consist of the development of a prototype. Although in its completed stage the gateway should be generic in its application, the prototype will be based on the logistics planning function.

Phase III will be the installation and testing of the prototype in BETA sites.

N90-120 TITLE: Next Generation RADIAC

CATEGORY: Exploratory Development

OBJECTIVE: To determine if it is feasible and cost effective to develop a radiac which can accurately measure radiation at a distance from the source while displaying the location of the source.

DESCRIPTION: High radiation sources have to be localized by using hand held probes on telescope extenders which is difficult and/or a greater hazard to the user. This effort would determine a video display system which would show the area and objects under surveillance with the specific location of the radiation source. A Sonar System found in cameras used to help determine the strength of the source.

Testing in Phase I would be to determine usefulness in the field as well as Cost Benefit Analysis.

Phase II would develop a militarized system.

N90-121 TITLE: Shipboard Communications Systems Network Model

CATEGORY: Engineering Development

OBJECTIVE: To select a ship communications system network model for comparison of different network configurations and architectures.

DESCRIPTION: Phase I consists of a review of candidate models for design and predicting performance of shipboard communications. The issues of performance shall include survivability, reliability, and intelligibility. Interfaces with other shipboard models for survivability and damage control are important.

Phase II will select and evaluate the model(s).

N90-122 TITLE: Submarine Quiet Announcing Systems

CATEGORY: Advanced Development

OBJECTIVE: Determine the means to produce an announcing system that emits no acoustic noise outside of the hull.

DESCRIPTION: Phase I consists of a study which reviews the acoustic performance of submarines and the acoustic performance of various announcing techniques and evaluate them with respect to the requirements for voice recognition and intelligibility of combat communication.

Phase II will build and test selected engineering models for practical application in the operational environment.

N90-123 TITLE: Shipboard Non-Detectable Portable Communications Systems

CATEGORY: Engineering Development

OBJECTIVE: Determine the availability and practicality of a mobile shipboard communication system that is not detectable off the ship.

DESCRIPTION: Phase I consists of a study to identify candidate technologies. Issues will be safety, range and detectability.

Phase II will select and fabricate systems for evaluation.

N90-124 TITLE: Translation of IDS/Protocols into Mathematical Expressions

CATEGORY: Advanced Development

OBJECTIVE: Develop a methodology to be used in the translation of existing IDS/protocols and the formulation of new ones. Use of mathematically expressed IDS/protocols would eliminate much of the confusion that now exists when an IDS/protocol is implemented.

DESCRIPTION: Phase I shall consist of developing a cost effective methodology for translating and formulating IDS/protocols in mathematical expressions. Preparing documentation and recommending candidate test systems.
Phase II would consist of translating an existing IDS/protocol and then proving the effectiveness by having a third party, not involved in the translation, implement the IDS/protocol. The measure of effectiveness will be the delta between the implementation of a conventional IDS/protocol and the mathematical IDS/protocol.

N90-125 TITLE: Development of Transducer Coatings with Low Volatile Organic Compound

CATEGORY: Advanced Development

OBJECTIVE: Develop corrosion resistant EPA-approved paint systems for transducers.

DESCRIPTION: Many Navy sonar transducers are coated with paint to inhibit corrosion. Some existing paint systems have a high volatile organic solvent content which do not meet EPA guideline for volatile organic compounds (VOC's). Potentially more stringent EPA guidelines may be issued which could severely limit available transducer paint systems. Proposals are invited for the development of improved coating systems for use on Fleet sonar transducer assemblies and other underwater piece-parts that meet current and future environmental regulations controlling volatile industrial solvents. These systems should be identified and directly compared to systems currently in use. Durability in Fleet service conditions is to be determined.

Phase I will review low solvent coating technology and identify formulation with potential as transducer coatings.

Phase II will be a formulation and test period.

Phase III will include successful coatings transitioning to large production formulation and processing specifications.

N90-126 TITLE: Non/Low Magnetic Signature Engines

CATEGORY: Engineering Development

OBJECTIVE: Develop a Non/Low Magnetic Signature Auxiliary Engine to provide electrical power Minesweeper/Mine Countermeasure ships.

DESCRIPTION: Non/Low magnetic signature auxiliary engines are required for ocean minesweepers (MSO's). Typically these engines are in the 80-150 horse power range. Various approaches have been used to reduce the

magnetic signature of the engines; degaussing or use of non-magnetic materials for the block and engine components. The Navy is looking for a reliable non magnetic engine capable of providing electrical power to the Minesweeper/Mine countermeasure ships.

Phase I would be the identification of a non magnetic engine/material candidate for Phase II development and testing.

N90-127 TITLE: Acoustic Propagation Path Determination

CATEGORY: Advanced Development

OBJECTIVE: Provide an approach to determine acoustic propagation path (i.e. DP/BB/CZ) using analytical environmental modeling/heuristics. This is needed to support the APP program.

DESCRIPTION: Develop an operational methodology using both analytical modeling and underwater acoustic phenomenon to aid in determining the sound propagation path of acoustic data received by a thin line towed array.\

It is expected that Phase I would provide an in-depth report on analytical methods/procedures developed which demonstrates feasibility of technique using synthetic data.

Phase II would provide a computer based system which could be tested at-sea under realistic conditions.

N90-128 TITLE: Azimuthal Noise Variation Effects

CATEGORY: Advanced Development

OBJECTIVE: Investigate new innovative methods to account for real-time changes in azimuthal noise in ASW acoustic sensor employment. These methods are needed to support the APP program.

DESCRIPTION: Several shipboard systems measure ambient noise in a beam which provides a “snapshot” of existing environmental conditions on an azimuthal basis. Attempts to develop high fidelity APP models that account for azimuthally dependent noise measurements are too slow and can provide misleading results since any change in own ship heading or the disposition of adjacent force renders the noise measurement obsolete. It is necessary to develop an innovative and rapid methodology to account for this noise variation in ASW search planning and sensor employment.

It is expected that Phase I would provide an in-depth report on analytical methods/procedures developed which demonstrates feasibility of the technique.

Phase II would provide a computer based system which could be tested at sea under realistic conditions.

N90-129 TITLE: MIL-STD-480B Expert System Tool Compound

CATEGORY: Engineering Development

OBJECTIVE: Demonstrate expert system design to simplify Engineering Change Proposal (ECP) preparation. Use AN/SQQ-89 ASW Combat System as test bed. The proposed end product would be a system supporting ECP preparation and a process for applying the system to Navy projects.

DESCRIPTION: MIL-STD-480B is a complicated process used to control changes to Navy equipments and software. Often, project managers tailor away the control that 480B attempts to impart to the change process in order to simplify and minimize impact on their day-to-day operation.

Rather than simplifying the task by a redefinition of the ECP requirements, the Navy should provide tools that allow easy compliance with all 480B requirements.

The proposed research would prototype a system that would provide on line help for identifying the requirements for each ECP block. Additionally, an Expert System would be developed based on knowledge about the project under control, and would provide logical alternatives for information to be included in each ECP block. Ultimately the intent would be to tie the ECP CASE TOOL to the CM database(s) and a "function matrix" in an attempt to predict change impact through all documentation.

For the first phase, plan to demonstrate interactive production of ECP forms, select a MAC II with 2 page monochrome display, mouse and laser printer as the basic engine. The system would be designed within the HYPERCARD paradigm (using Super Card or its predecessors). A help file would be generated and a "help" interface developed for the interactive ECP forms.

Certain critical blocks within the ECP would be singled out to demonstrate the functioning of a simple expert system for Phase II. Rules and relationships would need to be identified and incorporated within the HYPERCARD context. Alternatives would be presented in windows adjacent to the online ECP form and selection of an alternative would be via the mouse point-n-click capability. The Expert System would be focused on identifying logical alternatives for the selected ECP block based on previously entered information and the knowledge of the AN/SQQ-89 (or other) system. The system would be able to learn new alternatives through a common usage algorithm.

The proposed expert system should be considered in the context of an assistant or mentor. It will not even come close to displacing an engineering from the ECP process.

Follow on work would look at linking the ECP CASE Tool to non-destructive editors, spread sheets, electronic mail, and database systems to further expand the engineers ability to produce complete, correct, and well defined Engineering Change Proposals. Red-lined change pages, cost estimates, and automatic logging, tracking, distribution, and recording in the CM database are future possibilities for inclusion in such an expert system.

N90-130 TITLE: Shipboard Medical Waste Treatment System

CATEGORY: Advanced Development

OBJECTIVE: Develop a shipboard treatment system that disposes medical waste in an environmentally acceptable fashion.

DESCRIPTION: Ships routinely generate small amounts of medical waste. The volume of waste is a function of crew size. The Navy is searching for a concept and system to dispose of this waste in an environmentally acceptable manner. This system must be suitable for use in a shipboard environment, it must sterilize and destroy the waste. Destruction through incineration is preferred.

Phase I should address design and Phase II should include development of a prototype for land based evaluation.

N90-131 TITLE: Non-Vapor Compression AC System

CATEGORY: Exploratory Development

OBJECTIVE: Develop a prototype non-vapor compression AC plant for potential shipboard use.

DESCRIPTION: Concepts may use Stirling cycle, Brayton cycle, thermal electric, etc. Target size is 200 tons cooling. Prototypes should be in the 3 to 10 ton range. Seawater at 88 degrees F is the heat rejection reservoir. Innovative approaches are invited. Size, weight, power consumption, reliability, and safety are critical parameters.

N90-132 TITLE: Integrated Online R&M Design Program

CATEGORY: Engineering Development

OBJECTIVE: Integrated family of Navy TIGER R&M computer programs in workstation oriented ship design and overhaul process.

DESCRIPTION: The Navy is focusing increased attention on reliability, maintainability, quality, and logistics due to extended service lives and scheduled depot availability. This effort extends to both design and overhaul. Modified ship designs are continually being developed and increasingly complex ship overhauls will occur in the near future due to presently scheduled cycles and deferred maintenance. Concepts for integration of Reliability and Maintainability (R&M) as an online part of workstation oriented computer aided engineering are required to provide significant improvements in weapons system effectiveness and decreased life cycle costs. Integration of an enhanced Navy TIGER R&M computer program in the ship design product model and adoption of the evolving Computer Aided Acquisition and Logistic Support (CALS) data interface standards are needed.

N90-133 TITLE: Rotational Propulsor Concepts for Surface Ships

CATEGORY: Exploratory Development

OBJECTIVE: Improve acoustic and powering performance of surface ships using advanced propulsor concepts. Phase III transition into revolution at sea and advanced machinery efforts.

DESCRIPTION: In the near to mid-term (1990's-2010) the Surface Ship Navy will require increased stealth and propulsion efficiency to maintain and/or improve our current threat advantage. This will require the development of advanced rotational propulsor concepts. Proposals are requested which address alternative advanced rotational propulsor concepts.

Phase I: Develop advanced rotational propulsor concepts and quantify improvement relative to establish baseline. Provide supporting sketches, drawings, design calculations and performance calculations of alternative concepts.

Phase II: Provide detailed designs of propulsor concepts for specific applications and validate with model experiments.

N90-134 TITLE: Ship Design Tools – Measures of Effectiveness

CATEGORY: Advanced Development

OBJECTIVE: To provide an expert system to recommend naval surface combatant systems which can meet a given set of mission and operational requirements and identify measures of effectiveness (MOE) for the systems and the combatant.

DESCRIPTION: It would be quite useful if the naval surface combatant ship designer could input top level ship, mission and operational requirements (AAW, ASW, range, speed, etc.) into a computer and have an expert system/optimization program apply rules from a knowledge base to determine what kind of ship HM&E and combat systems provide the required capabilities. The designer would confirm or modify the equipment list and the program would access the knowledge base to find the resulting characteristics performance attributes for the selected systems. These attributes would be automatically categorized into seven mission drivers (battlespace, firepower, battle management, sustainability, survivability, mobility and readiness) which have known impacts on the force war fighting capabilities. Using further rules from the knowledge base and optimization algorithms, like attributes would be combined in each driver category and converted to total ship MOE's. Results would then be compared with current ships in the knowledge base having similar mission profiles. Significant benefits would result in quantifying this information in expert systems containing hypermedia capabilities. Knowledge engineering concepts and tailored prototypes of commercial grade computer programs for ship design are required for non-programmer,

ship designers who need continually update the knowledge base and develop freely distributable knowledge based systems on micro computers.

Phase I would develop a prototype expert system and Phase II would produce the operational program.

N90-135 TITLE: High-Efficiency Thermoelectric Material

CATEGORY: Exploratory Development

OBJECTIVE: To develop material for use in thermoelectric cooling modules.

DESCRIPTION: Develop semiconductor material for use in thermoelectric cooling modules that yields a higher coefficient of performance than the currently available doped bismuth telluride (i.e., produces more cooling for a given amount of input power at a fixed set of temperature conditions). The goal for the material developed under this task is to demonstrate consistently a figure of merit greater than 3.5 x 10-3 K-1.

N90-136 TITLE: Fiber Optic Current and/or Voltage Sensor

CATEGORY: Exploratory Development

OBJECTIVE: Development of a model fiber optic voltage sensor and/or a laboratory demonstration of a fiber optic current sensor.

DESCRIPTION: The National Bureau of Standards and the Navy have developed fiber optic technology for current and voltage sensors. The current sensor technology uses the Faraday effect with bulk glass fibers and the voltage sensor technology uses polarization rotation, Pockels effect, and standard Navy fiber optic components. Proposals are requested for development of current and/or voltage sensors for Naval shipboard monitoring, control electrical distribution, and propulsion systems based on the fiber optic technology.

Phase I proposals should include sensor design and laboratory test and evaluation plans: followed by laboratory hardware evaluations to determine suitability for shipboard evaluation.

N90-137 TITLE: Composite Flexible Pipe Coupling for Surface Ships

CATEGORY: Exploratory Development

OBJECTIVE: Develop a flexible pipe connector constructed of composite (Fiber Reinforced Resin) Material

DESCRIPTION: Develop a flexible pip connection, similar to the currently used rubber insert sound isolation coupling, from fiber reinforced resin materials. Coupling of this type are found on surface ships in the controllable pitch propeller hydraulic piping and Prairie Masker piping. The newly developed coupling should closely match the form fit and function of the metal couplings in use. Flexibility within the coupling can be achieved by use of elastomeric materials similar to current practice. Coupling design may be either repairable or non-repairable in nature and conform to the function and fit of current couplings.

N90-138 TITLE: Cavitation Suppression Technologies for Surface Ship Propulsors

CATEGORY: Exploratory Development

OBJECTIVE: Reduce surface ship acoustic signature through suppression of propeller cavitation. Phase III transition into revolution at sea and advanced machinery efforts.

DESCRIPTION: Propeller cavitation broadband radiated noise is a major, and often dominant, contributor to the total noise signature of surface ships. The Navy needs to reduce or eliminate propeller cavitation. Proposals are requested which address advanced cavitation suppression technologies applicable to surface ship propellers.

Phase I: Develop propeller cavitation suppression technologies and quantify expected improvements relative to established baseline. Provide supporting sketches, drawing, design calculations and performance calculations for technology assessment.

Phase II: Provide detailed designs of technology improvements for specific applications and validate with model experiments.

N90-139 TITLE: Novel Materials for Shipboard Fire Barrier Applications

CATEGORY: Advanced Development

OBJECTIVE: The purpose of this effort is to develop lightweight composite fire barrier material with the capability of significantly improving the protection of vital ship spaces for extended periods following weapon impact. Materials emerging from this effort that satisfy established fire exposure criteria for shipboard use may be transitioned to the Advanced Shipboard Materials effort under the Passive Fire Protection Materials NAPDD (PE 63514, Project S1565, Damage Control).

DESCRIPTION: The Naval Sea Systems Command has identified the development of lightweight composite fire barrier materials as a key technology for future ships. It is highly desirable that the materials selected be capable of surviving initial weapon impact effects and secondary fire effects, thus providing sufficient protection to vital ship spaces to insure “fight-hurt” capability.

The objectives of this Phase I effort is to identify novel approaches to fire protection which offer the potential for order-of-magnitude performance improvement compared with current materials, and to assess their potential in shipboard applications from the standpoint of cost, development, risk, weight, volume and performance.

Phase II will consist of fabricating samples representative of the most promising materials which emerge from the Phase I trade study for testing in a simulated post-hit environment.

N90-140 TITLE: Realizing the Potential of Total Platform Sensor Data Fusion

CATEGORY: Exploratory Development

OBJECTIVE: Investigate innovative approaches that will lead to Total Combat System Integration/Automation of shipboard sensors with the goal of increasing shipboard reaction time to the threat environment.

DESCRIPTION: Sensor data fusion can be viewed as a method for combining similar/dissimilar sensor data from multiple shipboard sensors to provide local and area air defense against anti=ship missile and aircraft threats. It attempts to overcome existing shipboard sensor system limitations and ever increasing 1990’s threats characterized by:

a. Low observable technology which is sharply decreasing radar cross sections.
b. Decreasing threat infrared (IR) signatures.
c. Decreasing attack altitudes of low flyers and terrain/sea skimming missiles.
d. Threat speeds escalating to MACH 3.0 and beyond.
e. Increasing threat maneuverability with higher “G” terminal maneuvers.
f. Increasingly sophisticated threat countermeasures and effective jamming in support of incoming raids.

While current sensor integration has demonstrated the potential for some automation of the combat system, demonstrate the potential gains that could be achieved by multi-sensor fusion of the entire spectrum of visual,

infrared, radio, laser, acoustic, and ESM sensors. Shipboard sensor data fusion architecture which exploits the diversity of frequency and characteristics of each sensor to provide a complete, timely, and accurate picture of the tactical situation in the post 1990 threat environment under adverse conditions including clutter, ECM/ECCM, and multi-path environments is the goal of this effort. Technologies that can help sensor data fusion architecture reach their full potential is sought.

A survey of the capabilities of existing and planned tactical sensors must be conducted with computer models of sensor performance generated during Phase I.

During Phase II candidate multi-sensor data fusion architectures must be hypothesized. Each of these candidate architectures must address scene registration/sensor alignment problems, track initiation decisions, and track correlation concepts. Concepts for triangulating passive data from both ownership and remote platforms must be evaluated. Measures of effectiveness must also be developed to assist in determining the most promising sensor fusion architecture.

N90-141 TITLE: Shipboard High Speed Optical Data Transport Network (HSODTN) – Compartment Area Network (CAN)

CATEGORY: Exploratory Development

OBJECTIVE: To demonstrate cost effective trade-off CANs.

DESCRIPTION: The CAN is the only part of the HSODTN to which the agent(s) has direct access. Thus it is of particular importance to achieve a good cost/performance trade-off for the CAN. Considerations of broadband services from the CAN in a few years, with risks of independent implementation of products, could lead to less difficult interconnections in the future HSODTN. Furthermore, the CAN requirements for combat or critical systems are different from logistics or non-critical systems, so well conceived CANs studies are justified in this specific area.

The tasks are to:

1. Define the CAN requirements and then establish an architecture which can act as a frame work for satisfying these requirements the range of diverse applications and varying traffic capacities and speeds.
2. Ensure that proper technologies are available to achieve the required costs and performance for the CAN.
3. Implement subsystems of the overall predefined CAN architecture to validate technologies and system choices (compatible with HSODTN interfaces).
4. Integrated subsystems into a laboratory prototype to validate the feasibility of the model.

An effective interwork with the HSODTN functional requirements is necessary, so that implementations can take into account the functional specifications defined and the results of the technology validation can be made in a timely manner.

N90-142 TITLE: Ice Phobic Coatings for Ship Antenna Application

CATEGORY: Advanced Development

OBJECTIVE: The goal of the proposed program is to develop a low cost material to inhibit ice accretion on antenna systems during cold weather operations. Current systems are expensive and exhibit limited stability in the marine operational environment. Successful development of coatings which improved behavior will result in large scale testing as part of Phase III.

DESCRIPTION: Ice accretion on surface ships operating in the arctic regions and North Atlantic can have a severe effect on the operational capability of top side systems including antennas for radar and communications. Degradation of these systems can reduce the war fighting capability of the vessel thus limiting its ability to meet

mission objectives. Coatings currently in use are expensive, abrade easily, and can be difficult to apply. New coatings are sought which demonstrate improved environmental stability, can be easily applied to wide variety of surfaces at minimum cost, and exhibit electrical properties compatible with the operating parameters of the antenna system.

Phase I will address performance requirements and goals in addition to initial formulation, sample fabrication, and proof-of-concept testing.

Phase II will expand on the Phase I effort generating sufficient data to assess feasibility of large scale application.

N90-143 TITLE: Non-Corrosive Composites for EMI Shielding Applications

CATEGORY: Advanced Development

OBJECTIVE: The purpose of this effort is to develop conductive, lightweight composite materials for topside hardware EMI shielding applications which are stable in the marine environment. Materials satisfying established performance goals at the end of Phase II will be transitioned to Phase III for large scale testing.

DESCRIPTION: The Naval Sea Systems Command has identified the need for new EMI shielding materials as a key technology for future systems. Highly conductive, non-corrosive materials are of great interest for these applications. Candidate materials systems under consideration must be easily fabricated into complex shapes, low cost, and highly reliable. Signal reductions in excess of 60 dB across a broad frequency range represent the performance goal for this program.

Phase I will involve identification of candidate materials, fabrication of samples, and preliminary testing.

Phase II will optimize the best candidates emerging from the Phase I study and thoroughly characterize their properties in terms of environmental stability and electrical behavior.

N90-144 TITLE: Equipment Readiness Status Monitor and Recorder (RSMR)

CATEGORY: Exploratory Development

OBJECTIVE: Naval Combat system equipment must be monitored for operating time in its various modes of operation and for non-ready status due to marginal states, reduced capability, critical failures, preventive and corrective maintenance, etc. to access its operational availability in the fleet environment. Current procedure is to monitor by fleet technicians who manually record these operating status changes as part of his assigned tasks.

DESCRIPTION: An automated microprocessor based monitoring and recording capability requiring minimal or no technician entry is needed to collect accurate consistent data while detecting operational status changes at the source. The output would be a daily/weekly operating log report for each unique equipment that can be electronically transferred off ship to a centralized computerized database for analysis. The RSMR production cost must not exceed $500 per unit and either installed new as part of the existing equipment architecture or back fitted to existing equipment.

Phase I:

1. Survey industry for monitoring and recording capability and propose existing or new research to design to requirement.
2. Conduct life cycle cost analysis of cost to design, procure and operate.
3. Conduct cost benefit analysis for having accurate data to optimize maintenance philosophy and equipment availability.

Phase II:

1. Select a design to meet requirement
2. Build a prototype RSMR.
3. Conduct test and evaluation to verify and demonstrate operational suitability.
4. Conduct production cost analysis to meet design-to-cost criteria.
5. Produce acquisition specifications and planning documentation for product decision.

N90-145 TITLE: Microwave Monolithic Transmitter/Receiver Designs for Naval Electronic Warfare

CATEGORY: Exploratory Development

OBJECTIVE: Develop phased array designs and modular architecture employing MMIC transmit/receive modules adaptable to several Naval platforms.

DESCRIPTION: The DoD Microwave Monolithic Integrated Circuit (MMIC) program is developing transmit/receive modules for employment in phased arrays that may serve the needs of EW and radars in the future. Octave band phased array design architectures are required to use the basic modules in moderate power decoy designs and to build toward higher power designs for aircraft, helicopters and small ships. Nanosecond beam steering techniques, multiple signal capability, high transmit/receive isolation, polarization control and extension to higher frequency bands are basic goals for this design architecture.

N90-146 TITLE: Versatile Signal Recognizer

CATEGORY: Engineering Development

OBJECTIVE: To develop a signal recognizer that is small, versatile, easily interfaced with any receiver and capable of rapidly adapting to the changing threat.

DESCRIPTION: Since the development of Radar Warning Receivers (RWR), there has been specific signal recognizers that set off alarms to give warning of imminent danger. These recognizers are relatively signal specific and are built around hardware and firmware in a module. The number of signals of interest (SOI) and the number of modules are normally one for one. These recognizers also suffer from variations in signal parameters so that a new SOI's at the same time, be readily programmable in t he field with available assets and maintain all the desirable characteristics such as high probability of intercept/detection, low false alarm rate, rapid recognition and have good sensitivity. The module should be able to interface with a variety of receivers and permit integration of modern devices as the technology changes. The device should also be capable of operating on multiple types of modulations such as FMCW, plus stagger, etc. and be able to accept both analog and/or digital inputs.

N90-147 TITLE: De-interleaving Pulse Trains in Severe Multi-path Environments

CATEGORY: Exploratory Development

OBJECTIVE: Development of an algorithm that can sort radar pulse trains in the presence of strong multi-path by using angle of arrival information.

DESCRIPTION: Radar pulse sorting by submarine ESM systems is complicated by multi-path in that near sea surface environment. When a mono-pulse capability is present, pulses may each be tagged by direction-of-arrival (DOA). Design a de-interleaving algorithm for pulse trains in a dense signal and multi-path environment, that takes advantage of DOA tagging and takes into account DOA measurement tolerances. The only other parameters the algorithm can make use of are frequency and time of arrival.

N90-148 TITLE: High Power, Short Pulse Jammers

CATEGORY: Exploratory Development

OBJECTIVE: Demonstrate feasibility of electromagnetic pulse radiator for disrupting airborne missile systems.

DESCRIPTION: There is an increasing need for more generic means of jamming communications and electro-magnetically guided weaponry in all services and the U.S. Navy has unique needs to disrupt anti-ship missile guidance systems. The effects of electromagnetic pulses (EMP) on sensors, electronics and servos is documented in the open literature and provides the impetus for research to provide practicable shipboard jammers of this type. Photoconductive switching, using silicon or gallium arsenide diodes can switch large power (gigawatts) with nanosecond risetimes. A laser can be used to trigger the photoconductive switches that discharge high voltage capacitors into a waveguide horn array. This array jammer could also be possibly used in a dual mode as a radar to detect low observable missiles and aircraft. Trade-offs on alternate practicable and affordable EMP mechanisms must be presented with effects of projected electric field intensity on the target at ranges from two to fifteen miles. A plan for testing the demonstration transmitter should be addressed.

N90-149 TITLE: Radiometric Detection of Targets at Sea

CATEGORY: Exploratory Development

OBJECTIVE: To develop passive detection system for targets at sea

DESCRIPTION: Passive detection of targets from on-board Navy surface ships is needed in order to maintain radar silence and to detect low observable targets through fog and rain. Microwave and millimeter wave radiometry have demonstrated potentials for detecting and even imaging ships and aircraft at sea. The target may have reduced infrared signature and the radiometer will measure “radio temperature” difference between the target and its background. A four foot parabolic antenna disk and cryonic cooling will be acceptable for demonstration, but diode arrays should be explored for more compact and higher sensitivity designs. Signal processing, displays and data recording shall be addressed with a plan for demonstration with U.S. Naval facilities.

N90-150 TITLE: Tailoring Tool for Assuring Effective R/M/QA Clauses in Acquisition Documents

CATEGORY: Engineering Development

OBJECTIVE: To provide EW System Managers with Cost Effective Options for Specifying R/M/QA Requirements that meet Navy Policy.

DESCRIPTION: To develop an IBM PC compatible program (on floppy disk) expending preparation of “tailored,” cost effective Reliability (R), Maintainability (M), Quality Assurance (QA), requirements, mission profile, Availability and R/M/QA tests for Acquisition Plans and Packages (SOW and SPEC). This program would be designed for Program Manager/Acquisition Engineer use in selected clauses that comply with OASN/NAVSEA requirements policy but categorized for selection by contract type, environment, EW requirements and cost alternatives (minimum requirements). Development of program will include user friendly display and development of some clauses. Results will be more intelligent and less costly requirements imposed in new RFPs designed to program needs.

N90-151 TITLE: Testing of Shipboard EW Equipments

CATEGORY: Advanced Engineering Development

OBJECTIVE: Develop test set to verify operation of Shipboard EMC & ESM operation.

DESCRIPTION: Current equipment used to test shipboard EW system for correct operation prior to deployment is outmoded and is not able to fully test modern EW systems. A set of test equipment is needed to simulate active systems externally and measure ECM performance parametrics such as effective radiated power, transmit beam pattern, J/S ratio, and jammer set on accuracy. Approaches to fixed site and portable equipments are desired as well as automated measurement techniques.

N90-152 TITLE: Passive Ranging with Limited Data

CATEGORY: Advanced Development

OBJECTIVE: Exploiting characteristics of electromagnetic signals emitted at great distances in ways that allow passive ranging by submarines in relatively short periods of time.

DESCRIPTION: Submarines usually need to support Over-The-Horizon (OTH) targeting by locating distant signal emitters by purely passive means. Classical methods such as triangulation have been generalized into powerful techniques but almost always require large times and distances of travel to collect the necessary data to determine the location of very distant emitters.

Develop an algorithm that may exploit any and all characteristics of received signal such as phase, amplitude, polarization, etc., to determine the position of distant emitters without traveling large distances or making numerous maneuvers.

N90-153 TITLE: The Use of Artificial Intelligence for Torpedo Detection

CATEGORY: Exploratory Development

OBJECTIVE: Detect and classify torpedos using artificial intelligence

DESCRIPTION: The Navy has a requirement for a system that can rapidly and reliably classify torpedoes while maintaining a low false alarm rate. The use of Artificial Intelligence (AI) in digital processors for human speech recognition is an example of present capabilities in this technology. A natural extension would be the use of AI to discriminate between the acoustic radiation of a torpedo from non-torpedo noise. The input to the system would be acoustic data provided by the Navy. The offeror should have an understanding of underwater acoustics and torpedo radiated noise characteristics in addition to AI technology.

During Phase I, the contractor will demonstrate detection in a laboratory environment with acoustic data provided by the Navy.

Continuation into Phase II, the contractor will be provided a larger acoustic data set and demonstrate a low false alarm rate along with reliable demonstration in a Navy ship. The contractor should include in the proposal: 1. a description of how the system requirements will be met, 2. an analysis to support how the requirements will be satisfied, and 3. any real data to substantiate the analysis. The qualifications of the principal investigator(s) should be provided. The company must also hold or be able to obtain a facility clearance for the storage of classified data.

N90-154 TITLE: Neural Networks for Torpedo Detection

CATEGORY: Exploratory Development

OBJECTIVE: To develop a system capable of detecting torpedos using neural networks.

DESCRIPTION: The Navy has a requirement for a system that can rapidly and reliably classify torpedoes while maintaining a low false alarm rate. Recent advances in neural network technology have the potential to satisfy this requirement. The input to the system would be acoustic data from existing onboard sensors. The offeror should

have an understanding of underwater acoustics and torpedo radiated noise characteristics in addition to neural network technology.

During Phase I, the contractor will demonstrate detection and classification in a laboratory environment with acoustic data provided by the Navy.

Continuation into Phase II will be based upon successful performance in Phase I. During Phase II, the contractor will be provided a larger acoustic data set and demonstrate a low false alarm rate along with reliable detection and classification. This will be followed by an at-sea demonstration in a Navy ship. The contractor should include in the proposal: 1. a description of how the system requirements will be met, 2 an analysis to support how the requirements will be satisfied, and 3 any real data to substantiate the analysis. The qualifications of the principal investigator(s) should be provided.

N90-155 TITLE: Preset Capability for Expendable Countermeasure (CM) Devices

CATEGORY: Exploratory Development

OBJECTIVE: To identify a new concept for presetting countermeasure devices after loading.

DESCRIPTION: This task involves the investigation and selection of the most feasible, new, innovative concepts for presetting CM devices after they have been loaded in water-tight CM launch tubes. Currently such devices have presets (such as hover depth, noise mode, run duration, etc.) selected before loading in the CM launcher located inside the submarine.

For external CM launchers these presets are made using a small electrical umbilical cable and a 64 bit digital word. Ideally these presets should be made without physically attaching a link to the CM device. An acoustic, optical or magnetic link would be acceptable if the transmission of data is reliable.

Phase I will consist of engineering analysis sufficient to determine concept feasibility. During Phase II, a breadboard model will be fabricated and undergo test and evaluation.

N90-156 TITLE: Automatic Radar Scan Recognizer

CATEGORY: Exploratory Development

OBJECTIVE: Development of an automatic radar scan recognizer for complex scan patterns in a multi-signal environment.

DESCRIPTION: The Navy requires an automatic scan recognizer to enhance radar signal identification. Current Navy submarine EW systems reply on the three basic radar signal parameters (radio frequency, pulse repetition interval, and pulse width) to perform automated signal identification. Additional radar signal parameters are required to resolve ambiguities when multiple candidate solutions are present after identification attempts using three basic parameters. The best candidate additional parameters in the submarine environment are scan type and scan rate/period.

Current automated scan measurement systems deployed on submarines are effective only when the most ideal signal to noise ratios are present, and normally are limited to simple scan types such as circular. The Navy's requirement includes automated recognition and measurement of radar signal scans in multi-signal environments, when signal side lobes are present and on all scan types including complex scans such as conical and lobe switching.

N90-157 TITLE: High-Efficiency Low-Noise Hovering Systems for Underwater Devices

CATEGORY: Exploratory Development

OBJECTIVE: To investigate the development of high-efficiency low noise hovering systems for underwater devise.

DESCRIPTION: Several types of submarine-deployed expendable devices are required to remain at pre-determined depths for periods of time up to one hour. These devices range size from 3" diameter by 40" length to 6.25" diameter by 106" length, and have wet weights from a few ounces to several pounds. Hovering systems which are small in volume, quiet, reliable, and energy efficient are of great value to the success of device development programs.

Phase I will consist of engineering analysis sufficient to determine concept feasibility.

During Phase II, a breadboard model will be fabricated and undergo test and evaluation.

N90-158 TITLE: Low-Noise Microwave Receiver Using High Temperature Superconductors

CATEGORY: Research

OBJECTIVE: The application of the new, high-temperature, superconductors to develop ultra low-noise using only liquid nitrogen refrigeration.

DESCRIPTION: Receivers with some cryogenic and superconducting elements have been used in radio telescopes in the millimeter and sub millimeter ranges for more than 7 years. The noise figure for such receivers are much lower than those for comparable receivers operating at room temperature. The very low temperature used in these receivers are usually obtained with liquid helium refrigeration units. The recent discovery of superconductors with transition temperatures in the 90 degree K range, and above, make possible such receivers cooled by liquid nitrogen refrigeration units.

Develop a very low noise microwave receiver, cooled only by liquid nitrogen, using one of the new high temperature superconductors.

N90-159 TITLE: Advanced Machinery Monitoring Sensors

CATEGORY: Engineering Development

OBJECTIVE: The key to automating ship and machinery control functions is durable, reliable sensors which need little or no care. Existing sensors are electrical and either contact closure type or continuous type. They generate low level signals and are prone to EMI, shorts and grounds. They require recalibration (annual basis) and in many cases there is no way to distinguish between a failed sensor and an actual alarm condition.

DESCRIPTION: Existing electrical type sensors will be examined for approaches to provide automatic recalibration and loss of sensor detection. Various transducer types will be compared on the bases of cost, accuracy, availability, reliability, operating temperature range and compatibility with computer based monitoring and control systems. Fiber optic sensors will be developed for areas in which no electrical sensor can meet the requirement and as a replacement for existing sensors for improved reliability, survivability, lower cost, broader environmental operating range, and/or elimination of EMI, shorts and grounding problems. Integration of fiber optic sensors into the advanced monitoring and control systems for maximum utilization of potential benefits will also be addressed.

PAYOFF:

Weight: If properly integrated into the system the fiber optic sensors will be lighter and have lighter cabling.
Volume: Fiber optic sensors are smaller as are the connecting cables.
Maintenance: Self calibration, increased reliability and redundancy of critical sensors will essentially eliminate more survivable.

Operating envelope: Fiber optic sensors will operate in more extreme environmental conditions and are more survivable.
Manning: Reduced maintenance burden.
Reliability: Sensor reliability vastly improved.
Cost: Fiber optic sensors cabling have potential for substantially reduced costs.

N90-160 TITLE: Undersea Fiber Optic Communications Network

CATEGORY: Exploratory Development

OBJECTIVE: To develop a fiber optic communications network for underwater use.

DESCRIPTION: The Navy has 3 requirements for a high data rate underwater Fiber Optics Communications Network which is robust, self healing, and automatic reconfiguring. The network must be randomly accessible at multiple points by means of an attachable/detachable fiber optic coupling device. Recent advances in neural technology have the potential to satisfy the network requirements. Innovative research will be required to design and access coupling.

During Phase I, the contract will provide the initial engineering analysis necessary to develop the network architecture and the access coupling.

Phase II will be based on successful performance in Phase I. During Phase II the contractor will demonstrate the fiber optic neural network and access coupling in a laboratory environment. This will be followed by a prototype installation for testing in the undersea environment. The contractor should include in the proposal: 1 a description of how system requirements will be met, 2 an analysis to support how system requirements will be satisfied, and 3 the qualifications of the principal investigators.

N90-161 TITLE: Pressure Compensation Systems for Moving Coil Projectors

CATEGORY: Exploratory Development

OBJECTIVE: To improve reliability of moving coil projectors.

DESCRIPTION: The Navy has the need to improve the reliability of moving coil projectors. To this end, approaches to either ruggedize existing designs or develop novel concepts to minimize the pressure compensation requirements need to be developed. Hydrostatic pressure requirements are in the range of 0-100 psig.

During Phase I, the contractor will submit a paper analysis with a breadboard of the proposed pressure compensation system.

Phase II will require the contractor to make a prototype pressure compensation system, attach this system to a moving coil transducer and conduct a laboratory test.

Phase III would produce from scratch a compact moving transducer Advanced Development Model (ADM) with an improved pressure compensation system. Finally, this ADM would be subjected to an at sea test. The contractor should include in the proposal: 1 a description of how the system requirements will be met, 2 analysis to support how the requirements will be satisfied, and 3 any real data to substantiate the analysis. The qualifications of the principal investigator(s) should be provided.

N90-162 TITLE: High Order Spectrum Applied to Time Delay Estimation

CATEGORY: Exploratory Development

OBJECTIVE: To develop a method of estimating signal propagation times

DESCRIPTION: The Navy has an interest in developing improved methods of estimating signal propagation times and time differences. This technology has direct application in active and passive sonars to support bearing and range estimation. The contractor shall develop a signal processing technique based on high order spectrum estimation to measure time delay differences between different sonar signals.

The contractor shall describe the signal processing algorithm used and how it will meet the requirement to measure time delay. The contractor shall describe how this signal processing can be demonstrated and tested using simulated data and report the performance achieved. Testing shall include a sample of data recorded during at sea exercises. The contractor shall describe the qualifications of the principal investigator for this task.

N90-163 TITLE: Automated Ground Wave Recognition for HF Communication

CATEGORY: Advanced Development

OBJECTIVE: Development of an algorithm which can discriminate between ground wave and sky wave signals in the HF band when antennas are used which are electrically very small.

DESCRIPTION: The HF signals of interest to Submarine ESM system operators are usually the ground wave. However, often HF sky wave signals are intercepted. Sometimes sky wave and ground wave signals are intercepted together.

Develop an algorithm which will recognize HF ground wave from sky wave signals when received by an AN/BRD-7 antenna array in close proximity to the surface of the ocean. The algorithm must detect when an intercepted ground wave signal is contaminated with a sky wave.

N90-164 TITLE: High Frequency, High Power Transparent Transducer

CATEGORY: Exploratory Development

OBJECTIVE: Hardware demonstration of high power, broadband transducer.

DESCRIPTION: A requirement exists for a high power, broadband, acoustically transparent, high frequency transducer. A broad operating band (one octave) is required).

The Phase I requirement is a design and hardware delivery of a projector(s) suitable for test and evaluation for initial demonstration of the feasibility of the concept.

Phase Ii will be a full array hardware demonstration of the total concept.

N90-165 TITLE: Electronic Precision Focusing for the Type 18 Periscope

CATEGORY: Engineering Development

OBJECTIVE: To develop an electro-optic sensor that determines the optimum focus of an optical system from its real scene image within the limitations and restrictions of packaging, cost and vehicle environment and improve intelligence, reconnaissance, sensor contrast and atmosphere contrast with regard to image acquisition.

DESCRIPTION: A study performed by EK and sponsored by OP 924 in the early 1980's showed that lack of resolution of intelligence imagery shot through the Type 18 periscope was due to poor focusing of the IMCCS. Accuracy of focusing relies on the operators eyeballs without any electronic assistance. Results by the end user of the imagery show about a 7% return of usable film negatives, however not necessarily at resolution levels designed

into the Type 18 periscope. The proposed task is to analyze the Type 18 focusing shortcomings, evaluate current state-of-the-art automatic electronic focusing systems and incorporate it into the Type 18 periscope. The addition of precision focus capability should greatly enhance intelligence gathering missions, reconnaissance scenarios, and provide the photo interpreters with more usable imagery during image acquisition missions.

N90-166 TITLE: Pulse Power Supply for Submarine Electromagnetic Launch

CATEGORY: Exploratory Development

OBJECTIVE: An appropriate power source for submarine electromagnetic launch system capable of supplying 15,000 amperes at 250 volts DC for a period of 1 second with an approximate rate of 8 shots per minute for a total of 40 shots does not exist, and much of the technology required for such development is deficient.

DESCRIPTION: Develop a power source for the electromagnetic launch system based on advanced fuel cell technology. The fuels and oxidants will be generated electronically and stored onboard with no requirements for shore side replenishment.

PAYOFF:

Envelope: Allows development of an electrolyte weapons launch system requiring no additional support systems, independent of the ship's battery system.
Signature: Decreases noise signature 90% over conventional power sources utilizing heat-engine technology. Reduced weight 50% over conventional battery systems.
Synergistic: It is possible for this fuel cell power system to share or be combined with a fuel cell system, used as emergency power generation. In this case, development of the reactant systems would converge, and the electrolytic oxygen generator used in life-support, could be eliminated.
Maintenance: Fewer moving parts yield 50% improvement in the main-time-to-repair compared to engine generators and battery maintenance.
Liability: 50% increase over heat-engine technology
Manning: No change except that a higher level of training is required.

N90-167 TITLE: Directional Hydrophone for Acoustic Towed Arrays

CATEGORY: Advanced Development

OBJECTIVE: To develop a directional hydrophone for towed arrays.

DESCRIPTION: The Navy has a requirement for a directional hydrophone for acoustic towed arrays. Current towed arrays have a left/right ambiguity because they are constructed with omni directional hydrophones. If the omni directional hydrophones were replaced with hydrophones that discriminate between left and right, this ambiguity would be removed. Additionally, the hydrophone must have the sensitivity, frequency response, and low acceleration response comparable to current hydrophones, must physical fit within a 2.5 inch ID hose (and preferably within a .75 inch ID hose), and must maintain left/right discrimination as the towed array rotates.

During Phase I the contractor will design, fabricate and test a hydrophone in a laboratory environment. A decision proceed into Phase II will be based upon actual test results.

During Phase II, the contractor will fabricate and support calibration and at-sea tests on a Navy test ship. The contractor's proposal should address how he will satisfy the requirements and provide analysis and any test data available to support performance predictions. The proposal should include the predicted level of left/right discrimination and sensitivity as a function of frequency.

N90-168 TITLE: Non-Electric Shipboard Systems Diagnostic Concepts

CATEGORY: Engineering Development

OBJECTIVE: To develop portable, diagnostic systems and concepts for non-electronic shipboard system or equipment.

DESCRIPTION: The Navy requires portable diagnostic systems and equipments which can be used to 1 diagnose non-electronic equipment and 2 assist repair technicians during the repair and post repair check out process. Three categories of equipment are of interest: 1 rotating machinery, 2 reciprocating machinery, and 3 high current handling electrical equipment such as circuit breakers and switchboards. The Navy is particularly interested in a concept for using the same system on more than on type of equipment and throughout the diagnostic, repair, and checkout process. These processes may migrate through all three levels of maintenance, organizational, intermediate, and depot.

Phase I of the project should provide the concepts or products to be used and the rationale for selecting the shipboard systems for diagnosis. It should also include a description o the range of applicability and a description of the Phase II effort.

Phase II should demonstrate the use of an actual system in a Navy ship and repair activity, and should lead to actual fleet-wide introduction. The contractor will be expected to deliver the required procurement specifications and contract CDRL requirements for inclusion in the system procurement solicitation for Phase III.

N90-169 TITLE: Wave Characterization System

CATEGORY: Exploratory Development

OBJECTIVE: To develop a system for use on Amphibious ships capable of supporting Landing Craft, Air Cushion (LCAC) operations to reliably characterize the sea conditions immediately prior to and during LCAC operations.

DESCRIPTION: The ability of the LCAC to effectively conduct its mission to carry personnel and equipment to and from shore including interfacing with well deck ships is significantly effected by sea conditions. Optimal LCAC cargo loading, fueling, craft speed and heading can only be determined based upon a relatively accurate characterization of ambient sea conditions. Means currently available to the Task Force Commander for assessing these conditions in order to determine resultant effect on LCAC performance are limited. A system that would reliably measure, and provide a real time display of sea-state data including wave height, wave length and a period of maximum energy would prove to be a valuable tool for use in the planning and conduct of LCAC operations.

The Phase I program involves further definition of requirements, development and comparison of alternatives and demonstration/validation of concept(s).

Phase II would involve full scale prototype test and evaluation, and further development of the preferred configuration.

N90-170 TITLE: Inflatable Craft Design Developments and Improvements

CATEGORY: Advanced Development

OBJECTIVE: To improve current Combat Rubber Raiding Craft for future procurements through development of:

a. Low detectability
b. A means of suppressing wake and spray
c. A more producible design
d. New/better construction techniques

e. New materials for overall construction
f. A personnel cover
g. Strengthened transom for higher horsepower engines

DESCRIPTION: Combat Rubber Raiding Craft are used by Naval Special Warfare (SEAL) Teams for many types of operations. A primary method of reducing threat in this arena is by decreasing detectability. A low detectable craft will improve the survivability of SEALs in the combat arena.

In the past, the Navy has purchased many of these craft off GSA contracts which decay efforts of configuration management and Navy Logistics support. The design development and improvements stated above would further Navy development of Combat Rubber Raiding Craft Specifications.

Phase I should include feasibility studies and preliminary design sketches for those items listed above.

Phase II development of feasible products and techniques culminating in production drawings and the production and testing of a prototype craft.

Phase III, after incorporation of concepts developed in Phase I and II into the specification for CRRC, a firm fixed price production contract may be awarded based on either a RFP or an IFB.

NAVAL SURFACE WEAPONS CENTER/WHITE OAK

N90-171 TITLE: System Design Methodology for Massively Interconnected Models

CATEGORY: Exploratory Development

OBJECTIVE: Develop methodologies, techniques and tools to reduce insertion time of massively interconnected models into hardware for Navy Systems.

DESCRIPTION: Numerous massively interconnect models with simple computational nodes (such as artificial neural networks) have been shown to have great promises for Navy applications. However, these models have only been used as part of software simulations on their proposed applications. To have any real value to embedded, real time systems, they must be implemented to a large extent in hardware.

A huge bottleneck to such implementations is the complexity of the communication interconnection required by these computation models. The Navy seeks a performance based (response time, volume, area, etc.) methodology and associated techniques and tools to systematically reduce such interconnection complexity for hardware implementation without disturbing the value of the underlying algorithm. These techniques and tools must allow the analyst to tradeoff feasible designs for area, time, fault tolerance and system performance.

N90-172 TITLE: Statistical Testing of Model Hypothesis in Binomial Regression

CATEGORY: Research

OBJECTIVE: Improve and develop the properties of a statistical test for model goodness-of-fit in binomial regression problems involving a complicated regressor function.

DESCRIPTION: Numerous military significant problems, such as the evaluation of weapons system effectiveness, the sensitivity and reliability of explosives, and the vulnerability of complex structures to severe loading conditions, often involve the regression of a binomial proportion (number of successes/number of trials) on some loading functions or quantity that is assumed to characterize the severity of the trial environment. The probability of success estimated in this manner (mean of the binomial proportion) as well as further interference, is dependent upon the assumed model hypotheses, i.e., the loading function (or class functions) employed and the class of distributions used to relate probability to success to loading level. The credibility of any prediction model developed in this

manner depends on statistical test of the model hypotheses and the power to the test against alternative model hypotheses.

The Phase I effort would develop the properties of an existing chi-squared test, perhaps by numerical situation, and explore the possibility of developing a test with improved small sample properties.

The Phase II effort would continue the development of the improved test. An important focus during both phases would be the power of the tests as a function of sample size. The broader impact of this work would be to provide the Navy with a means of discriminating between effective and weak prediction models and for determining the data requirements for significant comparisons.

N90-173 TITLE: Improved Methods for the Manufacture of Pentafluorosulfanyl Components

CATEGORY: Exploratory Development

OBJECTIVE: Develop chemical reactions, methods, or processes which will permit the economical synthesis of key pentafluorosulfanyl intermediates.

DESCRIPTION: Pentafluorosulfanyl (SF5) compounds exhibit reduced sensitivity and relatively high energy content. These properties would allow the formulation of improved explosives for insensitive and high-yield underwater munitions, and of fast burning pyrotechnic compositions. However, practical use of SF5 compounds is restricted by their high cost.

The Phase I effort would identify and evaluate, on a laboratory scale, novel approaches to the economical synthesis of SF5 compounds such as those listed above, as well as other SF5 compounds which can be made economically and have appropriate functionality for further chemical reactions.

Under the Phase II effort, the synthesis of selected SF5 compounds would be scaled up using economical processes developed during Phase I. Significant quantities of selected compounds would be produced as precursors for explosive and pyrotechnic ingredients. Such ingredients would be prepared and evaluated in follow on effort supported by appropriate 6.2 programs.

N90-174 TITLE: Discontinuously Reinforced Magnesium for Missile Components

CATEGORY: Exploratory Development

OBJECTIVE: To develop an improved discontinuously reinforced magnesium matrix composite material.

DESCRIPTION: Magnesium is a lightweight structural material that has relevance to missile applications. A magnesium matrix composite which exhibits significantly improved thermal conductivity or dimensional stability versus the baseline metal would be useful for components such as heat sinks, mirrors, or stable platforms. This composite should be isotropic in thermo mechanical behavior. Proposals are sought with a demonstrated capability to fabricate high conductivity or high stability magnesium matrix composite.

The Phase I deliverable is test data sufficient to indicate the quality of the composite.

Phase II efforts will consist of defining an application and making components that manifest the improved material properties. The deliverable will be small or reduced scale components for evaluation by the Navy.

N90-175 TITLE: Phased Array Antenna

CATEGORY: Advanced Development

OBJECTIVE: The Navy is interested in monopulse phased array antenna technology that would enable the construction of a low cost, back-to-back, rotating phased array.

DESCRIPTION: The antenna should possess the following characteristics:

Aperture – 2m vert by IM horiz or larger
Frequency – x-band or higher
Bandwidth – 10% minimum, 30% desired
El Scan - +7- deg to –20 deg
Az Scan – 0 to 20 deg
Scan rate – 120 rpm minimum
Sidelobes - -23 dB maximum, -35 dB desired
Peak power – 100 Kw

Designs should minimize the number of phase shifters. Space and reciprocal feel designs are encouraged. Wide bandwidth, low weight and low sidelobes are desirable. Azimuth scan is not necessary but could result from squinting over the operating band. Beam spoiling in either azimuth or elevation will also be considered desirable.

The first phase of the contract would be to produce a detailed design of the proposed antenna. The design would include predictions of far field antenna patterns.

The second phase of the development would be the construction of a full scale or sub scale model of the antenna and the measurement of far field antenna patterns over the operating frequency band and over all scan angles.

N90-176 TITLE: Detection of Hidden Corrosion Under Aircraft Skin

CATEGORY: Research

OBJECTIVE: Research to discover new ways of detecting corrosion under aluminum aircraft skins.

DESCRIPTION: The Navy presently expends considerable effort in assessing the extent of hidden corrosion in its aircraft. The current method involves the expensive and time-consuming process of removing the outer aluminum skin so that a visual inspection can be conducted. A means of assessing hidden corrosion without skin removal could result in significant cost savings. Such an approach would require the development of a technology suitable for ultimate transition to a typical aircraft maintenance environment. Despite prior research in this area using neutron radiography, the development of a practical inspection tool has been elusive.

Either totally new technologies or significant advances in the practicality of implementing neutron based methods are sought in Phase I. Salient features of any instrumentation associated with the technique would include portability, ease of operation, and capability to adapt to the wide range of geometries encountered in a typical aircraft structure.

Phase II of this effort should use approach defined in Phase I to develop and deliver hardware/software to the government for test and evaluation.

N90-177 TITLE: Nonlinear Transforms for Optical Signal Processing

CATEGORY: Exploratory Development

OBJECTIVE: To develop and demonstrate optical systems or devices capable of real time nonlinear transformations.

DESCRIPTION: Optical systems provide true parallelism and thus great speed advantages over electronic systems in a large number of signal processing applications. Linear operations such as correlation, convolution and Fast

Fourier Transformations are relatively easy to implement. Many signal processing techniques for radar and sonar applications utilize nonlinear transforms such as the log function.

New concepts and techniques for nonlinear optical processing are sought in Phase I.

Phase II of this effort should use approach defined in Phase I to develop and deliver hardware/software to the government for test and evaluation.

N90-178 TITLE: Embedded Training Capability for Afloat Crypto Logic Systems

CATEGORY: Exploratory Development

OBJECTIVE: The objective is to develop an approach for implementing an embedded training capability in crypto logic systems in surface combatants. Such a capability would significantly reduce the manpower and funding required to provide formal operator training a class room environment.

DESCRIPTION: A priority Navy requirement exists for the development of an approach for defining and implementing an embedded operator training capability in crypto logic systems installed in surface combatants. This capability must be structured enough to allow for stand alone, individual system operator training, while being flexible enough to provide afloat crypto logic systems operators the capability to participate in own ship Combat Information Center (CIC) simulated training exercises and scenarios. This task is to develop and evaluate candidate approaches for implementing such an embedded operator training capability in afloat crypto logic systems.

N90-179 TITLE: Crypto Logic Expert System Man-Machine Interfaces (MMIs)

CATEGORY: Exploratory Development

OBJECTIVE: The objective of this task is to perform appropriate analysis and engineering studies to define Man Machine Interface refinements and improvements to the multi-faceted internal operations of a crypto logical expert system to enhance the systems combat effectiveness, while reducing operator workload.

DESCRIPTION: The use of expert systems in crypto logic system operations is a relatively new concept. Few scientific studies, if any, have been conducted to address the Man Machine Interface requirements of such a concept on a global scale encompassing Navy wide crypto logic operations. The concept is valid, and essential, however, the implementation may not be so straightforward. This effort is to apply analytical tools/methodology, tables, lists, charts, statistical and other data and methods to develop a cost effective Navy wide implementation approach.

N90-180 TITLE: Distributed Operating System Design Assistant

CATEGORY: Exploratory Development

OBJECTIVE: To develop a methodology and tool for tailoring of distributed and parallel processing operating systems for real time systems.

DESCRIPTION: The research will evaluate and develop a methodology and tool to facilitate optimized distributed and parallel processing operating system for real time systems. The methodology will be implemented to allow an automated way for real-time system developers to tailor a distributed/parallel operating system to their applications needs while minimizing the requirements for knowledge of low-level operating system details. The tool should handle characteristics such as fault tolerance (detection, localization, and recovery); memory management (local and global), resource allocation, I/O management, interrupt handling, data synchronization, critical deadlines, and error monitoring. Similarities between existing operating systems should be examined to determine key design requirements for a highly efficient and generic operating system development tool. The methodology should handle a wide range of software architectures as well as isolate and manage identification of device dependent partitions of

the operating system to accommodate a wide variety of hardware architectures. The result of the research will be a methodology and tool to optimize the design and implementation of distributed/parallel processing operating systems to meet the requirements of the complex and computational intensive real-time applications.

N90-181 TITLE: Modeling of the Human Decision Maker in Support of C3I

CATEGORY: Exploratory Development

OBJECTIVE: Develop candidate model structure in Phase I in order to develop various implementations of future C3I Assessments.

DESCRIPTION: Present C3I modeling techniques are based on scientific analysis and/or various object-oriented techniques that will additionally capture queuing/contention type issues. In these approaches, some aggregate affective delays for the human decision making process that supports the command of warfare assets. Of considerable importance is the development of better detailed representations of the decision process and the associated delays and non-linearities introduced in the overall system performance.

During Phase I various detailed techniques and structures would be developed in preparation for integration with other C3I assessments.

N90-182 TITLE: Optical Neural Networks

CATEGORY: Exploratory Development

OBJECTIVE: To develop and demonstrate an advanced optical neural network system to support a wide range of military real time pattern recognition applications.

DESCRIPTION: Neural networks provide high speed and fault tolerant associative memory, classification and data extraction from partially obscured information. Neural network implementations require a highly interconnected and parallel architecture. Optical neural network implementations can exceed many, if not all, of the present capabilities of the electronic implementations. Using optics it is potentially possible to obtain up to 1 Giga associations per second, 1 Giga interconnections per cubic cm of optical materials using holographic interconnects and 10 to the 18^{th} (Exa) interconnects per second. Such a system could be used for spread spectrum communications which cannot be implemented at this time due to the speed limitations of digital pattern recognition systems. Innovative neural network systems concepts using new optically implemented paradigms, or novel architectures, and/or advanced device/materials applications are sought.

N90-183 TITLE: Advanced System Architecture for Target Tracking and Recognition

CATEGORY: Exploratory Development

OBJECTIVE: Develop new and improved neural network architectures for real-time target tracking and recognition.

DESCRIPTION: Automatic targeting for imaging systems is becoming a requirement in development of a smart weapon system. The promise of employment of emerging technology of artificial neural networks provides novel opportunities in achieving full autonomy and realization of smart weapons that reduce load on the personnel.

Concepts are being sought that represent new and/or modified neural network architectures with one or more the following features: invariant detection of patterns, reduced learning cycle, dynamic and adaptive system, robustness to noisy data, and real time processing using IR or radar sensory data.

N90-184 TITLE: High Energy Melt-Castable Explosive

CATEGORY: Exploratory Development

OBJECTIVE: Develop a melt castable explosive in which the matrix is an inorganic oxidizer.

DESCRIPTION: Hydroxylammonium perchlorate (HAP) is a compound that is related to ammonium perchlorate (AP), an ingredient in many explosives and propellants. Calculations indicate that there could be advantages of using HAP as an ingredient in an explosive formulation for underwater applications, particularly if it could be used as the matrix in a melt case system. The melting point of HAP is lower than that of AP, and if a eutectic were formed between the two, the melting point would be even lower. Proposals are solicited for investigating the use of HAP as a melt cast matrix for an aluminized explosive with bubble energy superior to PBXN-103.

Phase I should include a study of the phase diagram of HAP and AP, and of HAP and other potential oxidizers. The questions of hygroscopicity and sensitivity of the materials should also be addressed.

Phase II should include the development of a melt-cast explosive formulation using HAP has a melt cast matrix. It should include: small scale impact, electrostatic discharge and friction sensitivity tests; thermal stability tests; determination of failure diameter and detonation velocity; underwater performance test: and cylinder test.

N90-185 TITLE: Acousto-Optic Signal Processing

CATEGORY: Exploratory Development

OBJECTIVE: To develop and demonstrate systems and devices based on acousto-optic principles for high speed radar signal processing.

DESCRIPTION: To defeat the high performance air targets of the future, signal processing systems must be capable of instantaneously processing target information and providing missile guidance commands in a hypersonic engagement. New concepts, techniques and improved acousto-optic devices for optical signal processing systems are required to perform real time processing and interpretation of radar and other sensory information at extremely high data rates. Specific applications include range and doppler processing of pulse radar and non-cooperative target recognition. These require high time bandwidth products for the system and wide time apertures, low signal attenuation and high diffraction efficiency in the acousto-optic cells.

N90-186 TITLE: Advanced Damage Model Development

CATEGORY: Exploratory Development

OBJECTIVE: To develop/improve/validate models describing damage to targets from warheads.

DESCRIPTION: A need exists for the development of advanced models for predicting the damage inflicted on targets by underwater weapons. The tasks requires that finite element codes and models be upgraded to treat the following topics: large dynamic plastic deformation; perforation; erosion of penetrators; spalling; crack growth; fluid structure interaction; and propagation of strong shock and detonation waves through several media, and long duration subsonic shock waves. Not only are new capabilities added to the codes, but basic improvements in the codes themselves are made. These include modular architecture; numerically stable interfacing between the modules; efficient integration; and “user-friendly” pre-and post-processing. Supporting experimental efforts to validate the models are planned in detail and executed, if possible.

Phase I deliverables: Refine methodology and apply to specific Navy problems. Develop small scale tests to assess the validity of the methodology. Using the results of these tests, design new large scale tests to validate and further refine the methodology.

Phase II deliverables: Refine the methodology developed in Phase I and apply it to specific navy problems. Develop small-scale tests to assess the validity of the methodology. Using the results of these tests, design new large-scale tests to validate and further refine the methodology.

N90-187 TITLE: Design Guidelines for Touch-Sensitive Screens

CATEGORY: Exploratory Development

OBJECTIVE: To develop design guidelines for Touch-Sensitive Screens which can be incorporated into MIL-STD-1472 (and applied to future systems).

DESCRIPTION: Due to the advent of the Touch-Sensitive Screen, MIL-STD 1472C requirements have become insufficient for key fields (i.e., dimensions, separation, resistance, etc.). The forthcoming version D of MIL-STD-1472C is also deficient in this area. As a result, current separations and dimensions are being specified by individual system designers without the benefit of detailed research and documented studies. While this information has DOD-wide application, specific needs exist for this information relative to the Navy (e.g. sea state and shipboard vibration).

Questions have arisen whether the limited amount of screen display area has been efficiently utilized by the designers of systems for the Navy. The operator of a Touch-Sensitive Screen should have a screen which compensates for these conditions. In addition, when the key field dimensions and key field separations are too large, the overall screen design is inefficient and underutilized. If the key field dimensions and key field separators are too small, an incorrect entry or inadvertent action may be made. AN incorrect entry may cause severe problems, especially if he operator is controlling a fire control system. Currently, without formalized design guidelines, recommendations, or standards for utilization by system designers, the overall design is configured without consistency. A good user-system interface makes the program not only ease to learn but also easier and more efficient to operate. Conversely, a bad user interface may make things so difficult for the operator that the program is inefficient and unusable.

N90-188 TITLE: High-Speed Photo detector Switching to Avoid Backscatter

CATEGORY: Exploratory Development

OBJECTIVE: To investigate, design and demonstrate performance of techniques to gate optical detectors so as to avoid saturation effects during laser transmission (especially in high backscatter environments under water).

DESCRIPTION: Short range laser ranging systems are often limited by the detector turn on and setting time. Laser ranging systems are composed of a short pulse laser, high speed counter, and photo detector. The photo detector is disabled and the laser is pulsed. During the laser pulse a high speed counter is started. The photo detector is turned on and the reflected pulse stops the counter. The range is calculated from the counter.

Phase I would investigate methods to switch photo detector (Discrete Dynode PMT and Micro channel PMT) on and resulting settling times to achieve full gain or time variable gain. A method would be selected and circuits would be proposed that would supply the high voltage to the detectors and perform the gating or switching function.

Phase II would involve the construction of three breadboards systems and evaluating their performance. Physical packaging, high voltage components, high voltage converters, high speed switching would be studied.

N90-189 TITLE: Crack Detection in Explosives and Rocket Motor Propellant

CATEGORY: Exploratory Development

OBJECTIVE: Develop a system for detecting very small cracks in solid rocket motor propellants and warhead explosives.

DESCRIPTION: A system is required which is capable of examining loaded solid rocket motors and warheads, and detecting very small cracks and voids anywhere at the surface or in the interior of the motor propellant or warhead explosive. These motors and warheads will of course have steel outer cases. The warheads could contain performed fragments or other irregularities in the case design. Center burning rocket motors may contain large irregular voids at the center of the solid propellant. The warheads may contain tubes of metallic or non-metallic design in the center of the warhead. This system should have a void or crack detection resolution which exceeds the resolution of standard x-ray techniques. The system should produce a visual image and printout of the cracks or voids which are detected.

Phase I will propose a method of achieving the desired capability. It will define the degree of superior resolution and should contain a preliminary design to build a system It will also address safety issues with using the system in conjunction with loaded warheads and rocket motors.

Phase II will be to design, construct, demonstrate, and deliver an operational prototype system.

N90-190 TITLE: Time-Resolved Radiation Diagnostics for 0.6-1.3 Mev Peak Bremsstrahlung (X-Ray) Generators

CATEGORY: Advanced Development

OBJECTIVE: To develop the time-resolved dose rate (silicon) and/or spectral diagnostic measurements of 0.6-1.3 Mev peak 5 1000 KA Bremsstrahlung (X-Ray) Generators.

DESCRIPTION: Methods to measure time-resolved dose rate (with direct or calibrated dose/second) and time resolved spectra are needed for 0.6 1-3 Mev peak, 5 – 1000 kA Bremsstrahlung (X-Ray) generators. These diagnostics will have to operate in a 1E6 to 1E10 rads field. The region, conditions, and dose rate levels where the measurements will be made vary from generator to generator and from experiment to experiment on a given generator. Therefore, it is important that the diagnostics have as flexible a range and operating characteristics as possible.

These diagnostics have to be made in a real time environment with data analysis taking less than 15 minutes after each shot. The data acquisition and analysis should be done on the same data acquisition system used by the generator facility (Macintosh, IBM PC, or minicomputer).

Phase I: Prove feasibility and develop a prototype detector. Demonstrate feasibility on x-ray generators having the same characteristics as NSWC's nuclear weapons effects (NEW) generators. Provide documentation including 1 test results; 2 detector principle of operation and calibration; 3 detector design drawings; 4 feasibility study considerations; 5 detector size, weight, speed; 6 detector operating conditions; 7 data acquisition and analysis requirements and times. If a prototype can not be developed in Phase I, then the documentation should include additionally information to delineate the feasibility, limitations and operating conditions of the proposed detector.

Phase II: Produce finalized detectors with all associated hardware, software, and calibration procedure and apparatus. Demonstrate operation on NSWC's NEW X-ray generators. Provide documentation including 1 test results; 2 detector principle of operation and calibration 3 detector and associated hardware design drawings 4 analysis considerations, assumptions, limitations, and results 5 operations, calibration and maintenance manual, and 6 software listings and documentation.

N90-191 TITLE: Stable Silver Oxide (AgO) Battery Electrode

CATEGORY: Advanced Development

OBJECTIVE: Develop, manufacture and demonstrate prototype electro chemical cells employing silver oxide (AgO) cathodes that have extremely low thermal decomposition rates during storage and that are suitable for use in high-capacity; high-rate primary batteries.

DESCRIPTION: Deterioration of discharge performance during storage seriously limits the storage life and reliability of silver oxide/zinc batteries used in such applications as torpedo propulsion and missile guidance and control. Decomposition of the silver oxide (AgO) cathode material during storage is recognized as a major cause of this problem.

The invention of a new high-temperature method for the preparation of highly-stable silver oxide cathodes on a laboratory scale is disclosed in NSWC TR89-66, "Thermal instability of AgO Cathod Material: Causes and Solutions." Further development of stable silver oxide cathodes is sought, based on the new high-temperature method, and leading to commercialization in Phase III.

The Phase I goals are to identify and define, and to verify by experiment the methods, conditions, and design requirements of production-scale equipment for manufacturing stable, high purity AgO cathodes. This should include preparation of sample cathodes, testing for purity and stability, and discharges to verify high rate performance capability.

The Phase II efforts should include 1 fabrication of manufacturing equipment and pilot scale production of several small lots of stable, high-purity AgO cathodes, 2 development of quality control methods, 3 fabrication of small prototype high-rate primary silver oxide-zinc cells employing stable, high-purity AgO cathodes, 4 accelerated storage and discharge testing of prototype cells to demonstrate successful achievement of the objective, and 5 delivery of cathode samples and prototype cells for Government tests.

N90-192 TITLE: Active Mine Batteries with Long Shelf-Life

CATEGORY: Exploratory Development

OBJECTIVE: Develop and demonstrate improved technology to enable prolonged storage of active lithium-thionyl chloride cells without significant loss of capacity.

DESCRIPTION: Unfortunately, much of the high energy advantage of lithium battery technology is lost during storage of active cells. Recent tests of various manufacturer's C-size cells stored for about one month at 54 C and 70 C indicated a 15% to 70% loss of capacity. Innovative concepts to mitigate this loss during storage are needed. One promising approach is an over layer of thin polymeric ion-conducting film on the anode to serve as a barrier to corrosion during storage. Other possible approaches are encouraged.

During Phase I, potential concepts would be evaluated in terms of practicality, safety, reliability, cost and, complexity. A design would be proposed, and a hardware prototype, if possible, would be fabricated and tested. An estimate of performance after storage for various periods at various temperatures would be prepared. Requirements of the concept include storage at temperatures up to 70 C for fiver years or more with minimal impact upon the cell's tendency to vent under abuse conditions such as short-circuit, forced discharge, and charging.

During Phase II, hardware would be fabricated, tested, and evaluated, and a practical design would be proposed. Performance in terms of reliability, safety, producibility, and the environmental conditions of transportation, storage, and underwater use would be determined.

N90-193 TITLE: 1750 A Microprocessor Optimized for Low Power Digital Signal (DSP) Processing

CATEGORY: Engineering Development

OBJECTIVE: Optimize a 1750A architecture chip for signal processing by use of special ship hardware and microcode, analyze its performance as a replacement for other general purpose microprocessor architectures.

DESCRIPTION: Present 1750A microprocessors offer the advantage of a MIL-STD language and state-of-the-art design and process. However the 1750A architecture is general purpose and could be greatly improved for the math intensive algorithms needed for signal processing. The latest die shrink will allow for extra microcode and improved chip hardware to greatly enhance the DSP capability and therefore result in lower power consumption per function.

Phase I should be a study would detail the areas of greatest possible improvement, i.e. the Arithmetic and Logic Unit (ALU) section on the chip and the operations that need to be put in the microcode. Computer simulation would detail the computational improvements offered and quantify the power reduction. The study would investigate which manufacturing processes offer better efficiency and project power reductions vs. die feature dimensions for advanced and future manufacturing processes.

In Phase II, Phase I data would be used to optimize a 1750 A microprocessor to offer a low power DSP. The chip would be augmented with enhanced math capabilities and special DSP macros in microcode. Microcode would implement high-level DSP operations as high efficiency macros, minimizing power consumption and program memory. The most efficient manufacturing processes would be used to deliver a small number of test dies to be used as advanced technology demonstration. A study would follow detailing the performance capabilities of the optimized 1750A microprocessor. A contrast and comparison will be drawn between this optimized 1750A microprocessor and other existing general purpose microprocessors. Examples of other general purpose microprocessors are: Motorlo 68020 and 68030, Intel 80286 and 80386.

N90-194 TITLE: Development of High-Energy Density, Pressure Tolerant Batteries

CATEGORY: Advanced Development

OBJECTIVE: This project will develop and evaluate high energy density (greater than 100 Watt hours per pound) batteries which are able to tolerate pressures of several thousand pounds per square inch, as might be experienced in deep water, without the use of an additional case.

DESCRIPTION: The batteries in much Navy equipment, including sonobuoys, mines, transponders, surveillance systems, vehicles, etc., must operate under water. In most currently available equipment the batteries are isolated from the external water pressure by some form of protective hull or container. These containers are often bulky and heavy and therefore reduce the effective specific energy (Watt hours per unit volume) and energy density (Watt hours per unit weight) of the battery. The reduction in battery effectiveness are often directly reflected in reductionism equipment performance.

This project will develop a pressure tolerant battery with an energy density of at least 100 Watt hours per pound. The ideal battery will have good shelf life, a high degree of safety and reliability, a wide range of operating temperatures, and will operate in all environments (including out of water).

During Phase I, an electrochemical system and cell design will be chosen and built as prototype cells. These cells will be tested to demonstrate that they can tolerate external pressure during discharge.

During Phase II, practical cells will be built and tested at a variety of applied pressures. The cells' performance and safety will be assessed. Progress during Phase II should allow the cell design to be ready for production and use in batteries during Phase III.

N90-195 TITLE: UAV Compatible Sensor, Processing, and Communication Systems

CATEGORY: Exploratory Development

OBJECTIVE: In depth study of low cost, off-the-shelf, infrared sensing technology for wide area surveillance and battle damage assessment.

DESCRIPTION: Naval surface and subsurface elements need an organic capability for wide area surveillance and battle damage assessment. Unmanned aerial vehicles (UAVs) are currently under development, and there is a need to fit the UAV's with the appropriate sensor , processing, and communication systems. The intent of this study is to examine and evaluate the availability and suitability of existing, inexpensive off-the-shelf technology to meet systems requirements. The sensing package may operate at altitudes between 10,000 and 25,000 feet at speeds ranging from 80-120 knots for periods of time ranging from 24-94 hours.

The specific goal of Phase I is to examine the capability of the uncooled pyricon thermal television tube in a real time processing environment to eliminate clutter and located and track ships. The system must have the ability to save important data and imagery for transmission to the launch platform at appropriate intervals. The study must address costs/benefit trade-offs involved in lens selection, spectral bandwidths, resolution and area coverage, probability of false alarms and missed detections, and system reliability.

Phase II should produce a prototype.

N90-196 TITLE: Electronic Cooling System Electrolytic Corrosion

CATEGORY: Research

OBJECTIVE: Quantitatively describe cooling system destructive electrolytic corrosion and find substitute materials.

DESCRIPTION: Many electronic system design result in voltage gradients being applied across a low conductivity cooling path. For example, a high voltage tube anode may be cooled via low conductivity de-mineralized water channeled in an insulated hose. Often electrolytic corrosion will cause the metal associated with the hose fittings to dissolve. In practice this results in a high maintenance expense. Various metals including high purity steels and Titanium have been used as hose fittings with limited success. This corrosion mechanism in not well understood.

Proposals are sought that develop a quantitative theory of this phenomena which can be developed and verified by experiments. The theory and supporting experiments should as a minimum describe corrosion rate behavior as a function of applied voltage, current, water conductivity, and metal type. Alternate hose fittings types should be proposed and evaluated.

N90-197 TITLE: Development of Test Methods for Graphite Fibers

CATEGORY: Exploratory Development

OBJECTIVE: To develop test methods for the characterization of graphite fibers.

DESCRIPTION: Graphite fibers are now being produced with higher moduli, strengths, and thermal conductivities than ever. Innovative techniques are desired for the characterization of these fibers. Procedures are needed for both individual filaments and tows with greatly different numbers of filaments. The methods should encompass the ability to test for modulus (possibly including obtaining stress-strain curves), strength, thermal conductivity, etc.

Phase II would encompass validation of the procedures by testing a number of lots of production material (to be furnished) and extending the test techniques to continuous online examination of the fiber during production.

N90-198 TITLE: Electronic Safe and Arming Devices

CATEGORY: Exploratory Development

OBJECTIVE: Develop components required to design electronic safe and arming devices for naval ordnance. Electronic safe and arming devices might improve system reliability and on-target effectiveness.

DESCRIPTION: In order to build electronic safe and arming devices whose cost would be acceptable for use in a conventional warhead, advances are needed in high voltage power supplies, high power switches, safing electronics, slapper detonators, and sensors. The power supply converts weapon voltage to DC potentials needed to function slapper detonators. Switches are needed to couple energy stored in capacitors to the slapper detonator. Safing electronics will assure that energy does not unintentionally accumulate so as to erroneously initiate the slapper detonator. Slapper detonators might be incorporated into the safe and arm to permit the explosive train to be in line with the main explosive charge. Sensors are needed to monitor launch, safe separation from the launch platform, water impact, target proximity, and ideal firing time.

N90-199 TITLE: Infrared Background/Clutter/Target Signature Model

CATEGORY: Exploratory Development

OBJECTIVE: To develop PC based signature model.

DESCRIPTION: An infrared background/clutter/target model is needed to characterize the scenarios most often encountered in naval surface warfare. This model will be used in conjunction with both existing and future target signature data, to specify the required operationally environments for Automatic Video Trackers (AVTs) and Automatic Target Recognizers (ATRs) to be developed for shipboard use. In addition, the model will form the basis for synthetically generating realistic infrared scenes to test AVTs and ATRs. The model must accommodate the wide variety of backgrounds encountered in naval warfare (i.e., land, sea, sky) and capture the contrast and spatial attributes of backgrounds which have the greatest impact on AVT and ATR performance.

It is anticipated that Phase I of this effort will encompass the analysis of existing infrared background imagery to develop a preliminary mathematical background signature model.
Phase II would then encompass extensive background signature collection, model refinement, commuter implementation and model validation.

N90-200 TITLE: Advanced Automatic Target Recognition (ATR) Techniques for IRST Systems

CATEGORY: Exploratory Development

OBJECTIVE: Innovative utilization of state-of-the-art automatic target recognition techniques to enhance target vs. clutter discrimination in shipboard IRST systems.

DESCRIPTION: A typical scanning shipboard IR Search and Track (IRST) system generates several millions of data samples per second. These raw video samples undergo signal processing by means of different types of filters; threshold are exceeded or detection data are thus created. The detection data, which may contain targets, but are mostly due to clutter or other noise, are the subjected to additional target vs. clutter discrimination algorithms. An innovative approach is needed to exploit advanced automatic target recognition (ATR) techniques in order to enhance the target vs. clutter discrimination process. Such ATR techniques may be applied to optimally selected windows in the raw video, prior o or after the threshold exceedances. The result of this effort should be optimum ATR algorithms with the demonstratable capability to increase the probability of target detection, while decreasing the probability of false alarm. This capability may be demonstrated by means of the ATR techniques acting independently or in conjunction with the other algorithms mentioned above. Due consideration must be given to the extraordinarily high number of data samples to be processed very effectively so as to achieve timely target declarations.

Phase I should demonstrate a high probability of success for the proposed concept.

Phase II should produce a complete prototype set of highly effective target vs. clutter algorithms for a generic scanning shipboard IRST sensor, with particular emphasis of ATR algorithms.

N90-201 TITLE: Synthesis, Chemistry, and Reaction of Energetic Phosphazenes

CATEGORY: Exploratory Development

OBJECTIVE: Research and development of synthesis pathways to energetic substituted phosphazene compounds.

DESCRIPTION: Future high-energy density explosive and propellant systems will require advanced binder, plasticizer and oxidizer ingredients to meet the demands of increased performance while substantially reducing weapon vulnerability. One potential major class of compounds designed to meet this objective are the phosphazene telomeres. Although standard synthesis methodology exists for the preparation of a variety of phosphazenes and their derivatives, the introduction of energetic moieties have not appeared in the literature. The conception of basic synthesis methodologies and the development of preliminary process and scale-up techniques to prepare reasonably cost-effective energetic alternatives like those described above will enhance the development of these critical new ingredients for ordnance applications.

The basic research addressed in Phase I of this opportunity should be directed towards the development of synthesis routes for the formulation of cyclic and linear energetically substituted phosphazenes. Development of synthesis routes should be demonstrated to prove feasibility of chemistry. Theoretical energetic compositions resulting from the new materials synthesized by the contractor will be performed by NSWC after receiving small samples of new phosphazene compounds along with standard technical information such as, densities melting points, NMR, IR, elemental analysis and stability data (DSC, TGA).

The Phase II plans of the research and development efforts should address the large scale preparation of selected cyclic and linear energetically substituted phosphazenes prepared and characterized in Phase I. Additional basic research and development work will be required to maximize synthetic efficiency for selected target compounds. Focus should be on the cost factors related to the control (process) and scale-up of selected new materials. Sufficient material should be synthesized and forwarded to NSWC to determine experimental heats of formation and for preliminary formulation studies for energetic performance evaluations.

N90-202 TITLE: High-Speed Launcher for Fragment Simulator

CATEGORY: Exploratory Development

OBJECTIVE: Develop a launcher capable of projecting parallelepipeds weighing from 30 to 250 grains at speeds to 15000 ft/s.

DESCRIPTION: Modern air to air weapon – target encounters are producing fragment impacts at speeds of 15000 ft/s and more. A system needs to be developed that is capable of duplicating these conditions which can be used in fragment impact research. The system must be capable of firing at least two shots per day. The system must launch the metallic simulators in a controlled orientation. Emphasis is placed on delivering the simulator to the target in a predefined orientation. The weight of 250 grains is minimum top weight, weights up to 500 grains should be addressed. The minimum speed range is 5000 ft/s to 15000 ft/s. Speeds to 20000 ft/s should be addressed. Overall size and power requirements should be minimized. The target will be sufficiently distant from the muzzle to allow for flash x-ray and other instrumentation.

The Phase I effort twill be a feasibility study reporting on the ability to produce a launcher capable of meeting the stated specifications.

The Phase II effort would design and construct an operationally prototype of the desired launcher.

N90-203 TITLE: Procedures for the Design of Software Controlling Systems

CATEGORY: Exploratory Development

OBJECTIVE: Develop a procedure for efficiently translating system requirements and design into software requirements and design with regard to equipment, interface and user requirements.

DESCRIPTION: Department of Defense procedures suggest a sequence of activities for developing software. Developers are to analyze overall system requirements, analyze design and construct software modules, and finally, progressively test software components as well as its integrated system it may serve. There is a need for studying the interrelationship of the development phases and determining the underlying structure to permit consolidation of the phases for more efficient software specifications.

Experience has shown that many software problems are due to a delayed recognition of system requirements or the fault translation of system requirements and design into software structures. Thus, solving the translation problem may require improved concepts for representing and translating system requirements and design into software requirements and design.

A procedure is requested for tracking and controlling the various project objectives and system requirements for which software is required. This procedure should include program and data structures, data flow, and program control such as data abstractions, information hiding and minimizing processing interfaces.

Phase I should define the procedures and propose a method for guiding software development.

Phase II should develop the method into a useful tool.

N90-204 TITLE: Ruggedized Fiber Optic Switch

CATEGORY: Exploratory Development

OBJECTIVE: Develop and build a ruggedized fiber optic switch for use in Navy standard fiber optic local area networks and other applications.

DESCRIPTION: We propose that ruggedized fiber optic switches be built. The switches should have low loss (less than 1 dB) with minimal transients and crossovers. The switching time, which includes the bounce time, must be less than or equal to 30 millisec. The switches must be applicable for either micron multimode and/or x/125 micron single mode fiber at 1300 mm. Electrical or optical signals should be needed to activate the switches. The proposals should indicate the feasibility of converting the multimode design to a single mode design or vice versa. The fiber optic switches should be able to operate under environmental stresses which exist aboard surface ships. The fiber optic switches should be able to perform during temperature-humidity, shock, vibration, and thermal shock environments.

Proposals for Phase I should contain multiple switch designs.

For Phase II, prototypes would be built and subjected to in-house testing. From these tests, we would evaluate and make suggestions for improvements. Phase II would result in several ruggedized fiber optic switches applicable for the naval shipboard environments.

N90-205 TITLE: High-Power Fiber Optic Sources

CATEGORY: Exploratory Development

OBJECTIVE: Design and produce prototype high power fiber optic LFD sources for use in naval communications and sensor systems.

DESCRIPTION: It is proposed that high power fiber optic LED sources be built. The sources should operate at 1300 nanometers and should launch greater than -12 dBm into standard single mode fiber. The sources should have

a greater than -5 dBm into multimode fiber. The LFD's should have a temperature dependence of less than 8 dB over an operational temperature range between -28 and +85 degrees Celsius.

Proposals for Phase I should include more than one LED design as well as background information and data indicating the feasibility of the designs.

For Phase II, prototypes would be built and evaluated for base performance, temperature dependence and reliability. Phase II would result in Engineering Development models that could be utilized in Navy fiber optic systems.

N90-206 TITLE: Laser Initiation of Secondary Explosives

CATEGORY: Exploratory Development

OBJECTIVE: Develop a method of initiating explosives with a laser whose size is small enough to be compatible with warhead design constraints.

DESCRIPTION: Ability to directly initiate secondary explosives with a laser might eliminate the need to use sensitive primary explosive initiation trains. Laser initiation of secondary explosives is limited by the efficiency of transforming laser energy into mechanical, thermal or other forms of energy capable of causing detonation in secondary explosives. The goal of this research would be to elucidate waves of using a laser to initiate detonation of secondary explosives and package them in sizes small enough to be practical for conventional weapons.

N90-207 TITLE: Theoretical Study of "Cold Fusion" Using Quantum and Statistical Mechanics

CATEGORY: Research

OBJECTIVE: To develop a novel theory for estimating the rates of nuclear reaction of deuterium and lithium nuclei in crystal lattices.

DESCRIPTION: The recent claim by Martin and Stanley Pons that nuclear fusion may be achieved at room temperature by electrochemical means has puzzled and started physicians and chemists throughout the world. Conventional nuclear theory indicates that fusion is possible only at very high temperature, and that neutron production should be much higher than is observed. On the other hand, the observed heat output appears to be large to arise from known chemical reactions at room temperature. Measurements of neutrons by different researchers continue to indicate that nuclear processes may be occurring in the palladium crystal lattice. That nuclear processes may not be ruled out on the basis of "conventional wisdom" finds historical precedence in earlier predications that muon-catalyzed fusion (MCF) of two deuterium nuclei would be improbable, and the mCF would be of little interest. Recent studies continue to show, however, that much higher rates occur for MCF of deuterium and tritium. In the same way, new nuclear reactions involving lithium may be important in the crystal lattice. It is interesting to note in this regard that Fleischmann and Pons have stressed the importance of using electrolytes containing the lithium and of employing carefully molded cathodes with the proper crystal structure.

The Phase I effort would involve the development of a quantum statistical mechanical theory of nuclear fusion among lithium and deuterium nuclei inside the palladium lattice. Since experiments show saturation of the electrode by deuterium to be essential, the theory would need to show the importance of coupling of the reaction of the nuclei to the entire lattice.

The Phase II effort would involve calculations of rates as functions of electrochemical potential in order to demonstrate the feasibility of fusion of deuterium and lithium as a source of propulsion in torpedoes.

N90-208 TITLE: Development of High Power Microsecond Two-Stage Free Electron Laser (FEL) Source

CATEGORY: Exploratory Development

OBJECTIVE: The objectives of this research is to provide and demonstrate a highly efficient two-stage FEL wiggier on an existing long pulse accelerator.

DESCRIPTION: A long-pulse generator and an electron beam diode have been acquired by NSWC. This generator is capable of producing a microsecond long electron beam. The objective of this work is Free Electron Laser (FEL) source development for anti-missile defense, both "soft" electronics kill, and hard kill applications. In addition, long range radar applications are of interest. The successful offeror will justify the selection of FEL parameters based on one of the applications mentioned above and clearly show its benefit to the Navy. There are many physics issues to be addressed in the production of this longer microsecond pulse which should also be addressed.

In Phase I of this work, a set of FEL wiggler parameters for this accelerometer should be determined according to a well defined navy application mentioned above. Computer simulations should be performed showing the feasibility and successful operation of this wiggler. Finally, a set of drawings from which the wiggler can be produced and a description of appropriate operation of this wiggler. Finally, a set of drawings from which the wiggler can be produced and a description of appropriate diagnostics for determining the FEL output pulse width, frequency, and power as functions of time should be produced.

In Phase II of this work, these parameters then should be used to manufacture, test, and optimize the wiggler on the Long Pulse Accelerator in cooperation with Navy scientists. This work also requires assistance in the analysis and design of the electron source to prepare the proper electron beam parameters required for input to the FEL wiggler, as well as the assembly of the diagnostics package to adequately measure the output parameters of the FEL. The contractor would have to develop an experimental task plan and coordinate the FEL work at NSWC with Navy scientists.

N90-209 TITLE: Programmable Linear Digital Beamformer

CATEGORY: Exploratory Development

OBJECTIVE: Produce prototype hardware capable of linear beam forming acoustic data received form a variety of experimental arrays.

DESCRIPTION: Many of the acoustic sensor investigations being conducted involve the collection and analysis of data from multiple hydrophones configured as an array. As part of the analysis process it is necessary to beam form the acoustic data at appropriate steering angles. In the past this beam forming task has been performed with dedicated hardware uniquely tailored to the array under test and with the minimum capabilities required to support the desired analysis. This approach has led to the repeated design and fabrication of array specific beam formers. What is needed is the design and fabrication of a programmable beam former that can be applied to a wide variety of array configurations.

The Phase I effort would review current beam form technology, determine the optimum approach for the class of arrays under investigation and produce the design plans.

Phase II would be the fabrication and testing of prototype hardware based on the design proposed in Phase I. Potential sponsor is NAVSEA.

N90-210 TITLE: Thin-Wafer Components for Thermal Battery Cells

CATEGORY: Exploratory Development

OBJECTIVE: Develop technology for the manufacture of thin wafers of inorganic mixtures suitable for use in thermal battery cells.

DESCRIPTION: Thermal batteries employ electrochemical cells with molten salt electrolyte. The cell components are usually in the form of thin, circular wafers. Future needs for very high power thermal batteries will require thinner cell component wafers than can be manufactured at present.

The Phase I effort will explore novel approaches to the fabrication of thin wafers for anode, anolyte, catholyte, and pyrotechnic heat source, cell components, prepare samples, and submit them to the Government for testing.

The Phase II effort will further develop methods for the manufacture of wafers in sizes suitable for use in thermal batteries, and will perform a demonstration test program through a subcontract with a thermal battery manufacture.

N90-211 TITLE: Non-acoustic Underwater Influence Sensors

CATEGORY: Exploratory Development

OBJECTIVE: To develop new sensors for underwater mines that can detect the non-acoustic influence fields of surface ships and submarines.

DESCRIPTION: Underwater mines detect targets at a distance using sensors that respond to influence fields generated by the target's equipment or by its presence or movements in seawater. There is a growing need to complement existing acoustic and DC magnetic field sensors with devices able to detect other influences. Such other influences include, but are not limited to: water, pressure, water current, gravity, electric field, AC magnetic field, total magnetic field, temperature, and nuclear radiation.

During Phase I, the potential influence or influences would be evaluated in terms of sensitivity, self-noise, linearity, power requirements, size, reliability, cost and complexity. A design would be proposed, and a hardware prototype, if possible would be fabricated and tested. An estimate of performance against typical targets would be prepared.

During Phase II, hardware would be fabricated, tested, and evaluated, and a practical design would be proposed. Requirements for compatibility with mines include: size less than approximately 25 cubic inches; power requirements less than approximately 25 milliwatts; shelf life greater than approximately 5 years; storage temperature -65 degrees to 125 degrees C; operating ambient temperature -10 degrees to 50 degrees C; and the shocks involved with parachute-retarded delivery and water entry.

NAVAL WEAPONS SUPPORT CENTER (CRANE)

N90-212 TITLE: Radiation Hardened Robot Positioner for Test Samples in Proton Experiments

CATEGORY: Engineering Development

OBJECTIVE: Develop a robot system for replacement and positioning of devices under test in a proton LINAC.

DESCRIPTION: The rate at which testing can be performed at proton LINAC facilities is limited by the activation of the test fixture and device under test. The test engineer must wait for the test cell to "cool" before he can enter and replace test samples. Much more of the proton facility time could be devoted to testing if the device under test could be replaced without human entry into the cell. The proposed system shall include a device test card and connector suitable for insertion by the robot positioner. The robot electronics shall be hardened sufficiently to withstand 1000 hours of operation in the test cell. The robot will not be located in the line of sight of the radiation. However, it will be subjected to the secondary irradiation resulting from the cell and fixture activation. Provisions shall be made in the design for the robot to "fail safe" to ensure that no damage will be incurred by either the proton facility or the test fixtures if a robot failure occurs. All electronics shall be modularized for ease of replacement. Self-test capabilities shall be designed into the robot. Complete design documentation and directed diagnostic procedures shall be included in the user manual delivered with the robot. A complete set of spare electronic modules shall be included with the deliverables. The robot shall be designed to be compatible with the physical environment in the proton LINAC test cell at Brookhaven National Laboratories.

N90-213 TITLE: Instrumentation for Logic Upset Detection in Transient Environments

CATEGORY: Exploratory Development

OBJECTIVE: Develop instrumentation which will detect and report upset for the most general class of state machine operating in a transient radiation environment.

DESCRIPTION: The detection of logic upset in VHSIC/LSI microcircuits is complicated by: 1 the large number of output terminals, 2 high operation frequencies, 3 the complex relationships among input conditions, previous internal states, and outputs. Test engineers are often uncertain about which output to monitor, when to expect an upset, and how to recognize and upset. These problems are particularly severe in testing class 4 state machines (conditional state output/conditional state transition) such as microprocessors. Phenomena such as single event upset, due to localized ionization in the track of a heavy ion, are especially difficult to detect because the location of the strike is unknown and the state of the microcircuit at the time of the strike is unknown. The developed instrumentation shall be capable of detecting upset at the operating speeds associated with VHSIC class CMOS and bipolar technologies. The upset reports shall include terminal location, I/O vectors, and the time of upset relative to a known reference. The instrumentation shall be sufficiently portable to permit transport to irradiation facilities.

NAVAL WEAPONS CENTER/CHINA LAKE

N90-214 TITLE: Optical Component Measurement for Multi-spectrum Guidance

CATEGORY: Engineering Development

OBJECTIVE: Develop equipment and techniques to perform an optical acceptance testing capability.

DESCRIPTION: Multi-spectrum guidance systems are being developed which contain extremely small, non-spherical optical components for long wavelengths IR seekers. These parts are fabricated using numerically controlled machines. The parts are then coated with anti-reflection coatings for assembly into the final optical system. These parts need to be tested for conformance to specifications prior to being assembled into the system. This must be done without contact to the parts which would cause damage to the optics. The optical equations, surface quality, coating performance, transmissibility, and other optical parameters need to be measured without damaging the parts. The parts for the multi-spectrum guidance IR seeker can be used to evaluated the ability of the measurement system to perform and to verify the optical parts at the same time.

Phase I should provide the testing concept and Phase II should provide a demonstration of the equipment and testing techniques.

N90-215 TITLE: High Temperature Radome Adhesives

CATEGORY: Engineering Development

OBJECTIVE: Develop and test an adhesive for high temperature radome application.

DESCRIPTION: Missile systems are being developed which fly at very high speeds. These missile have domes which cover target seekers. Dome fabrication and assembly is becoming more complicated and includes the assembly of dome parts with adhesives. A low cost, easily applied adhesive which can withstand the high temperatures and stresses when mounted in the front of high speed missile is needed. Current adhesives fail in this environment or involve costly processing to apply.
Phase I should recommend solutions and propose a Phase II development and test of the recommended adhesive.

N90-216 TITLE: Optimized Antennas for Multi-spectrum Guidance

CATEGORY: Engineering Development

OBJECTIVE: Develop and test an optimized RF antenna for multi-spectrum guidance

DESCRIPTION: Multi-spectrum seeker systems are being developed which include a coaxial IR system mounted in the radome of an RF seeker. Presently these seeker systems are developed independently and then integrated into a single system. The RF antenna patterns are degraded by the presence of the IR seeker in front of the RF antenna. Total system performance could be improved by designing the RF antenna for optimum performance in the presence of the IR seeker blockage.

Phase I should recommend solutions and propose a Phase II development and test of the recommended RF antenna for multi-spectrum guidance.

N90-217 TITLE: IR Background Modeling and ANalysis

CATEGORY: Engineering Development

OBJECTIVE: Develop the classes of IR background models and incorporate them into analysis programs to calculate background IR signals for seeker performance analysis of actual target signals.

DESCRIPTION: The analysis of the performance of IR detectors/seekers in background is a difficult task. Some computer analysis programs have been developed which analyze target signals in presence of uniform background. These need to be extended to the analysis of categories of structured backgrounds (sea, various land models, urban, etc.) which can bound the performance of the IR detectors/seekers in this variety of backgrounds.

Phase I should propose an approach to the Phase II modeling and analysis.

N90-218 TITLE: Spectral Analysis of Stray Light

CATEGORY: Engineering Development

OBJECTIVE: Develop and test the capability to perform computer analysis of stray light in the frequency domain.

DESCRIPTION: Free gyro IR seekers are being developed for the Multi-spectrum Guidance Project that operate in the long wavelength IR spectrum. These systems are susceptible to degradation due to stray reflected and emitted light from internal and external sources. Currently, specialized computer programs exist for the analysis of stray light in static conditions. This analysis is done in the time domain. In order to evaluate the performance of the Long Wavelength Infrared seeker, it is highly desired to perform the stray light analysis in the frequency domain. This would produce frequency spectrums for the rotating free gyro seeker.

Phase I should propose an approach to the Phase II development and testing of this stray light analysis capability.

N90-219 TITLE: Multi-spectrum Guidance Target Generators

CATEGORY: Engineering Development

OBJECTIVE: Develop and test a target generator for use on multi-spectrum guidance.

DESCRIPTION: Multi-spectrum guidance seekers are being developed which use the RF spectrum and long and medium wavelength IR spectrums. Target generators are needed which provide both point source and extended source target signals in each of these spectrums which are coincident. Target generators are needed for laboratory,

field, and hardware-in-the-loop testing. These target generators must present signals to the seeker in the frequency bands which are representative of the signals actually emitted from a target source under a variety of conditions. The complexity of the target generators may vary from simple to very complex which more accurately model the targets. Verification of the target representation is needed. The Multi-spectrum Guidance Project seekers would be used to test the capability of these target generators.

Phase I should propose an approach to the Phase II development and testing of the target generator.

N90-220 TITLE: Passive Fuel Vapor Detector Device

CATEGORY: Exploratory Development

OBJECTIVE: To explore the feasibility of developing a passive device that can identify the presence (or absence) of carbon based fuel vapor within a closed container without opening, or disturbing the seal on the container. The product of this research would be used by fleet personnel to determine by viewing an indicator device from the outside of the sealed container, if the pre-fueled contents such as a missile, has developed a leak.

DESCRIPTION: Several modern air launch missiles (HARPOON, TOMAHAWK, TACIT RAINBOW) use turbo-jet engines with an associated liquid fuel (JP-10) fuel bladder or tank. These weapons are delivered to the government pre-fueled in reusable transportation/storage containers. Part of the periodic and pre-use integrity inspection is to ensure there is no fuel leak by opening the container for visual inspection. In the case of TACIT RAINBOW, part of the warranty for missile integrity is to maintain the container sealed until intent for deployment. TO allow an electrical integrity test of TACIT RAINBOW without opening the container, the containerized weapon has an electrical cable connected to the missile umbilical, with the other end of the cable attached to an external connector on the container. This allows running an electrical built-in-test of the weapon without opening the storage container. For safety purposes, the present planning for TACT RAINBOW is to perform a vapor “sniff” test through the container esiccant port prior to running the electrical test. The candidate device to be used is t he BACHARACH, Inc. model 502 battery operated Portable Combustible Gas & Oxygen Deficiency Indicator. This unit is very sophisticated, cumbersome to use, time consuming, and maintenance intensive for the intended fleet operations application. Recommended exploratory research to develop a passive JP-10 vapor detector that can be mounted or affixed within a container sight glass. Something similar to the commonly used passive humidity indicators that change color in the present of moisture would be ideal. A reliable device such as this will find immediate application with TACIT RAINBOW and likely other DoD carbon fuel based weapon systems.

Phase I should identify a practical passive medium for fuel vapor detection.

Phase II should establish the vapor content types and density, or ratio of air to vapor detected and include application planning for the device package or packaging.

N90-221 TITLE: Measurement of Explosive Outputs Electronically

CATEGORY: Advanced Development

OBJECTIVE: Develop methods to electronically collect data during explosive detonations which will allow quantitative and qualitative analysis of the output of various devices. Electronic data collection techniques should allow development of an instrument which should give a direct comparison of an explosive output with the required input of another device.

DESCRIPTION: Presently, the output of an explosive device cannot be directly related to the known inputs necessary for the reliable initiation of the next device in an explosive train. The small scale gap test (devised in 1960) is currently used to measure the shock sensitivity of an explosive. The sensitivity is specified in units of Decibangs, a unit of measure convenient to the method of testing. Outputs of devices, on the other hand, are measured in terms of dents on steel block. This too, is a unit of measure convenient to the method of testing. No direct method of comparing decibangs to dents exists. Hence, the reliability of an interface is estimated by sing a

third explosive to indirectly determine how the output of one device relates to the need input of the next in line. From this relationship, a reliability "estimate" is made. Varicomp explosives currently available have not been produced since rate of energy out, and output calibrated to decibangs, it possible. This will permit more efficient design of explosive trains and the possible elimination Varicomp explosives. The time savings could potentially be enormous.

Phase I – develop methods to electronically collect data during explosive detonations which will allow quantitative and qualitative analysis of the output of various devices.

Phase II – develop/demonstrate method.

N90-222 TITLE: Safe-Arm Indicator for Inline Fuses

CATEGORY: Advanced Development

OBJECTIVE: Design, fabricate, and test a visual safe-arm indicator for inline safety arming devices.

DESCRIPTION: Paragraph 4.5 of MIL-STD-1316 requires either a feature that a "assures a positive means of determining the safe condition at the time of fuse installation into the munition, for example by visual observation," or b "a feature which prevents installation of an armed, assembled fuse into the munition; or c "a feature which prevents assembling the fuse in the armed or partially armed position." Since modern electronic inline fuses are armed when firing capacitor is charged, it is desirable to have a visual indication of the charged condition. The indicator should be of a cylindrical configuration of not more than 0.5" diameter by .35" long. The device should cost less than $20, require less than 1 microampere to operate and shall indicate a change from the "safe" to "armed" condition which the firing capacitor voltage is between: '00Vdc and 600 Vdc. The device must be "fail-safe" so that if failure occurs, it would indicate the device was in the "armed" condition.

Phase I should document the intended approach to continue into Phase II objective design, fabricate, and test a visual safe-arm indicator inline safety arming devices.

N90-223 TITLE: Electronic Retard Sensor for Bomb Fuses

CATEGORY: Advanced Development

OBJECTIVE: Design, fabricate, and test an electronic retard sensor for advanced bomb fuses.

DESCRIPTION: Mechanical spring-mass retard sensors currently in use in bomb fuses are prone to failure due to imperfections in machined surfaces, contamination and tolerance stack-up. Imperfections during manufacture have resulting in "sticky" operation and non-repeatability during acceptance testing. It is desired to develop new concepts, preferably electronic, that will eliminate siding components and contacts. Specific requirements for Phase I design and Phase II fabrication and test are as follows:

Electrical:

a. Contact Resistance: 500ohm Max @ .03 mA
b. Max Contact Current: 2A @ 28 Vdc, 5 sec pulse
c. Max Supply Current: .1mA for 5 sec max

Function:

a. Sensor contacts shall not close at accelerations below 1.9 G
b. Sensor contacts shall be closed at acceleration above 2.3 G

Size/cost: The device shall be housed with a 0/5" diameter TO-8 can or a 20 pin leadless chip carrier and shall cost less than $20.

N90-224 TITLE: Long Wave Infrared Non-mechanical Electronic Scan

CATEGORY: Advanced Development

OBJECTIVE: Demonstrate the capability to non-mechanically slew the line of sign of an 8 to 10 micron optical system through an arc of at least plus and minus 10 degrees.

DESCRIPTION: It is desired to be able to smoothly move the field of regard of 8-10 micron optical systems by at least 10 degree rates up to 60 degrees per second without the use of mechanical positioning equipment as is presently done. The electro mechanical scanning systems now used have several disadvantages: primarily cost, complexity, and inertia. Acousto-optical devices used in commercially available laser printers permit 0.633 micron laser energy to be moved by at least 6 degrees with no mechanical involvement. Perhaps a technology exists that can non-mechanically scan, bend, or refract 8010 micron energy rapidly and over an angle of at least 20 degrees. The device that achieves this capability must be able to be packaged within existing military tactical missile optical systems/night vision systems or added to them in no more space than is now taken by their mechanical scanning systems.

Phase I should document the approach the Phase II, demonstrate the capability to non-mechanical slew the line of sight of an 8-10 micron optical system through an arc of at least plus and minus 10 degrees.

N90-225 TITLE: Solid FAE Detonation Mechanism Model

CATEGORY: Advanced Development

OBJECTIVE: Develop a mechanistic model of the detonation zone for fuel-air explosives (FAE) that use fuels in the solid state.

DESCRIPTION: Current fuel-air explosive warheads use a fuel in the liquid state. This results in handling and storage hazards associated with the liquids and also result in large warhead volumes since the liquids have a low density. The use of solid fuels in these warheads would greatly reduce the hazards and also significantly increase the energy density of the warheads. In order to realize these advantages, methods for ensuring the detonability of solid fuels dispersed in air over a wide range of conditions need to be developed. A mechanistic model that include the significant factors governing both initiation and propagation of a detonation is needed to provide direction for the development or reliable and efficient fuels. As a minimum, the model needs to be capable of prediction the effect of these initial input conditions, temperature, particle size and shape, particle spacing, coatings, and radiation factors. The model shall be compatible with machines no larger than a VAX.

Phase II should use design approach defined in Phase I to develop and deliver hardware/software to the government for test and evaluation.

N90-226 TITLE: Compaction and Rapid Dispersion of Powdered Fuels

CATEGORY: Advanced Development

OBJECTIVE: Develop techniques for compacting powdered fuels to high bulk densities and then disperse them rapidly to form clouds in air that are detonable.

DESCRIPTION: Current fuel-air explosive warheads use a fuel in the liquid state. This results in handling and storage hazards associated with liquids and also results in large warhead volumes since the liquids have a low density. The use of solid fuels in these warheads would greatly reduce the hazards and also significantly increase the energy density of the warheads. In order to realize these advantages, techniques are needed that will take the powdered fuel and pack it to a relatively high density in the warhead, and then, upon warhead function, disperse it into a nominally uniform cloud of very fine particles in the atmosphere. This dispersion process must occur in a very short time, explosive charges are used to disperse the liquid fuels. Also, the final particle size needs to be on

the order of microns with little or no agglomeration. Some of the fuel candidates have coatings which may contribute to agglomeration under compaction of the shock loading conditions of explosive dispersion. The cloud that is formed must be in a concentration range that is detonable.

The deliverables shall be a Phase I design concept and a Phase II feasibility hardware demonstration.

N90-227 TITLE: Replication of Aircraft Structure for Ballistic Vulnerability Testing

CATEGORY: Advanced Development

OBJECTIVE: Design cost-effective methods of replicating mechanical behavior or full scale aircraft structures (metal and composites) in ballistic test samples.

DESCRIPTION: For many years the survivability/vulnerability community has performed ballistic testing on small panels (one to ten square feet) because of the high cost and limited availability of actual aircraft structures. This is especially true for investigation of "hydraulic ram" – induced failure mechanisms. (Hydraulic ram is a very destructive high-pressure shock which propagates through fuel when tankage is impacted by bullets or warhead fragments). However, such samples, even though faithful to the full-scale structures in most ways, often behave differently from the replicated structures and each other. This is largely the result of boundary or "edge" conditions required to mount the sample in a test fixture. The fixture and its mounting mechanisms exhibit strengths, stiffness, mass, and natural frequencies must different form the aircraft structure surrounding the local area being replicated by the sample.

Phase I studies are solicited to determine different (but cost effective) test approaches or fixture designs or panel design necessary to obtain reasonably comparable ballistic behavior between the sample and actual aircraft structure. Emphasis is on fuel tank structures under hydraulic ram loading and other stressed-skin structures.

N90-228 TITLE: Inertial System Expert System

CATEGORY: Advanced Development

OBJECTIVE: Develop an expert system to assist weapon system planners and missile system designers to elect candidate inertial sensors/systems for particular applications.

DESCRIPTION: Early in the planning phase for every new missile system or missile system upgrade, trade-off studies are performed to determine what subsystems will enable the missile to meet its performance requirements and cost goals. TO be certain that the studies are complete, the system planner or the system designer must rely on specialists in each subsystem. Fortunately, the nature of these studies is such that the needed inertial system's expertise can be codified and incorporated into an expert system.

For Phase I design, the expert system must run under VAX/VMS, and the data base or the rules set must be simple to modify in order to keep it up-to-date and to allow for growth. The system must be interactive with tutorial or help utilities which will guide any scientist, engineer, or technical manager through a session. The system must respond to queries involving technologies, (e.g., gimbaled, strap down), system implementations (e.g., space stabilized, local level, north slaved, wander azimuth, etc.), aiding systems (e.g., doppler radar, GPS, etc.), performance or error characteristics, service life, recertification intervals, and cost. Ideally, the expert system will include provisions for automatically generating the files necessary to run our covariance analysis program for the particular system configurations the user specifies the accurate performance predictions can be generated. (Implementing this feature can be deferred, but the system must be designed to allow this feature to be added later).

Phase II should develop, demonstrate and deliver software designed in Phase I.

N90-229 TITLE: Determine the Aggregate Heat Transfer Coefficient into Objects within an Expanding Supersonic Rocket Plume

CATEGORY: Exploratory Development

OBJECTIVE: Develop a simple technique to determine the aggregate heat transfer coefficient into selected elements within the flow of rocket motor exhaust. Examples of applications for these techniques are rocket nozzle improvement, jet vane thrust vector control development, heating of turbine blades or elements within a ramjet or rocket exhaust, ionized flow aerodynamic heating, etc. The typical application flow field may be opaque due to the presence of aluminum in the flow. Simple and innovative methods are sought to improve the state-of-the-art in this measurement technology.

DESCRIPTION: Approaches envisioned for this research may be unique new technology or substantial development improvements on existing processes such as: scanned (IR thermo graphic video techniques, computational fluid dynamic modeling if verifiable by test measurements, empirical or semi-empirical process modeling showing analytical and experimental methods to accomplish repeatable results, development of very high temperature heat flux gauging methods, laser induced fluorescence, spectrographic analysis of flow field showing correlation with heat transfer processes, optical pyrometry suited to very high temperature flow conditions, etc. The nominal flow field conditions are: Mach 3.4, Gamma 1.2, and Stagnation Temperature 5800 F. Generally, the flow is short duration (3-10 sec), unsteady, and non-uniform.

Major consideration for measurement work will be tailoring the method to address the unique severe conditions of this application including short duration testing, thermal interference, high temperature measurements, and optical path contamination. If considered, computational modeling must consider exhaust effluent gas-dynamic properties including particulate phases, and radiation influences on film coefficient behavior as well as supersonic compressive flow. These must be verifiable by test measurement to prove predictive capabilities of the model.

N90-230 TITLE: Laser Brazing Ceramics to Metals

CATEGORY: Advanced Development

OBJECTIVE: Develop a laser brazing process capable of joining a wide variety of ceramic materials to metals.

DESCRIPTION: Current ceramic materials used in missile applications have been selected primarily for their unique IR or RF properties. The use of these materials necessitates significant constraints in design and production techniques due to significant thermal mechanical differences between the ceramic and other structural components of the missile. Current methods of joining such materials to the structural components of the missile system rely on adhesive or polymeric joining techniques. There is a need for unique joining/bonding processes that can directly join ceramic IR and RF dome components, 2 inches to 13 inches in diameter, to cylindrical metal surfaces. Performance requirements dictate that the joining process should produce hermetic joints which can withstand an environment of 550 C for a minute or more and up to 150 cycles form –40 to 200 C. Exposure to the high temperatures associated with conventional brazing processes can degrade the optical merit of materials like ZnS and promote chemical reaction. It is therefore desirable to utilize a highly localized heat source for the joining effort. Laser brazing is a promising joining technique which is capable of providing the heat necessary for a metallurgical bond. The heat provided by the laser is localized, thus limiting thermal degradation to regions adjacent to the joint. Residual stresses due to thermal expansion of the entire component during assembly are also avoided. Process development for a ceramic to metal joining method which takes advantage of the highly localized heating offered by a laser source would be most desirable.

NAVAL AIR DEVELOPMENT CENTER

N90-231 TITLE: Applications of Anti-Jam (AJ) Direct Sequence Spread Spectrum (DSSS) Waveforms to High Frequency (HF) Communications

CATEGORY: Exploratory Development

OBJECTIVE: The objective of this effort is to exploit current advantages in modulation and coding theory to provide a demonstrated improvement in the jam resistance and reduction in intercept/exploitation probability of High Frequency (HF) communication signals.

DESCRIPTION: The Navy uses the HF to support over the horizon and extended line of sight communication requirements. In general, these links are both easy to exploit and easy to jam. Application of spread spectrum techniques are the classical method of providing AJ protection and lowering the probability of exploitation. Historically frequency hopping has been used to provide some AJ or LPI protection. Direct Sequence techniques have not been applied in the past due the non-coherence of the HF channel.

This effort should concentrate on the application of modern spectrum spreading techniques coupled with state of the art signal processing techniques to overcome the traditional limitations of the HF band. Techniques that may be applicable include:

- Use of an efficient modulation scheme to maximize data rate
- Concatenation of multiple channels to increase processing gains and data rate
- Bandwidth independent communications with a reasonably compromise for performance
- Fast acquisition schemes
- Techniques that minimize computational complexity

Phase I of this effort should concentrate on providing the theoretical basis and a solid proposed approach. Phase II should carry that approach through design and into a feasibility demonstration model.

N90-232 TITLE: Multi-Tadil Task Force Connectivity/Communication Systems Capacity Processor

CATEGORY: Exploratory Development

OBJECTIVE: Develop a dynamic/adaptive processor to allocate tactical communications system and data link resources (e.g., transmit slots of opportunities) to optimize multi-link throughput/functional efficiency based upon available task force disposition and relative position information.

DESCRIPTION: Phase I effort will be an expanded concept definition, development of system measures of effectiveness, and specification of relative position based algorithms of increasing levels of sophistication.

Phase II will involve development and operation of simulations and modules evaluating proposed algorithm performance for communication systems such as JTIDS, MILES, and other data links with resource sharing protocols.

N90-233 TITLE: New Techniques to Enhance AJ in Spread Spectrum Communications

CATEGORY: Exploratory Development

OBJECTIVE: The objective of this effort is to develop advanced techniques in spread spectrum system technology that will augment pseudo-noise spreading as a means of providing anti-jam (AJ) protection. These techniques will be applied to spread spectrum AJ techniques currently being considered for use with Navy expendable sensor systems.

DESCRIPTION: The Phase I effort should include the performance of engineering studies and simulation efforts that will provide a recommended AJ protection technique that is applicable to expendable sensors such as

sonobouys. The recommended system must be simple to implement at the transmitter such that recurring cost can be kept quite low. Techniques applicable to digital implementation at the receiver are preferred.

Phase II of the effort would result in the completion of the system design and the construction of engineering prototypes. A demonstration should be performed that shows the increase in AJ protection.

N90-234 TITLE: Constraints and System Primitives in Designing Operating Systems for Real Time Distributed Warfare Systems

CATEGORY: Exploratory Development

OBJECTIVE: To identify constraints placed upon operating systems in real time distributed Navy warfare systems and the operating system primitives necessary for successful performance.

DESCRIPTION: Navy warfare systems function in very demanding distributed real time environments. AN operating system provides system resource control to support software applications in critical areas such as memory management, scheduling, and input/output. The operating system must guarantee predictable and timely services to application software. Application software currently must often circumvent the operating system to achieve the stringent performance levels necessary to meet Navy warfare system requirements. There is a need to identify operating system primitives which can provide the functionality required for successful performance of real time distributed Navy warfare systems. A study is required to identify constraints placed upon operating systems in Navy warfare systems. The study should also identify operating system primitives necessary for successful performance in light of the identified constraints.

N90-235 TITLE: GPS System Specification for Shipboard TACAN Replacement

CATEGORY: Advanced Development

OBJECTIVE: Generate system specification to ensure that GPS can be properly implemented as an eventual replacement for shipboard TACAN.

DESCRIPTION: Current implementations make use of GPS as a mission sensor only and this is not adequate for TACAN replacement. Concepts are sought which will enhance carrier operations at sea using a differential or pseudo-lite system mode. The contractor will address control/display issues, flight instrument interface, and flight safety issues. The work will specify a minimum level of integration required to satisfy shipboard TACAN replacement objective.

N90-236 TITLE: Machinability of AF1410 High Strength Steel

CATEGORY: Advanced Development

OBJECTIVE: To determine quantitative machinability data for use in establishing optimum tool life in machining of AF1410 steel. The resulting data would facilitate the use of this improved property material and would reduce the cost of its machining at the Naval Aviation Depots.

DESCRIPTION: Ultra-high strength steels currently used for applications such as aircraft landing gears are flaw sensitive and subject to hydrogen embrittlement and stress corrosion cracking. AF1410 steel has been shown to offer improved fracture toughness and stress corrosion cracking resistance, but its machinability parameters are not well established. Unknown factors in machining contribute to increased cost and discourage the application of this otherwise beneficial high strength steel. The lack of established machining procedures must be resolved in order to achieve high-production machining at lowest possible cost and to facilitate the use of this improved flaw resistant steel in naval aircraft.

Phase I should consist of a study outlining an approach for establishing optimum tool life in machining AF1410 steel.

Phase II should use the approach outlined in Phase I to determine the speeds, feeds, and other parameters associated with boring, drilling, grinding, milling, reaming, thread grinding and turning of aircraft components (such as landing gear) and present the parameters in handbook form.

N90-237 TITLE: Cognitive Workload Measurement Device

CATEGORY: Exploratory Development

OBJECTIVE: Design of a non-intrusive hardware/software system capable of measuring and predicting cognitive workload of the human operator is needed. This system will reduce the uncertainty and maintain maximum return of investment of many funded new system development. It will also enable Navy contract monitors to measure the performance effectiveness of system design without the expense of simulation and the critical risk of field operation. Application must extend to new system design technologies involving interactive computer operation, expert systems and artificially intelligent/predictive systems.

DESCRIPTION: Current methods of determining and developing designs and system aides often lead to ineffective efforts that do not solve problems and that frequently create new and more complex cognitive workloads. Current and near term new technologies will be applied to help design a system and method of measuring cognitive load. Resulting application will provide output, give direction to design and guarantee performance gains of state-of-the-art systems. Expenditure of large sums of monies, hardware, and technical personnel to support new requirements of techniques involving complex computer simulation will be avoided. Measurement/prediction system must be universal and modular application. System must also be generic and capable of direct measurement of human performance in state-of-the-art applications. Newly developed technologies capable of mapping and measuring cerebral processing are to applied to the design of this non-intrusive cognitive workload measurement device.

N90-238 TITLE: Thermo-graphic Non-Destructive Evaluation

CATEGORY: Exploratory Development

OBJECTIVE: Develop thermo-graphic techniques for nondestructive inspection and defect evaluation of fracture critical advanced aircraft materials.

DESCRIPTION: An experimental study is required to determine the capabilities of using the adiabatic thermo-elastic effect to assess the criticality of flaws in advanced aerospace materials such as the high temperature high strength engine materials use in the hot stage of a turbine engine. Advanced composite materials in which stress concentrations are difficult to analyze either theoretically or experimentally might also be profitably studied using this technique. Both laboratory studies and theoretical considerations indicate that this approach when used with synchronous detection of temperature changes can produce images of stress concentration in damaged materials under cyclic loading.

Phase I should apply this technique to the detection of defects and determination of defect severity for one or more of the advanced aerospace materials currently in use or planned for use on US Navy aircraft and propose the development of the technique for Phase II demonstration. The materials might include ceramics, ceramic or metal matrix composites, high temperature alloys, protective coatings for propulsion materials or advanced structural composites. Critical issues which should be addressed would include the sizes of defects which the technique can detect and its capability for detecting subsurface flaws. Also simple and innovative techniques for applying loads to real components would be important in the implementation of the techniques.

N90-239 TITLE: Drag Reduction on an ejection Seat During High Speed Ejection

CATEGORY: Exploratory Development

OBJECTIVE: Conduct aerodynamic analysis on a typical ejection seat shape using appropriate computational fluid dynamics models. Define novel methods and select an optimum design that can reduce the overall drag on the seat, especially behind it, thus reducing the acceleration forces imposed on the occupant during high speed ejections.

DESCRIPTION: Future aircraft missions dictate high speed, low level scenarios, thus requiring an expansion in the ejection seat envelope up to 725 KEAS. Ejections at 700 KEAS in current state of the art seats can cause g x acceleration levels on the occupant beyond his physiological tolerance levels. The g x acceleration forces executed on the occupant are mostly due to the drag forces. Therefore, a thorough aerodynamic analysis using the latest CFD models will be conducted on the seat in order to understand the flow behavior. First, an appropriate model for this application will be chosen. Then analysis will be conducted on a understand the flow behavior. First, an appropriate model for this application will be chosen. Then analysis will be conducted on a typical shape. Novel concepts and methods will be investigated to reduce the drag on the seat within the geometrical constraints of the aircraft installation.

In Phase II, conduct wind tunnel tests on scaled down models including the new designs to verify the CFD findings and optimize the designs.

N90-240 TITLE: Design for Pre-Tensioning Restraint Straps for Crash Protection

CATEGORY: Exploratory Development

OBJECTIVE: Design pre-tensioning restraint straps for cash protection.

DESCRIPTION: It is known that helicopter occupants are better protected during a crash if their restraint straps are tightly adjusted. However, during normal flight routines they normally adjust their restraint loosely to gain mobility and comfort. The inertia reel, which attaches from the seat back to the crewmember's restraint does not serve the purpose of pre-tensioning the restraint at the onset of a crash.

A design which interfaces with conventional type seat restraints used in military fixed wing and helicopter aircraft (non-ejection seat) and which upon sensing a crash, pre-tensions the occupant's restraint is required for Phase I. The design should consider its interface with a crashworthy seat that is capable of moving downward during the crash event. Bucket downward displacement of 12 inches should be accommodated.

A prototype development will be required for Phase II.

N90-241 TITLE: Elastomeric Pitch Link Bearings for Helicopter Rotor heads

CATEGORY: Advanced Development

OBJECTIVE: Design and fabrication of elastomeric pitch link bearing for helicopter rotor heads.

DESCRIPTION: Bearings which carry rotor blade pitch control loads and motions are needed which have long life (1500 flight hours minimum), are maintenance free, are highly reliable, can operate in the full operational temperature range of the helicopter, and can be retrofitted into existing helicopters without major modification of mating hardware.

Phase I would provide for design and fabrication of experimental bearings for a specific rotor head application for either the SH-60B, CH-53E, r AH-1W tail rotor pitch link bearings.

Phase II would provide for bench testing of the bearings. Bench tests to accurately simulate the load/motion regime of the application will be required. Successful completion of bench tests would demonstrate that the bearings are safe-for-flight.

N90-242 TITLE: Airborne Low Frequency Sonar Cable

CATEGORY: Engineering Development

OBJECTIVE: Develop a small diameter high strength cable which is not subject to distortion (stretching) when run under load at high speed. Must remain flexibility at 40 C temperatures.

DESCRIPTION: The Airborne Low Frequency Sonar requires the use of approximately 1500-2500 ft. of cable to transport and provide an electrical cabling conduit to a sonar device which will weigh between 250-1600 lbs. The sonar must be raised at approximately 22 fps. Previous cable designs have experienced distortion (stretching) which cause difficulty in depth control as well as safety problems in the proximity of the aircraft. (The sonar is dropped from a hovering helicopter).

Phase I should recommend/develop a prototype cable to interface with the prototype sonar device for Phase II follow-on.

NAVAL UNDERWATER SYSTEMS CENTER

N90-243 TITLE: Periscope Laser Eye Protection

CATEGORY: Engineering Development

OBJECTIVE: Demonstration of a device to protect the eyes of a submarine periscope operator from damage due to laser radiation. Successful demonstration will lead to development of a field change kit.

DESCRIPTION: Submarine periscope operators are vulnerable to eye damage or dazzle due to hostile use of laser radiation. Protection is required against this threat. Passive devices that do not severely reduce overall light transmission are required. Such a device may take the form of a filter or a possible optical switch. Different implementations are required for two basic periscope optical designs. Phase I should result in a detailed conceptual design that can be built and tested in Phase II.

N90-244 TITLE: Single-Sided Flextensional Transducer

CATEGORY: Exploratory Development

OBJECTIVE: Hardware demonstration of a flex tensional transducer capable of both omni directional and unidirectional radiation.

DESCRIPTION: A high power, low frequency Class IV flex tensional transducer is needed that has the ability to radiate both in its normal omni directional radiation mode and in a single-sided directional radiation mode. The required transducer shall exhibit a primary mechanical resonance in the frequency band from 500 Hz to 8 kHz and be capable of an acoustic output of at least 2000 watts. The transducer shall be capable of highly efficient operation in its omni directional mode with an in water mechanical Q less than six. The directional mode shall generate a radiation pattern with a front-to-back ratio of at least 15 dB.

Phase I deliverables shall include a scaled prototype transducer capable of demonstrating the concept.

N90-245 TITLE: Single-Sided Electrodyanmic High Power, Underwater Projector

CATEGORY: Exploratory Development

OBJECTIVE: Hardware demonstration of a partial array of electrodynamic transducers exhibiting a bandwidth of one octave.

DESCRIPTION: A requirement exists for the development of a single-sided electrodynamic projector for use in a planar array at low frequency and high power. The mechanical Q(Qm) of the array shall be less than one with the frequency band of interest being in the 500 to 1500 Hz band.

The Phase I hardware demonstration shall be a prototype transducer.

The Phase II partial array demonstration may consist of transducers resonant at a scaled frequency (due to cost constraints) but must be completely tractable with the full-size transducer.

N90-246 TITLE: Turbulent Boundary Layer Drag Reduction

CATEGORY: Exploratory Development

OBJECTIVE: Develop a novel and/or revolutionary technique to reduce drag and noise on a turbulent boundary layer on an undersea vehicle.

DESCRIPTION: Novel techniques are required to reduce the turbulent boundary layer drag and noise on underwater vehicles. The technique should not require large amounts of volume or weight and should be energy efficient. Total levels of drag reduction greater than 30% and turbulent boundary layer pressure fluctuation reduction greater than 5 dB are desired. The length of time over which the technique must work is on the order of one hour The techniques will be required to work at high Reynolds numbers.

The objective of Phase I will be to perform a proof of concept of the proposed drag/noise reduction technique. It is anticipated that this will be a feasibility experiment.

In Phase II the technique would be demonstrated at full scale.

N90-247 TITLE: Live Plankton Characterization in Fluid Flow

CATEGORY: Exploratory Development

OBJECTIVE: Develop experimental techniques to determine the mass density, drag coefficient and particle alignment/tumbling ratio in a boundary layer for living marine plankton.

DESCRIPTION: Small particles (marine plankton), which range in size from 50 to 1000 microns, can enter an underwater vehicle's boundary layer and produce substantial local disruptions. In order to understand this disruption process, characteristics of the small particulates must be known. The parameters that are critical are the mass density, drag coefficient and alignment to the flow of the living organism as it traverses a boundary layer. The living characteristics are required because upon death, the particles rapidly deteriorate and the resulting characterization becomes meaningless. The experimental characterization data will be used as input to a particle trajectory simulation computer code that tracks a particle's trajectory as it moves past an undersea vehicle. With this information we will be able to predict particle trajectories for naturally occurring particulates for the first time.

Particles of interest include both zooplankton and phytoplankton. Species of interest include (but are not limited to) the copepodacartia hudsonica, the diatom Rhizosolenia and rotifers. It is expected that there will be a distribution of plankton characteristics for a given species according to particle size, health and other environmental factors. The density measurement technique should have an accuracy greater than 5%. The drag coefficient measurement

technique should be accurate to 10%. Particle Reynolds numbers of interest range form the Stokes range to 1000 and it is expected that the density of these particles is close to that of seawater. These particles are highly nonspherical and may exhibit tumbling motions in particle specific Reynolds number regimes or in certain regions in the boundary layer. The alignment/tumbling measurement technique should work for the entire range of Reynolds numbers of interest. Currently there are no measured mass density measurements or drag coefficient measurements as a function of Reynolds number for live plankton. Particle alignment in sheer flows is also unknown.

Phase I of the effort should culminate a proof-of-concept characterization demonstration for a single species of marine plankton. In Phase II the technique would be improved so that routine plankton characterization measurements could be made. If more than one area is addressed in the proposal the effort may be priced accordingly.

N90-248 TITLE: Multi-Line Array Retrieval and Stowage System

CATEGORY: Exploratory Development

OBJECTIVE: The intent of this effort is to establish a method to retrieve a multi-line array in a manner which will make it possible to reliably separate and store the arrays without inducing damage. It would be necessary to verify the proposed drive principle during Phase I via a low cost test mock up and to critically test the accepted drive principle under load and speed during Phase II. The deliverables for Phase II would be a functional test model, critical test results, and a system level drawing package.

DESCRIPTION: Submarine handling of multi-line towed arrays presents unique problems. The methods for retrieval and storage of these arrays have not been determined. It is necessary to investigate drive principles which have the potential of inhaling multi-line arrays separately without causing undue stress on any one array, then to reduce the tow tension to a low level for array stowage. The equipment must be capable of operation on a surface ship or submarine. Because of submarine requirements, the system weight, size and noise levels must be minimized with maximum reliability. The minimum bend radii of the arrays is ten feet, and the arrays will be entering the submarine at twenty to thirty degrees from its direction of travel. It is required to verify feasibility of the drive with a simple mockup. It will then be required to verify functionality through critical tests. Because of minimum bend radii requirements of the array and space limitations of a submarine, conventional capstan methods may not be applicable.

N90-249 TITLE: Pre-launch Electric/Acoustic/Optic Communications

CATEGORY: Exploratory Development

OBJECTIVE: The objective is to replace the pre-launch umbilical cable with a reliable, close range communication system for operation in a full flooded torpedo tube environment. Innovative electrical, acoustic or optic concepts should be applied to the communication system. Weapon fire/refire time is to be minimized.

DESCRIPTION: Research into replacing the existing submarine to torpedo pre-launch system with an improved system which applies innovative electrical, acoustic, or optic concepts is desired. Current submarine launch weapons rely upon umbilical cables that are connected during the weapon loading cycle to provide pre-launch communication and warm power. The umbilical has a large 65 pin screws. Each weapon has its own unique cable variation that has been developed or adapted to suit specific operational demands. All variations have displayed low reliability, high cost, lengthy time to make ready, and procedural complexity. The major problem facing all designs is that salt deposits and moisture cannot be effectively isolated from the active elements because they are continually mated and unmated at sea. The components cannot tolerate such contamination.

The desired features of an electrical, acoustic, or optic pre-launch communication system include: high reliability, versatility, reusable, free flooding, solidly encased, simplified set-up procedures, and minimal fire-refire time.

N90-250 TITLE: Development of Miniature High Temperature, High Pressure Steam Throttle Valve

CATEGORY: Advanced Development

OBJECTIVE: Develop a miniature valve to throttle the flow of high pressure superheated steam from a boiler to an expander. If testing of initial prototype hardware is successful, this device may be further refined and incorporated into a propulsion system speed control loop.

DESCRIPTION: A valve is desired which can throttle the flow of 1600 degrees F steam from 1.8 bm/sec required to .25 bm/sec. Over this throttle range, the valve must be designed to operate without produce audible whistles or roars. The valve should no exceed 10 pounds in weight and 40 cubic inches in volume. The valve should have a full stroke response time of less than 100 milliseconds.
The control signal will most likely be a pulse width modulated Direct Current (DC) voltage source. The maximum electrical power required shall not exceed 100 watts and the maximum voltage shall be limited to 33 volts. The actuating force may be electrical or power may be provided from external supplies of 1500 pounds per square inch (psi) hydraulic fluid or high pressure water at 200 degrees F. The steam inlet and outlet ports shall conform to MS 16142. The design life for the valve shall be 20 cycles of 1 hour operations.
Phase I shall result in a layout of a design concept supported by stress and thermal analysis. Particular attention must be paid to differential thermal expansion and selection of materials for corrosion and thermal stability.
Phase II effort will consist of refining the design based on comments resulting from the review of the Phase I product. After another design review and design intercepts two prototype valves shall be fabricated and submitted for testing in Navy facilities.

N90-251 TITLE: Automated Sound Velocity Profiler

CATEGORY: Exploratory Development

OBJECTIVE: To develop an acoustic array system which can determine the sound velocity profiles of a body of water, such as an acoustic tracking range.

DESCRIPTION: The sound velocity profile on a tracking range is currently obtained by a series of measurements of water temperature and salinity performed from a surface craft. These measurements are then processed using an empirically derived algorithm which provides an estimate of the sound velocity profiles. This approach is limited by the empirical model used, and by the small number of samples which can be cost-effectively obtained.
In recent years, CAT SCAN x-ray examinations have allowed the determination of the internal structure of an object via external transmitters and receivers. The basis of reconstruction from this data is the Radon Transform. Measurements are taken at various positions to determine variations of the internal structure of the object (e.g. intensity of the received x-rays depends on the density of the tissue). Profiles through the structure from any selected angle can then be recreated by post processing of the raw data. Using a similar approach, the new sound velocity measurement system will employ several sets of hydrophone arrays at the boundaries of a range, with processing through a derivation of the Radon Transform, to determine the internal structure of the range (i.e. sound velocity profile).
Phase I, offerors shall: 1 Perform a literature search and determine what work has been done in this area; 2 Modify the Radon Transform for application with acoustic signals, 3 proposal a practical acoustic array geometry and a discrete computer algorithm based on item 2, 4 show theoretical and simulated proof that the approach will work as described and 5 provide a description of restrictions or special requirements for use.
In Phase II experimental hardware will be developed to verify the approach through an actual range test.

NAVAL ENGINEERING CENTER

N90-252 TITLE: Optical Correlator for Aircraft Recognition

CATEGORY: Exploratory Development

OBJECTIVE: To investigate the capability of optical signal processors to determine aircraft parameters during terminal phase of guidance on aircraft carriers. If successful, this system would replace video trackers and provide aircraft identification and feature recognitions for LSO display and automated setting of recovery equipment.

DESCRIPTION: Identifying aircraft during terminal phase of landing on aircraft carriers requires recognizing aircraft type and various features such as hock down, wheels down and configurations as well as its dynamic performance about glide slope

Phase I is to investigate the capability of optical signal processors working on a direct image or an image from a video sensor such as FLIR to recognize aircraft type, various features and its potential for determining dynamic track data.

Analytical methods as well as proof of concept model should be demonstrated in Phase II. Aircraft type should be determined by two nautical miles and hook down/wheels down should be identified by one nautical mile from ship. Tracking data would be required from one and one quarter nautical miles. Cost estimates and all required interfaces should be described that are required for a shipboard installation.

N90-253 TITLE: Radar Cross Section (RCS) Validation

CATEGORY: Exploratory Development

OBJECTIVE: Perform a rapid analysis of aircraft RCS prior to mission deployment.

DESCRIPTION: Navy and Marine Corps aircraft will be designed and retrofitted to minimize the RCS of the airframe. It will be imperative to verify and maintain this low observable (stealth) status. Innovative instrumentation/techniques are being developed to verify the multi-band RCS integrity of the aircraft. Advances in sensor and signal processing technologies will enable high resolution/dynamic RCS measurements in the operating environment.

Example: After launch of the aircraft, an array (e.g. deployed on the a carrier, an AEGIS cruiser, another aircraft, etc.) would scan the aircraft at various aspect angles and frequencies and then process this data utilizing the latest generation of parallel computer architectures and support tools to perform a real time one, two, or three dimensional RCS analysis of the target. A modification of this process would also enable the detection and identification of hostile aircraft/missiles. A dual-mode millimeter wave/infrared version (narrow beam width for sea clutter reduction, good resolution of target, and at certain frequencies – convert propagation/detection) can provide additional data for a shipboard point defense system.

Phase I: Requirements evaluation/development of algorithms and software for multi-octave, real-time analysis of targets utilizing innovative computer architectures.

Phase II: Array, software, computer and networking development/integration for demonstration of advance development model.

N90-254 TITLE: Derivation of Functional Testing Requirements from Weapon System Mission Requirements

CATEGORY: Exploratory Development

OBJECTIVE: Reduce weapons replaceable assembly testing time and test program complexity by testing for mission capability rather than full parametric performance standards.

DESCRIPTION: Functional testing is being hailed as a breakthrough in avionics testing by reducing test program set complexity and test run times. The assumption is that only mission requirements tests are to be performed rather than full-scale parametric testing for ready for issue.

Phase I would develop a rationale for comparing the effectiveness of functional testing and parametric testing based on weapon system performance and mission requirements.

Phase II would consist of a pilot effort comparing the effectiveness of functional testing approach to more traditional parametric testing for selected test program sets currently in use.

PACIFIC MISSILE TEST CENTER

N90-255 TITLE: New Emitter Sorting Techniques

CATEGORY: Engineering Development

OBJECTIVE: Develop new emitter sorting techniques which are fast, accurate and provide high resolution of signal parameters necessary for optimum signal sorting and cataloging.

DESCRIPTION: Modern radar systems use complex intrapulse coding technique to enhance radar performance and ECCM capabilities. Radar warning receivers (RWRs) and Deception Electronic Warfare (DECM) systems must detect, sort and identify these advanced radar systems in an extremely dense electromagnetic environment containing numerous similar emitters. To adequately sort specific emitters from this environment, catalogue the complex signal modulations and identify by comparison with stored emitter data, new sorting techniques must be developed. These techniques must be fast, have high accuracy and resolution of signal parameters as phase, frequency, modulation linearity, phase coding bit rates, etc. that are necessary for optimum signal sorting and cataloguing. They may also allow emitter and/or platform fingerprinting based on measuring unique characteristics of received signals. It would be desirable if the techniques allow the stored and catalogued data to be used for regeneration of the received signal at a later time for jamming purposes.

Phase I would identify potential sorting techniques for these advanced emitters, analyze each for capability/applicability to meet the requirements state above, ,investigate hardware and software implications of each technique, and describe findings in techniques report including a plan for Phase II.

Phase II would generate specification for optimum techniques as directed by the Navy, fabricate brass board prototype to demonstrate performance predicted in Phase I, prove feasibility of incorporation into present RWRs and DECM suites, and generate a final report on technique performance.

N90-256 TITLE: New Electronic Support Measure (ECM) Classifications and ID Techniques

CATEGORY: Engineering Development

OBJECTIVE: Develop a new classification and ID processor to handle LPI radar signals.

DESCRIPTION: The classification of LPI radar signals is important for advanced ESM systems. Technical developments should include basic classification approach, new and novel signal processing algorithms for feature extraction and classifier, software implementation, and actual classification analysis of simulated LPI radar signals ESM classifier performance should be estimated. Feature uniqueness and stability constraints should be developed and S/N requirements should be quantified. New classification techniques should be compared to existing ESM classification approaches. A new ESM classification processor should be designed.

Phase I will develop new signal processing techniques for classification and ID, determine measures of effectiveness in simulated environments, and report on findings with comparisons to existing techniques.

Phase II developments will demonstrate critical technical elements associated with the new processor and quantify expected performance in operational systems.

N90-257 TITLE: Airborne Imaging Spectrometer for Measurement of Low Observable Aircraft Infrared Signatures

CATEGORY: Advanced Development

OBJECTIVE: Develop a capability which is crucial to missile performance evaluation, built from a flight test and hardware in the loop laboratory aspect.

DESCRIPTION: Current infrared imaging systems and spectrometers or interferometers operating in the 1 to 12 micrometer wavelength range are unable to obtain accurate measurements of low signature aircraft and missiles. Imaging systems measure spatial distribution of infrared radiation and are able to distinguish aircraft from natural backgrounds, but are unable to obtain high resolution spectral data. Spectrometers obtain spectral data, but are unable to measure spatial distribution of radiation or to perform measurements under conditions of low contrast against background. Accurate measurement of low-observable aircraft signatures in flight requires a combined imaging spectrometer capable of simultaneously obtaining both spatial and spectral data. No instrument of this kind currently exists.

In Phase I perform the conceptual design and develop purchase specifications for a compact airborne imaging spectrometer and data acquisition system capable of obtaining simultaneous spectral and spatial infrared signature measurements of low observable aircraft.

Phase II would be the development of such an instrument.

N90-258 TITLE: Radar Reflectivity Polarization Matrix Measurement Instrumentation

CATEGORY: Engineering Development

OBJECTIVE: Design and develop radar reflectivity polarization matrix measurement instrumentation.

DESCRIPTION: Radar reflectivity measurements made in anechoic chambers are required to obtain the polarization scattering matrix. This is implemented by sequentially transmitting two orthogonal linearly polarized signals and receiving to each of the transmitted components. The microwave assembly required to perform these measurements must consist of two wide-band antennas capable of operating at two orthogonal polarizations and the microwave switching system capable of performing the multiplexing between the various channels. The entire assembly must be equalized to provide relatively constant phase and amplitude between the various channels.

N90-259 TITLE: Multi-Spectral Target Presentation for Missile Test and Evaluation

CATEGORY: Exploratory Development

OBJECTIVE: This project will develop prototype multi-spectral environment generation hardware and software to be used for anti-air missile system test and evaluation.

DESCRIPTION: At present, anti-air missiles employ guidance systems which use either microwave or infrared sensors. The next generation of anti-air guided missiles will employ dual-mode sensors. In order to adequately test and evaluate these systems, hardware in the loop test laboratories must be able to provide simultaneous real time simulation of each sensor. This will require real time calculation of both microwave and infrared signatures, clutter and countermeasures and generation and presentation of the data to the respective sensors. Phase I should investigate alternative methods of performing real-time, hardware in the loop evaluation of multi=mode anti-air missile systems.

Phase II should develop prototype multi-spectral environment generation hardware and software to be used for anti-air missile system test and evaluation.

N90-260 TITLE: Microwave Target Presentation for Missile Test and Evaluation

CATEGORY: Engineering Development

OBJECTIVE: Develop prototype hardware for RF environment presentation in hardware in the loop missile system evaluation laboratories.

DESCRIPTION: At present, RF guided missiles are tested in hardware in the loop (HIL) laboratories using one of two techniques for the presentation of target signatures, jamming sources and environmental effects. The less expensive of the two techniques generates appropriate angles and angular rates using microwave horns servo-positioned in one or two exes. Advantages of the servo positioned horn approach include moderate cost and the capability to handle power levels required for simulation of threat representative jamming sources. Disadvantages of the servo-positioned horn technique include inability to represent target glint and restriction to scenarios including one or two sources. The second technique employs an array of horns driven by a complex target signature phenomena. Disadvantages include cost and the inability to handle the relative and absolute power levels required for tests in some jamming environments.

Phase I to investigate alternative methods of simulation RF target, jamming and environmental sources in a HIL laboratory; phase II will develop prototype hardware.

NAVAL TRAINING SYSTEMS CENTER

N90-261 TITLE: Real Time Photographic Based Terrain Image Generator with Capabilities for 3D Objects

CATEGORY: Exploratory Development

OBJECTIVE: To produce a low cost visual system capable of receiving photographic terrain information and in conjunction with Defense Mapping Agency evaluation data produce a three dimensional real time image for flight simulation and mission practice applications. The system should also be capable of integrating 3D moving models, target and ground queuing objects into the scene.

DESCRIPTION: Photo based image generators have been utilized by using digitized 2 dimensional photographs and attempting to warp them to produce 3 dimensional perspectives. This has proven to be adequate for some areas of visual training, where low level flight of high detail terrain queuing are not required. Traditional polygon based image generators lack the fidelity to produce a realistic terrain scene, but have been used extensively for visual training because true 3D perspective can be accomplished. Today's hardware and software technologies have developed to a point where it is feasible to design a low cost and efficient visual system which could produce a 3D true perspective terrain scene form 2D photographs and elevation data. This system would be capable of displaying a wide geographical area at a real time (30 Hz) update rate. The inclusion of 3D polygons with texture capability onto a photographic based terrain scene would provide enhanced fidelity as well as realistic true perspective scenes. The system should use the latest methods of photographic retrieval and database standards to include rapid reconfigurability and mission practice application.

Phase I would be a study report explaining the approach to accomplish the above.

Phase II would be the development of the above.

N90-262 TITLE: Low Cost Reconfigurable Cockpit for Deployable Aircrew Team Trainers

CATEGORY: Exploratory Development

OBJECTIVE: To design and develop a low cost, modular, reconfigurable cockpit that can be transported to any site and easily reconfigured to simulate a variety of aircraft cockpits to be used with other out the window display and simulation computers in deployable aircrew team trainers.

DESCRIPTION: A low cost, deployable cockpit that can be easily reconfigured to simulate a variety of aircraft is desired. The cockpit instrumentation and controls would be modular in that they could be rearranged inside the cockpit to simulate different configurations. Display such as the head-up displays, weapon status, electronic countermeasures, etc. would be reconfigurable to simulate different aircraft formats. All aircraft functions need not be represented but if in a modular design, function could easily be added. This cockpit would then be connected, via a proper interface network, to a low cost, deployable simulator system for use in team training.

Phase I should be the preliminary design of the cockpit and Phase II would be a demonstration model.

N90-263 TITLE: Online Diagnostic System for Simulator Performance Monitoring

CATEGORY: Engineering Development

OBJECTIVE: To provide an online, real time diagnostic system for monitoring the health of field aviation training simulators. If successful, the approach could provide a means for determining when a simulator, or a simulation subsystem, is going out of tolerance.

DESCRIPTION: The amount of performance transfer which occurs from a training simulator to the actual equipment is a function of the simulator's fidelity. Fidelity is reduced, and therefore also training effectiveness, when a simulator goes out of tolerance. For example, even subtle changes in the response times of a motion base or visual system can cause significant performance effects. The human vestibular system can detect such discrepancies and, in the case of unexpected or conflicting inputs form the visual and vestibular senses, initiate an adverse physical reaction in the student. It would be desirable to detect change in simulator performance before they reach a threshold which would adversely affect student performance.

Phase I should investigate techniques which would be appropriate for implementing such a diagnostic system. At least one similar system has been developed which monitors various operational aspects of electrical power generator turbines. This is implemented as a rule based system and is able to diagnose problems and schedule preventative maintenance before the symptoms affect generator output. Phase I should also examine a representative of aviation training simulators to determine the feasibility of implementing and interfacing the diagnostic system.

Phase II should prototype the system and provide functional and design specifications for it.

N90-264 TITLE: Training Optimized Utilization Resource Scheduler

CATEGORY: Engineering Development

OBJECTIVE: Develop a scheduling tool for use by curriculum developers and planners testing alternative curriculum mixes, by training analysis simulating different training alternatives, and by course designers and schoolhouse management personnel responsible for the scheduling of training at their individual schools. It would also serve as a repository catalog of training resource and course constraints for all courses and resources at a school. The use of such a tool could improve training device utilization/availability ratios and result in significant trainer acquisition and maintenance cost savings.

DESCRIPTION: Utilization of a significant number of training devices averages less than 100 hours each per month although a recent sample survey indicated that device availability was above 90%. Scheduling problems are a major cause for the low utilization/availability ratio and results in increased training cost. Although resource scheduling systems have been built, none available address the multiplicity of precedence, conjoint and disjoint scheduling constraints typical of a training curriculum.

A computerized scheduling system capable of addressing these constraints should be designed in Phase I so that effective and efficient training schedules which will optimize device utilization can be built and used. It should

operate on a Zenith 248 personal computer (or equivalent) in order to maximize its utility and applicability throughout the Navy training community for use by curriculum developers and planners testing alternative curriculum mixes, by training analysts simulating different training alternatives, and by course designers and schoolhouse management personnel responsible for the scheduling of training at their individual schools.

Phase II should use design approach defined in Phase I to develop and deliver hardware/software to the government for test and evaluation.

NAVAL COASTAL SYSTEMS CENTER

N90-265 TITLE: Video Data Compression

CATEGORY: Exploratory Development

OBJECTIVE: Develop very high rate, low error data compression/reconstitution algorithms.

DESCRIPTION: In many cases image data in video format is acquired. Algorithms for very high data compression/reconstitution are required. The range of video data compression of interest is between 50-500 times, with emphasis at the higher rate of data compression. The data compression algorithm should be high compression/reconstitution fidelity and have extremely low (10-8) error rates. Means to characterize the errors should be in design of the algorithm.

N90-266 TITLE: Underwater Covert Communication Links for Short Distances

CATEGORY: Exploratory Development

OBJECTIVE: Develop covert, underwater communication modules in less than 0.25 ft footprints.

DESCRIPTION: Reliable, covert underwater communication links are required. The receiver/transmitter must support data rates in excess of 10 kilobytes/second and must not involve any type of wires (e.g., fiber optics/metal conductors) or other physical connecting material between receiver and transmitter. Ranges of operation should exceed 5 kilo yards. Receiver/transmitter diameter should not exceed 6 inches. Power sources should not be considered in the design except that power requirements should not exceed 1 kilowatt. The links may use optics, acoustics, magnetics or any other approach as long as links remain covert (i.e., not detectable by unintended receivers).

NAVAL CIVIL ENGINEERING LABORATORY

N90-267 TITLE: Heat Resistant Airfield Pavements

CATEGORY: Exploratory Development

OBJECTIVE: To identify and evaluate heat resistant materials for airfield pavement application.

DESCRIPTION: The exhaust gas from the auxiliary power unit of the Navy's F/A 18 aircraft causes spalling and erosion on Portland cement concrete (PCC) airfield pavement. The resulting pavement debris present foreign object damage (FOD) problems to aircraft engines.

The research to be conducted relates to the follow questions: 1 How can the Navy obtain airfield pavement that is both heat and jet fuels resistant? 2 What new pavement mixes and designs provide both heat and fuel resistance?

Phase I: The end product of this effort consists of a technical report summarizing research being conducted relative to developing heat resistant airfield pavements. The completed report will identify potential new mixes and

pavement designs that can be tested in later phases. Therefore, this work will also include developing both a research plan and a test plan.

Phase II: This effort consists of conducting tests of promising heat resistant pavements that meet the following requirements: 1 Does not deteriorate even after saturation with jet fuel and hydraulic fluid and subsequently exposed to repeated high temperature jet exhaust blast. 2 Withstands repeated and prolonged jet exhaust blast of 600 degree F at 250 mph with a one hour healing and one-hour cooling cycle. 3 Resists environmental effects such as freezing, thawing and ultraviolet light. 4 The material must be comparable to PCC in terms of strength and skid resistance and be compatible with PCC pavement in terms of adhesion and coefficient of expansion.

N90-268 TITLE: Development of Wall Composite Materials to Prevent Sympathetic Detonation Between Weapons Storage Cells

CATEGORY: Exploratory Development

OBJECTIVE: To explore new design concepts for preventing sympathetic detonation in weapons storage facilities.

DESCRIPTION: A new design concept for weapons storage consist of a series of three wall cells inside an earth covered magazine. The concept is based on storage of up to 10,000 lbs. of cased explosives. The cell walls are designed to prevent sympathetic detonation between weapons stored in adjacent cells, thus limiting the maximum credible event to the explosive capacity of one cell. The research being conducted relates to the following: 1 how can the Navy prevent sympathetic detonation? 2 How can composites be used to achieve this desired result?

If this project is successful, the Navy's ordnance storage capacity could be increased significantly by virtue of reducing established explosion arcs. Additionally, real estate could be freed for other uses.

Phase I: This task involves identification of innovative design concepts, materials and composite wall properties that mitigate explosion effects and prevent propagation by sympathetic detonation.

Phase II: This task involves the evaluation and testing of composite wall designs. Small scale tests will be conducted to evaluate the feasibility of using composite materials and wall designs for mitigating sympathetic resonance. This phase of the study will include material selection, development of composite wall designs, and feasibility testing. The effective material and design must be capable of preventing sympathetic detonation caused by initiating mechanisms such as fragments, overpressure, and temperature.

N90-269 TITLE: Diver Installed Recoilless Propellant Embedded Anchor (RPEA)

CATEGORY: Exploratory Development

OBJECTIVE: To develop technology for small recoilless propellant embedded anchors (RPEA), having capacities from 500 to 5,000 lbs. for installation by Navy divers.

DESCRIPTION: The recoilless feature allows the anchor to be operated in any water depth and on dry land. Thus it is potentially useful for quickly placing guyine anchors and other low-load dry land applications as well as for expeditious anchors/moorings in the surf zone and in deeper water. This type of anchor will be designed to facilitate placement by divers.

In related research, basic research technologies for gun ballistics and rock projectile designs are currently being developed under the Basic Research and Exploratory Development Programs. The technology for sediment fluke design as previous concept investigations, small RPEA are feasible. The Navy wants to develop RPEA that weigh 30 to 100 lbs in air and are neutrally buoyant in water. This type of anchor will facilitate placement by divers. Omni directional capacities of 500 to 5,000 lbs would be attained.

Phase I: This effort includes determining a useful size range for an RPEA, development of preliminary designs for guns and flukes to satisfy needs throughout the size range, and the development of a test and evaluation plan for experimental validation and refinement of the designs.

Phase II: This effort includes developing experimental models, developing a performance data base, developing and designing working experimental hardware, and preparing a report summarizing design and performance data, including recommendations for development of a diver-installed RPEA. Models will be built and tested and performance data obtained and compiled into a performance database. This database will be used to develop an engineering design and reliable working experimental hardware for testing and evaluation in commercial and military operations.

NAVAL AIR PROPULSION CENTER

N90-270 TITLE: Turbine Engine Component Deterioration Model

CATEGORY: Exploratory Development

OBJECTIVE: Develop a gas turbine code which utilizes and predicts component deterioration to calculate overall engine performance.

DESCRIPTION: Development of a computer based system or program that would enhance the abilities of aero thermodynamic component technologies in the prediction of turbine engine component performance deterioration with engine use is needed. The current methods for assessing component performance deterioration are not adequate for new engine models or advanced engine concept evaluations. This deterioration model will analytically and/or statistically determine estimated component structural and thermodynamic wear and loss patterns based on inputs of engine configuration, duty cycle, component loading, engine application, etc. The outputs of the program will pertain to individual components as well as overall engine performance and shall include trend charts/curves, component performance changes and the physical phenomenon associated with these changes (e.g. clearances, erosion, etc.)

Phase I would entail theoretical analyses verifying the feasibility of a component/engine performance deterioration model. The results of Phase I will be used to justify the pursuit of the Phase II effort.

Phase II would consist of the development of a user friendly computer based system for deteriorated performance prediction.

N90-271 TITLE: Compressor Boundary Layer Control

CATEGORY: Research

OBJECTIVE: Develop boundary layer control techniques that will enhance axial compressor blade performance.

DESCRIPTION: The three dimensional design tools along with flow field modeling are advancing the designs of axial flow compression systems. Improved understanding of the boundary layer and methods to control the boundary layer for increased efficiency are required to improve overall compression performance.

Phase I effort will identify candidate boundary layer control techniques and conduct preliminary analysis.

Phase II will select the most promising techniques and conduct appropriate rig tests to performance improvements.

N90-272 TITLE: Fuel Atomization Analysis for Advanced Gas Turbine Combustors

CATEGORY: Exploratory Development

OBJECTIVE: Develop a fuel atomization code for gas turbine combustors

DESCRIPTION: Fuel atomization plays a vital role in advanced gas turbine combustor performance (i.e., pattern factor smoke emission, ignition/blowout limits, etc.). The significant of modifying the fuel injector and its associated atomization characteristics to improve combustor performance has been shown in both combustor rig and engine tests. However, atomization analysis methods are limited to empirical correlations that are configuration and flow condition dependent, and do not provide a means for improving fuel injector designs. A need exists for developing methodologies of modeling the atomization process from fundamental principals of surface wave formation growth coupled with droplet stripping. The atomization analysis should be fully coupled with aerodynamic analysis of the airflow surrounding the liquid jet/sheet, and include droplet vaporization and combustion. The analysis should culminate in the accurate predication of ignition and/or lean blowout of a generic combustor typical, of advanced military gas turbine combustors.

Phase I – Develop base atomization model and compare it with literature results.

Phase II – Transition model to actual combustor boundary conditions and experimentally validate the results.

NAVAL OCEAN SYSTEMS CENTER

N90-273 TITLE: Sensor for the Detection of Buried Cable from a Remote Tethered Submersible

CATEGORY: Exploratory Development

OBJECTIVE: To develop a relatively small, lightweight sensor to be mounted on an underwater Remotely Operated Vehicle (ROV) which will allow the operator to determine the depth of burial of an underwater cable.

DESCRIPTION: The main method of protecting existing underwater cables from trawling operations is to bury the cable to a depth of around 12 to 24 inches into the bottom. Existing ROV will locate cables on the floor of the ocean, automatically track the cable, and bury the cable through the use of a water jetting system. There is a requirement to develop a sensor to locate, track and record the depth of burial for such cable after the jetting operation to insure that the cable is adequate. The sensor should be sufficiently light weight and compact to fit onto either the existing ROV or a generic ROV. Sufficient acoustic or magnetic noise immunity should be built into the unit to allow detection and tracking of the cable while the vehicle is underway and the jetting system is in operation. The cables cannot be counted on to always have a ferro-magnetic anomaly signature, a d.c. or a.c. active signal imposed, nor a size greater than ¼ inch in diameter .

Phase I: This phase will consist of investigation into alternative approaches and preliminary design.

Phase II: This phase will be the final design, breadboard, prototype fabrication and test.

N90-274 TITLE: Tools to Assist in Modification and Reuse of ADA Software

CATEGORY: Exploratory Development

OBJECTIVE: To develop software tools that will assist the ADA programmer in understanding existing ADA software so that it may be more easily modified or reused.

DESCRIPTION: An acute need exists today for tools that will improve the productivity of the programmer who must, or wishes to, make use of ADA code written by someone else. These tools are intended to help the programmer do the following: install a large existing system that is written in ADA and make modifications to it, reuse one component of a larger system, and reuse or modify ADA code in some other manner. A great deal of public domain ADA software exists is the SIMTEL20 and other repositories. Usually before software can be reused

it must be modified to fit a particular application. Tools that will facilitate the rapid understanding of potentially reusable ADA software as needed. These tools should encourage reuse as well as the use of ADA repositories.

Phase I: Determine capability to develop the tools.

Phase II: Develop specific tools for immediate use in naval systems as specified by DON/SPAWAR/NOSC.

N90-275 TITLE: Miniaturized Radio Relay for UHF/VHF Communications

CATEGORY: Advanced Development

OBJECTIVE: Extend line-of-sight UHF/VHF communications.

DESCRIPTION: The U.S. Navy ahs the need to extend line-of-sight VHF and UHF communications to provide over the horizon connectivity. This can be accomplished through the use of radio relays. These relays could be installed in fixed wing aircraft, helicopters, unmanned airborne vehicles, or buoys, but he use of free floating balloons or kites is of current interest. Using these vehicles the Navy has a requirement to relay at least two wideband 25 Khz AM voice and a 25 Khz FM channel to handle data. Because of FAA regulations, the balloon borne relay must not weight over six pounds (including batteries) and must be able to provide five (5) watts output at 50% duty cycle from the transmitters for a period of 12 hours. These relays should be considered expendable items and therefore must be low in cost in high production quantities.

N90-276 TITLE: Multi-Function Shipboard Antennas

CATEGORY: Advanced Development

OBJECTIVE: Reduce the number of shipboard antennas installed topside.

DESCRIPTION: U.S. Naval ships are currently saturated with a large number of antennas. Each antenna is a single purpose device dedicated to performing in a small portion of electro-magnetic spectrum. As new systems are installed on ships, they usually include a specialized antenna. The large number of antennas already in use are occupying valuable topside space. It is required that the total number of installed antennas be reduced, while at the same time the ship antenna vulnerability, reliability, and Near Vertical Incidence Sky wave (NVIS) characteristics be improved. Innovative approaches are being solicited which will reduce the quantity of shipboard installed antennas through hardware multi-function design.

N90-277 TITLE: Communication Devices and Techniques for Naval Special Warfare

CATEGORY: Advanced Development

OBJECTIVE: Develop communications devices for Special Warfare forces.

DESCRIPTION: The U.S. Navy has a specialized mission to support the Special Operations Force (SOF), and Amphibious Operations. This includes preparing, training and equipping specialized Navy teams to support the SOF in countering unconventional military threats. A vital part of this specialized mission is communication for which solutions are solicited. Primarily, the proposed approaches should address portability, ease of operation, maintenance and susceptibility to countermeasures, and Near Vertical Incidence Sky wave (NVIS) operation. The operational applications include man portable, land vehicles, boats and underwater requirements.

N90-278 TITLE: Miniaturized Antennas and Radio Frequency (RF) Components

CATEGORY: Advanced Development

OBJECTIVE: Develop miniaturized RF components.

DESCRIPTION: All RF systems have undergone tremendous miniaturization during the last few decades. The greatest changes may still be underway, with VHSIC making major contributions. However, the size of RF components such as filters, antennas, duplexers, ulticouplers, isolators, etc., have not been significantly effected. It is obvious that the greatest possibility for future miniaturization is in the RF component field. Innovative approaches to this problem are being solicited for all RF components where significant miniaturization can be achieved.

N90-279 TITLE: Solid State X-Band Radar Transmitter

CATEGORY: Exploratory Development

OBJECTIVE: Develop a modular, solid state, x-band radar transmitter.

DESCRIPTION: Innovative ideas are being sought on the feasibility of developing an X-Band radar transmitter using solid-state modular components. The following parameters are the performance goals for the transmitter. The modular power amplifier can consist of either existing components or components of own design which can be driven at the required frequency and combined to produce the required total power output to a waveguide. For the purpose of this exploratory development, the number of modules, size, and weight are not restricted. However, future design requirements will include these considerations.

N90-280 TITLE: Message Compression

CATEGORY: Engineering Development

OBJECTIVE: Successful software development would lead to the development of message compression algorithms and significant savings in terms of circuit capacity and throughput over currently operated satellite channels.

DESCRIPTION: Most of the communications bandwidth in the Navy is dedicated to record message data and bit oriented computer data exchange. Innovative techniques based on algorithms implemented in communications processors will help to more efficiently utilize the Navy's allocated communications circuits. The development effort shall demonstrate the capability to compress message and bit oriented data by an order of magnitude with the ability to provide performance in the navy environments. Environments to be characterized shall include but not be limited to Gaussian and bursty type noise distributions characteristic of current circuit operations. The feasibility demonstration shall be run using actual message and bit oriented data to be provided by the government.

Phase II of the effort shall address incorporation of the tested algorithms in current fleet communications systems. The task/work security level of this effort is SECRET.

N90-281 TITLE: High Data Rate Satellite Communications

CATEGORY: Advanced Development

OBJECTIVE: Successfully develop increased communication data rates with the Navy UHF SATCOM systems.

DESCRIPTION: To achieve the objective, an analysis and architecture study is to be performed to maximize communication data rates between naval surface and shore nodes using UHF SATCOM. The areas of investigation will include adaptive shipboard antennas, advanced modulation techniques, and optimum satellite channel bandwidth assessments. Minimum throughput improvement by a factor of 2 to 3 is anticipated. In addition, throughput improvement will have an impact on shipboard terminal size due to the ability to use on equipment at a

high data rate rather than multiple equipments at lower bit rates. The task/work security level of this topic is SECRET.

N90-282 TITLE: Small Ship UHF Antennas

CATEGORY: Engineering Development

OBJECTIVE: The successful prototype testing of a small ship UHF antenna would lead to the installation of antennas aboard small ships to support the eventual installation of UHF DAMA.

DESCRIPTION: Innovative techniques and concepts are required to provide for a follow on UHF SATCOM antenna system which is compatible with small ships. The new antenna must have the potential capability to be retrofit on existing platforms and the performance characteristics necessary to communicate via Demand Assigned Multiple Access processed satellite channels. This effort will require the identification of current and projected small ship antenna related operational requirements. Based on these operational requirements, an antenna specification will be developed. When considering upgrades, existing Navy/DOD UHF SATOCM equipment shall be used or modified. When existing Navy/DOD equipment cannot be used or modified, analysis shall justify proposed alternatives. From this specification a light weight, high gain, satellite tracking UHF SATCOM antenna prototype will be developed and tested to satisfy the small ship communications requirements.

N90-283 TITLE: Graser Communication System

CATEGORY: Research

OBJECTIVE: Determine the feasibility of using Grasers for communications and conduct initial research into Graser transmitters/detectors leading to a complete communications system.

DESCRIPTION: The Satellite Laser Communications (SLC) program has developed a space qualified blue/green laser to communicate with submerged objects. Gamma X-Ray Lasers have been shown to have potential as a weapons system. Graser, which are the size of a hockey puck, are theorized as being able to destroy a missile. Research is sought into the applicability of Grasers for communications. It is felt that a pellet size Graser can be used for communications. This could lead to an easily reconstitutable and survivable communications system due to the transmitter size.

N90-284 TITLE: Network Control

CATEGORY: Research

OBJECTIVE: Identify network access control protocols needed for a communication system with multiple satellites and multiple fixed, mobile, and transportable satellite access nodes.

DESCRIPTION: A communications system with multiple satellites and multiple fixed mobile, and transportable nodes requires an access control protocol function to regulate nodal access to the communication system. In one scenario, the fixed nodes may be designated as the primary communication system controller and would share the satellite resources. The mobile and/or transportable nodes would be relegated to operate as a backup to the fixed sites. In other scenarios, primary control may reside with t he mobile and/or transportable nodes. Offerors are to identify network access protocols needed for this multi-node system during various operational scenarios. Implementation of the network access control protocol should also address covertness and anti-jam capabilities.

N90-285 TITLE: Economical Environmental Performance Modifications to Commercial and NDI Equipment

CATEGORY: Engineering Development

OBJECTIVE: Data is needed to enable an estimation of the effectiveness, cost and schedule impact of possible modifications that can be applied to commercial and NDI computer and peripheral equipment to improve environmental worthiness. It is desired to present such data in a handbook that can be readily used by analysts.

DESCRIPTION: Shipboard command and control systems that employ information processing and display hardware and perform tactical functions must provide sufficient environmental worthiness to operate effectively in the intended shipboard environment. However, environmental performance that is fully compliant with MIL-STDs may exceed required performance and may not be compatible with affordability and constrained schedules. The new Navy instructions on procurement of Non-Development Items (NDIs) dictate that tailoring of MIL-STDs is required if significant cost or schedule benefits can be derived. A trade off analysis of candidate NDI performance, cost and schedule is a required step in formal program planning. Candidate NDI systems may have the potential of providing fully satisfactory environmental performance with application of relatively simple physical modifications. Examples of such modifications could include bracing and padding of printed circuit boards, card cages and equipment covers to protect against shipboard vibration and shock; methods of coating, resoldering, component substitution, and other means of protecting electronic components from the effects of humidity; dust protection with improved filtering systems and maintenance practices; reduction of electromagnetic interference effects with suppression devices and materials. The contractor shall select environmental specification areas for which documented results are available from own company experience and other creditable sources.

Experimental efforts may be required in Phase II of the program to demonstrate and validate proposed techniques.

N90-286 TITLE: Tradeoff Issues in Massively Parallel Implementation of Real Time Federated or Distributed Navy Warfare Systems

CATEGORY: Exploratory Development

OBJECTIVE: To determine how the Navy can make best use of new, massively parallel computers in real time applications.

DESCRIPTION: The Navy's ever increasing requirement to process more data in shorter times, with improved accuracy will soon outstrip the capabilities of existing standard Navy computers. The need for faster, more sophisticated computer equipment will become ever more pressing. The latest generation of massively parallel computers is expected to help fill the Navy need. However, there is little, if any, knowledge within the Navy of how to apply these new systems to Navy applications. Research is needed to determine the hardware and software tradeoff issues involved in using these massively parallel computers for real time navy federated and/or distributed warfare systems, and to identify any unique software implementation techniques required to use parallel computing effectively.

N90-287 TITLE: Workstation Architecture as a Function of Open Systems Architecture in Future Warfare Systems

CATEGORY: Exploratory Development

OBJECTIVE: To determine the impact of the Open Systems Architecture philosophy on workstation technology, and how these technology innovations can be best implemented in future warfare systems.

DESCRIPTION: Two of the most far reaching recent developments in warfare systems design have been the use of the Open Systems Architecture (OSA) philosophy in the design of computer systems, and the advances in workstation technology that make their use in warfare systems so important. As yet the application of OSA has not

been fully exploited in the development of workstations, and very little work has been done in the area of OSA workstations for use in warfare systems. The issues of survivability, maintainability and reliability, vital to warfare systems, may not be adequately addressed by commercial developers. Additionally, the ability to tailor OSA compatible workstations to meet specific needs from available and planned capabilities can insure that operational currency is maintained. Work is required to ensure that these issues are addressed adequately and any requirements peculiar to warfare systems are taken into account when OSA workstations are developed for use in warfare systems.

N90-288 TITLE: Directional Communication and ECCM Obtainable Through Architecture in Future Warfare Systems

CATEGORY: Advanced Development

OBJECTIVE: to provide an adaptive, electronic, counter-counter-measure in communications by utilizing randomly located phased-array elements to obtain a high directivity gain to many authorized receivers, simultaneously, but not to a hostile interceptor.

DESCRIPTION: A receiver system which can coherently sum information transmitted from multi-randomly-located antennas is desired in an ECM environment. Each antenna would be capable of operating at a different frequency and the receiver would be capable of coherently summing signals from these randomly located antennas. It is desirable that the receiver system would, in effect, provide a beam pointing toward the antenna cluster providing highly directional communications. Each element of the antenna cluster should be capable of transmitting the same information at different frequencies based on a coded basis, thus spreading the information over a wide frequency band. The system then benefits from both an equivalent high gain transmitting antenna and a wide RF bandwidth. The feasibility of such a technique or system needs to be explored. The potential advantages in the chosen technology in the presence of real life noise and its practical limitation, if any, need to be determined analytically.

Elements of the prototype system, which are high risk, should be tested during Phase II.

N90-289 TITLE: Adaptive Diversity Reception at HF

CATEGORY: Advanced Development

OBJECTIVE: To implement a signal processing system for HF shipboard and shore communications that will adaptively avoid signal fading due to multi-path, including the ground or ocean, reflected signals.

DESCRIPTION: HF communication signals can undergo fading because of mutually interfering signals arriving at the receiving antenna through various propagation multipaths that may include the ground or ocean reflected propagation path. Often the amplitude and phase changes of the signals introduced by multi-path can be severe and unpredictable. A diversity reception system using multiple antennas has been used to minimize fading at times, but such an arrangement is not adaptive and cannot accommodate rapidly varying multi-path signals. An adaptive technique or system that can coherently sum the useful multi-path signals to avoid fading and enhance the effective signal to noise ratio of the received signal is desired. The feasibility of such a technique or system needs to be explored. The potential advantages in the chosen technology in the presence of real life noise and its practical limitation, if any, need to be determined analytically.

Elements of the prototype system, which are high risk, should be tested during Phase II.

N90-290 TITLE: Natural Operator Input Techniques for Undersea Surveillance Systems

CATEGORY: Advanced Development

OBJECTIVE: Develop techniques that allow the undersea surveillance operator to use natural gestures and writing skills to enter information into and control computer based systems.

DESCRIPTION: The Navy has a continuing need for computer interface designs that simplify the operator's task and reduce the training required to operate complex undersea surveillance equipment. Progress has been made in non-military R&D in using touch-sensitive screens on horizontal display surfaces to record and instantly display the natural motion and writing gesture of the operator as if the operator were writing on a piece of paper instead of a horizontal computer display screen. Further development and application of these techniques to the undersea surveillance operator interface would allow annotation of computer displays just as paper systems are currently marked and would provide easy, natural menu selection and feature identification techniques.

A Phase I effort would require technique design and implementation on existing Navy laboratory equipment to demonstrate the feasibility of the technique with current surveillance system procedures.

A Phase II effort would require further design, technique development and prototyping of equipment specifically selected for natural gesture recording and instant display.

N90-291 TITLE: A Prototype Ada Repository for Command and Control Software Components

CATEGORY: Advanced Development

OBJECTIVE: Software for Navy Command and Control systems is a major product of the Naval Ocean Systems Center. Ada, the programming language mandated for use by the Department of Defense, is now being used in the development of Navy Command and Control systems. Due to a limited number of software engineers, an increase in software being developed, and a shrinking Department of Defense budget , it is critical to gain maximum utilization on of our limited resources. One such gain may be in the area of reusable software components which satisfy the functionality of command and control systems will aid the software engineering in curtailing software costs while contributing to software development productivity. The elements of this effort will include hardware, software tools, a repository of existing reusable components and software engineers assigned to a command and control software development program. The objective is to provide a prototype system that can be easily accessed by software engineers to provide software components for possible reuse in the development of new Command and Control systems.

DESCRIPTION: Phase I: Through domain analysis, specific operations of Command and Control software will be identified and grouped. An example of such functionality may include message origination, message parsing and database updating. A design of a database for Ada software components, a design for the retrieval of the information and tools to assist the software engineer would be specified and made available. The format and method for acquiring software component descriptions, techniques to identify a taxonomy and to locate relevant components, and identification of naming conventions will be developed.

Phase II: Ada software components will be acquired to fill and test the prototype. The system will be made available to software engineers and metrics associated with the use of the prototype will be gathered. An evaluation of these metrics as well as an evaluation of the repository itself will be used to enhance the prototype. Analysis of this information will improve understanding of the policies, methods and tools needed to encourage reuse of Ada software.

Phase III: A follow on phase will identify methods to improve the organization and expert system tools to aid in the retrieval of information. Additional software components will be identified and added to the software repository; selected components may also be deleted.

N90-292 TITLE: SAFENET Performance Evaluation

CATEGORY: Advanced Development

OBJECTIVE: The objective of the topic is to provide the navy with an approach for evaluating the performance of the navy's Survivable Adaptable Fiber Optic Embedded Network II. Phase II of this topic will develop a software tool which utilizes the method developed in Phase I.

DESCRIPTION: The Navy is developing a standard Local Area Network (LAN) known as SAFENET II. SAFENET II will provide the Navy with an efficient means of communication among its Mission Critical Embedded Computer Systems. This LAN will replace a large number of point to point computer interfaces that currently connect Naval systems both afloat and shore-based. No modeling and analysis methods and tools are currently available for analytically evaluating the performance and design of communication networks such as SAFENET II. The main focus of this topic is to develop a method and a supportive tool which will enable the Navy to analytically evaluate the performance of SAFENET II. The resultant method and tool shall provide important network measures of performance such as the maximum average and variance delay of each message class. Analytic techniques are preferred to simulation because of the simplicity of modeling inputs and outputs in terms of mean steady state measures of performance. The method shall consist of a technique for applying queuing theory results and algorithms derived from queuing theory. The performance tool shall automate this method.

Phase I of the effort would develop new analytical performance evaluation algorithms for determining the key values of network performance. These key values shall at least include maximum and average message delay, utilization, and maximum and average queue length at each member of the network.

Phase II of this topic shall apply the techniques and results of Phase I work into a software tool suitable to be used by the Navy to evaluate SAFENET II.

N90-293 TITLE: Advanced Receiver Technology

CATEGORY: Advanced Development

OBJECTIVE: To solicit new concepts and approaches in receiver technology which satisfy current efficiencies in size, weight, phase, coherency, rapid scanning, programmability, adaptability, and receiver processing or sophisticated signal formats.

DESCRIPTION: A need exists to refine the architecture and organization of surveillance/targeting receivers to detect, classify, and identify a wide range of radar emitters. Determination of frequency, power, deviation, data rate, pulse length, pulse interval, angle of arrival of the signals need to be determined. The methods of search, acquisition, and track must be addressed, with plans for maximizing the throughput of usable data, while achieving rapid acquisition. A system of autonomous operation for the accurate direction finding/location, classification and identification of radio emitters as applied to drone aircraft and missiles requires improved solutions.

Phase I should address methods and means which can be applied to markedly improve the function of receiver/processing systems for rapid search, acquisition, and track of sophisticated RF emitters. Phase II should use the approach defined in Phase I to develop and deliver hardware/software to the government for test and evaluation.

N90-294 TITLE: Advanced Passive RF Surveillance/Targeting Assessment Methodology

CATEGORY: Advanced Development

OBJECTIVE: To develop an interactive encounter model of representative threat electronic environments and Own Force Active/Passive RF surveillance/tracking systems for use as an evaluation tool in assessing system capabilities and their effect on Own Force operations and tactics.

DESCRIPTION: There is a need for the development of an advanced methodology capable of assessing electronic surveillance/tracking systems in representative scenarios typical of the anticipated environment in the post 1990 time frame. The emphasis of the methodology should focus upon detailed modeling of the nodes comprising the systems under evaluation, yet interface at the macro level for the global aspects of the encounter/scenario. The

modeling of the threat electronic environment and the interaction of Own Force Active/Passive RF surveillance/tracking systems will allow the assessment of the quality and extent of the surveillance/tracking data in various benign and cluttered environments. Emphasis should be placed upon assessing advanced passive RF systems and their use upon Own Force covert operations and tactics. Critical system parameters and their comparative measure of performance require assessment. The comparative evaluation of those unique technologies/systems capable of providing improved effectiveness form the basis for continued development of electronic defense systems.

Phase I should identify the characteristics and methodology which can be applied to markedly improve the ability to assess the viability and performance of passive RF surveillance and tracking systems.

Phase II of this effort should use approach defined in Phase I to develop and deliver hardware/software to the government for test and evaluation.

N90-295 TITLE: Protective Coatings on Aluminum for High-Efficiency Heat Transfer Applications

CATEGORY: Exploratory Development

OBJECTIVE: To develop a protective coating for aluminum alloys which ahs abrasion resistance and corrosion resistance comparable to commercial hard anodic coatings but high thermal conduction. Such a process will be used to protect expensive marine propulsion hardware, currently under development, which require very high efficiency heat transfer.

DESCRIPTION: The Navy has a need for a protective coating for aluminum alloys which is extremely hard, and has very good abrasion resistance, corrosion resistance, and thermal conductivity. Anodized aluminum coatings have been used for years to protect Navy equipment from the effects of corrosion and abrasion. The thermal conductivity of typical commercial anodic coatings has been found to be very low. Developmental marine propulsion systems require very high efficiency heat transfer from the condensing section to seawater. An improved thick anodic coating or other coating of inert material is required for protection against an abrasive and corrosive marine environment.

The coating must provide protection against the effects of abrasion and corrosion equal to or greater than that of commercial hard anodic coatings, but have a thermal resistance per unit area significantly less than that of a 2 milli inch, thick hard anodic coating. A reduction in thermal resistance per unit area of at least a factor of 3 is desired. The coating must be inert or non metallic in order to avoid electrolytic corrosion effects between dissimilar metals in a saltwater environment. Also, the coating must provide corrosion protection equivalent to a typical 2 milli inch thick commercial anodic coating, sealed using a standard hydration technique. The temperature of the aluminum part to be coated must remain low enough during the coating process that the wrought aluminum alloy does not lose its temper. Ultimately, the process must be capable of coating an aluminum surface area of several hundred square inches.

In Phase I preliminary tests will be performed to demonstrate a process that will have the potential of satisfying the above requirements regarding thermal transfer and abrasion resistance.

In Phase II the process will be optimized to obtain a process which will provide the best coating possible for the above application. Effectiveness against corrosion and abrasion will be demonstrated. Also, tests will be performed to determine the operating conditions necessary to produce consistent coatings in a commercial setting.

N90-296 TITLE: A Tethered Floating Fiber Optic Periscope for Submarines

CATEGORY: Exploratory Development

OBJECTIVE: Submarines are most vulnerable while viewing with the periscope. The object is to device and construct a retractable/disposable floating periscope system tethered via a suitable fiber optic cable, to a distant submarine, that has full image stabilizer and lock on target features.

DESCRIPTION: Several high resolution charge coupled device cameras, with lock on target features, jointly scanning the 360 degree field of view, convey digitized images, via a low db, single mode, fiber optic cable, to a closed circuit network aboard the distant submarine.

The scanning camera's lock-on features along with a small gyroscope, or recently used camera accelerometers, should jointly compensate for bounces, jitters, noises, etc. due to the ocean waves. Fiber optic systems offers opportunities for video signals from day or night vision systems, and from thermal imagers, to be brought from the periscope head, through the pressure hull for distribution where required throughout a submarine. This would allow designers to place the control room at the optimum location in the craft, not necessarily directly beneath the sail. A submarine commander could remain seated at a control console from which he and other command team members could view the surface scene on a large screen display (LSD) presentation. The screen could also display data form other sensors and onboard tactical data bases.

During the SBIR Phase I, only the feasibility of the optic will be examined.

During Phase II, however, the full scale of the system shall be tried where test and evaluation will be included. This retractable/disposable floating periscope could be camouflaged deceptively for tactical and operational use. This potentially low cost device may be retrieved, disposed of, or even destroyed as the tactical situation requires.

N90-297 TITLE: Voice Messaging and Response for Naval Ashore and Afloat Operations

CATEGORY: Engineering Development

OBJECTIVE: This objective is to develop a system that improves operational efficiency ashore and afloat by providing the means to send and receive verbal information and commands reliably and without time wasted waiting for the intended receiver or repeating messages for multiple receivers.

DESCRIPTION: naval operations require sending and receiving numerous verbal messages and commands. Advanced voice messaging and response systems optimized for naval operations would improve operational efficiency measurably. These systems can include many difference features which can be incorporated in many different ways. Which features to include and how to implement them, on what hardware, using which software, with what security features, are questions that need to be answered before a system can be designed built, evaluated, and installed. The major features of these systems are described along with some of the problems they address. When an immediate response is not required, the ability to leave a recorded message eliminates the sender's waiting time and frees up the lines for the messages requiring immediate response. Also messages can be composed off line and then sent at a rapid rate which serves to relive congestion on the lines. Auto attendants can reduce the time and personnel required to make connections. Intelligent routing can send a single message to many people, thus eliminating the time and effort for repeat calls. Personal assistants for secondary call answering can provide call transfer, verbal alert to secondary person that transfer call is coming in, notification to caller that transfer is occurring, and voice messaging on command if needed. Remote pagers can alert and inform the intended receiver when away form the workstation, reducing time to make contact and eliminating search efforts. Scratchpad capability permits the caller or receiver to record parts of the conversation for recall. Much information requested is database data which can be obtained or entered without a second person in the loop. Interactive mailboxes can be programmed with prerecorded questions to obtain database information in the required format. Voice messages and keypad entries can be combined to optimize interactions, such as sorting messages by coded input, redirecting calls by selecting keypad entry from recorded voice menu, providing priority, entering and receiving database information, and access voice bulletin boards.
The Phase I effort should address operational requirements for voice messaging and response and a survey of available hardware/software with small scale testing to evaluate various features.

The Phase II effort should set up a large scale demonstration system that would be tested in a simulated ashore or afloat naval operation. The work security level for the system analysis would be secret, the other tasks would be unclassified.

DAVID TAYLOR RESEARCH CENTER

N90-298 TITLE: Marine Paints with Ice phobic Properties

CATEGORY: Exploratory Development

OBJECTIVE: Develop topcoats for naval ships that exhibit inherent ice phobic properties.

DESCRIPTION: The nation's Maritime Strategy requires the U.S. Navy to operate surface ships at latitudes where environmental conditions conducive to significant topside icing is expected to be encountered. Designing ships to accommodate large ice loads is unrealistic and ships presently in commission were not designed with the objective of sustained operation in such conditions. Icing will cause impairment of mission and ship operation capability and in the extreme, place personnel safety at risk. State-of-the-art ice phobic coatings have demonstration that it is possible to retard the formation of ice. Undoubtedly these coatings will become more efficient. However, these coatings are parasitic in nature and intrinsically create a maintenance burden. The application requires manpower, renewal is required and their appearance requires that the coatings be removed when the ship is not operating in an icing conducive environment. Modification of marine topcoats to enable them to prevent and/or significantly retard the accretion of ice would significantly contribute to the readiness of all U.S. Navy ships to operate in the northern latitudes without the predeployment and post deployment manpower burden associated with presently available ice phobic coatings. Environmental conditions conducive to severe icing can infrequently develop in lower latitudes. Having a marine top coat with an intrinsic resistance to ice accretion will provide a built in safety margin in unanticipated environmental situations. Program phases would be as follows:
Phase I – coating development, compatibility with existing Navy paint system, water contact angle, weatherometer tests.

Phase II – anti-icing, ice adhesion, ice impact removal, ice chamber tests; test panel/patch tests aboard ship, application and maintenance requirements.

N90-299 TITLE: Composite Gear cases for Ship Main Propulsion Gears

CATEGORY: Exploratory Development

OBJECTIVE: To investigate the feasibility of advanced composite materials to reduce weight, noise and vibration of main propulsion gear cases.

DESCRIPTION: This effort will investigate and establish the feasibility of employing advanced polymer and/or metal-matrix composite materials to reduce the weight and enhance the vibration and noise damping characteristics of Navy gear cases, for both parallel shaft and epi-cyclic gearing arrangements. This effort will explore the suitability of advanced composite materials using constrained layer damping to provide adequate structural integrity and bearing support under normal and high impact shock loading conditions. Methods for controlling the stiffness of the gear case and its interconnection with the ship's structure when operating in heavy seas and under shock loading conditions should be developed and analyzed.

N90-300 TITLE: Optical Fiber Inspection System for Composite Propulsion Shafting

CATEGORY: Exploratory Development

OBJECTIVE: To develop a standard, low cost method of monitoring for composite shafts that will allow assessment of performance, damage and damage growth in composite shafts.

DESCRIPTION: The Navy is currently demonstrating the feasibility of a standard family or filament wound, composite propulsion shafts incorporating continuous carbon and glass filaments in a thermosetting epoxy resin matrix. A low cost enhancement to the standard composite shaft is required using a fiber optic maintenance monitoring system to assess performance and damage location/growth. The monitoring system would involve an optical fiber selection and optimization for composite shafting, determination of appropriate optical fiber spacing, and small scale demonstration of the system in a small diameter composite shaft to modify Navy standard specifications. The fiber optic system would receive standard light emitters with a demonstration of system practicality.

N90-301 TITLE: Composite Acoustic Enclosure for Intercooled Recuperated (ICR) Gas Turbine Engine

CATEGORY: Exploratory Development

OBJECTIVE: Develop a lightweight composite acoustic enclosure for the advanced ICR gas turbine engine.

DESCRIPTION: Develop a composite acoustic enclosure for the ICR gas turbine engine. The enclosure should meet the following operational requirements:

1. 84 db noise external to the module.
2. 135 F maximum external skin temperature.
3. Withstand a 7 psig peak overpressure resulting from a blast.
4. Prevent nuclear, chemical and biological contamination of the engine room.
5. Protect the engine in the event of engine room flooding.
6. Stop a turbine blade or metal splatter if the engine over speeds to destruction.
7. Protect the engine room from an initial gas turbine fire or fuel spray leak and vice/versa.

Complete concept design, material selection, and propose development plan.

N90-302 TITLE: Atomized Liquid Filtration for Air Contamination Control

CATEGORY: Exploratory Development

OBJECTIVE: This task would investigate emerging technology in the area of filtration by atomized liquids to develop low impact, shipboard air filtration for use in permanently installed and portable systems that will enhance survivability.

DESCRIPTION: Reduced survivability can result from the hazard to personnel and equipment from Chemical, Biological, and Radiological (CBR) warfare agents, the loss of visibility in smoke from fires, and the damage to equipment from the intake of missile exhaust. The damage in all of these examples is created by small particulates and vapors. Filtration of these materials is beyond the capabilities of conventional shipboard systems. Systems developed recently to address these problems use highly efficient barrier type filters to control particulates and activated carbon to physically absorb vapors. These systems require large amounts of shipboard space and impose increased pressure drop on the ventilation system which as required the development and installation of specialty fans. The filtration performance and useful life of these filter systems are adversely affected by the marine environment.

Atomized liquid spray filtration systems address the deficiencies of the current systems. Pressure drop across the liquid spray is low because there is no obstruction to the airflow, thus the system will require less space and can operate with conventional ventilation fans. The pressure drop does not increase with time because there is no buildup of particulate on a filter media; the contamination is carried from the filtration site by the liquid. The condition of the liquid can be monitored and maintained so that filtration efficiency is maintained with time. Filtration efficiency of the spray is not affected by humidity in the marine environment as is in the case with carbon filters. Theory and experiment indicate that high velocity, atomized liquid droplets are required to efficiently filter

particulate in the size range of concern. Atomized liquid droplets will also provide the large liquid surface area for vapor absorption which is normally provided by special packing materials in conventional liquid scrubbing towers. Initial efforts should be directed toward identification and development of effective and practical techniques for the generation of high velocity, atomized liquid droplets and evaluation of these techniques for filtration of specific shipboard contaminants. Follow on efforts would develop small scale, ship configured, prototype equipment for laboratory evaluation.

NAVAL AIR TEST CENTER

N90-303 TITLE: Programmed Control of Seaborne Targets

CATEGORY: Exploratory Development

OBJECTIVE: A programmable control system for seaborne powered targets to eliminate line-of-sight manual remote control, thereby enabling testing certain weaponry, mission profiles and in operating areas now prohibited. A market for this type of target control, as well as for the logical subsequent development of long range tracking and manual target control, exists throughout the military in the U.S. and friendly nations.

DESCRIPTION: Air-to-surface weapons are tested by firing against small powered target boats and powered target hulks. These targets are remotely controlled by operators who must be within line-of-sight. Safety of the operators requires safe distance stand off requirements which severely limits the types of weapons, mission profiles, and the operating areas of these tests. In addition, manual remote control results in inaccuracies and in tedious for the operators. A system is needed that can be programmed with the test profile and autonomously control the target. Development of this system will require the interfacing the technology of target control/autopilot systems with maritime positioning systems such as or satellite navigation. Capability to shut down the target at all times is required.

Phase I requires research of relevant technologies, specification of the system, drawings and possibly a working model.

Phase II will require production of a prototype system and its test on the target boats at the Naval Air Test Center.

N90-304 TITLE: Solid State Digital Voice/Data Recorder

CATEGORY: Engineering Development

OBJECTIVE: Develop a prototype recording device utilizing data encryption and data compression, and capable of storing 15 minutes of aircraft flight data along with one channel of voice communications. This prototype will transition into a compact, lightweight, reliable, crash survivable flight data recorder which will be much in demand for both military and civilian aircraft.

DESCRIPTION: Data recovered from a flight data/voice recorder is needed for analysis after an aircraft crash or incident and for monitoring of aircraft maintenance, fatigue, loads and stress. Current flight data voice recorders, for both military and civilian aircraft, employ analog magnetic tape memory technology. These recorders are unreliable, large, heavy, and may not survive a crash. The causes of many crashes go unresolved due to insufficient or nonexistent recorded data. Digital solid state non-volatile memory technology has recently become available for use in flight data/voice recorders. Employing this technology should result in a compact, lightweight, reliable, crash survivable recorder.

Phase I requires research of existing data compression technology, data encryption methodologies, and high density non-volatile memory devices, and the design and building of a brass board recording device to demonstrate the results of the research.

Phase II will require the development of a complete flight data recorder capable of interfacing with standard military and civilian aircraft data buses, and flight test demonstration at the Naval Air Test Center.

N90-305 TITLE: Synthetic Rope for Helicopter Rescue Hoists

CATEGORY: Advanced Development

OBJECTIVE: Develop a non-metallic rope for use in helicopter rescue hoists and which will prevent in the electrostatic discharges which often injure ground personnel. A large market, both military and civilian, exists for this type of rope for use in almost all helicopters equipped with hoists.

DESCRIPTION: The wire rope used on helicopter hoists presents a safety hazard to ground personnel because of dangerous electrostatic discharge. Additionally, wire rope is heavy and subject to both kinking and corrosion. Synthetic materials such as Kevlar and Spectra are promising candidates for a light weight, strong, electrostatic free rope; however, conductive contaminants can be entrapped in a rope of such materials. Research is needed to develop a synthetic rope with a coating which will bond sufficiently well to withstand hoist cycling under load. The rope should be mechanically equivalent to existing hoist wire rope; however, modifications to the mechanics to the mechanics of the hoists are allowed. Electrostatic nonconductivity or attenuation should be in accordance with MIL-STD-810C.

Phase I will require research and experimentation in the development of the rope.

Phase II will require the production of sample quantities of the rope and testing at the Naval Air Test Center.

NAVAL AVIONICS CENTER

N90-306 TITLE: Threat Missile Simulator Technology

CATEGORY: Exploratory Development

OBJECTIVE: To improve the performance of threat missile simulators while reducing size and weight. These improved threat missile simulators will be required by the Fleet Electronic Warfare Support Group for improved missile defense training. Plans to mount these threat missile simulators internally in aircraft will require significant size and weight reductions.

DESCRIPTION: Procurement is in process to lease/buy commercial aircraft to replace Navy aircraft presently flown by the Fleet Electronic Warfare Support Group. These commercial aircraft will use internally mounted threat missile simulators for fleet training. The threat missile simulator is in a 17 foot, 28 inch diameter pod which weighs 1800 pounds. The pod shell weighs 600 pounds. The remaining 1200 pounds of electronic needs to be reduced in both size and weight for the proposed internal aircraft installations. The threat missile simulator was designed using 1980 technology with no emphasis on size/weight reduction.

The goal of Phase I is to develop concepts and technology approaches to reduce the size (volume) by 50% and reduce the weight by 40% while enhancing threat replications and versatility.

If successful, the concepts and technology will be demonstrated under a Phase II effort and transitioned into production of internally mounted threat missile simulators and used by the Fleet Electronic Warfare Support Group for improved missile defense training.

N90-307 TITLE: High Effective Radiated Power (ERP)

CATEGORY: Exploratory Development

OBJECTIVE: To provide a high RF energy source for training Navy electronic warfare personnel. This RF source will be achieved by utilizing the existing RF microwave amplifiers and improving the ERP of the overall system. Specifically, the antenna gain in a narrow portion of the E/F Band will be considerably enhanced.

DESCRIPTION: The present Airborne Jammer Simulator provides realistic EW training and R&D support to Naval personnel and programs. A requirement exists to provide a high energy RF source in specific areas of the RF spectrum. This capability can be achieved by development of special narrow band high gain antennas to be used with the present microwave amplifiers.

Phase I should investigate the feasibility of the Phase II development of such an antenna. If successful, this antenna will be integrated into the production system and provide enhanced EW training to the Navy.

N90-308 TITLE: Integral Circuit Board/Frame/Heat Sink

CATEGORY: Exploratory Development

OBJECTIVE: Combine several newly emerged technologies to create a high thermal dissipation, highly reliable, integral circuits board/frame/heat sink technology. If successful, this technology could be used in high power electronics with difficult cooling requirements, especially in military avionics.

DESCRIPTION: Modern high power electronics modules dissipate a considerable amount of heat. In standard electronic modules (SEM) and other forms of integrated rack electronics where conductive, cold wall cooling is used, getting the heat out is difficult. Conventional printed wiring board on frame requires that the printed wiring board be glued to the frame. The adhesive always has a poor thermal conductivity as do most printed wiring boards. Normally, frames are machined from aluminum for light weight and high thermal conductivity. The advent of aluminum based metal matrix composites technology means that the potential exists for material specially tailored to the task of high thermal conductivity backplanes. Creation of thin coatings of ceramics (or even diamond) on large substrates are possible, these could provide isolation for circuit panels created directly on the frame. There are several new techniques for creating conductive traces directly on substrates. Combining these technologies could lead to an order of magnitude improvement in thermal performance.

Phase I would involve the examination of existing technology and possibly the development of crude concept demonstration prototypes.

Phase II would involve the development of manufacturing techniques and matching design tools aimed at SEM Format E and integrated power supply applications.

N90-309 TITLE: Generic Configurable Microprocessor Simulation Methodology

CATEGORY: Exploratory Development

OBJECTIVE: A methodology must be developed to provide processor loading and backplane input and output timing information for various types of microprocessors running ADA software. If successful, this methodology can lead to the development of a generic configurable microprocessor simulation which provides a suitable method to identify problems and risk in complex advanced avionic architectures without actual hardware or software constraints. The microprocessor simulation results could then be combined with avionic system simulations to study the effects on performance of input/output.

DESCRIPTION: A complex simulation of the modular avionics is necessary in the weapon system's conceptual phase to point out problem areas prior to hardware and software integration. This simulation must focus on communications between functions which occur through the processing of ADA software on various microprocessors between these microprocessors over data buses. The effects of data latency on these functions must be the outcome of these simulations to develop a robustness into the avionics system. A modular approach to such

simulation is needed, in which microchips, modules and systems are successively simulated. This SBIR focuses on microprocessors and supporting microchips which are candidates for use in advanced tactical weapons systems.

Phase I should develop the methodology necessary to generically simulate the capabilities of any given microprocessor, and provide a description of the requirements needed for this simulation. For example, ADA compiler timings and instructions, the pipeline controls, and/or the cache replacement algorithms should be demonstrated.

Phase II should develop a simulation, collect the requirements and data for several microprocessors and potential avionic 32 bit microprocessors, such as reduced instruction set computers, and incorporate these data into the simulation.

N90-310 TITLE: Aircraft Store loader

CATEGORY: Engineering Development

OBJECTIVE: To transport loads to and raise/attach stores on external racks of aircraft quickly with minimal manual exertion.

DESCRIPTION: While there are vehicles and devices that transport and raise stores to aircraft racks, it has been found that they do not work well or quickly enough. The alternative has been for six strong men to form a team, grab the load/store/weapon and muscle it into place on the bomb rack, launcher, etc. The participants are often at risk, and the store is often in jeopardy.

Phase I should study the problem, specify the desired parameters, and suggest/built several alternative devices for consideration in Phase II.