The Department of Defense

DoD DEPARTMENTS/AGENCIES:

- Department of the Army
- Department of the Navy
- Department of the Air Force
- Advanced Research Projects Agency
- Defense Nuclear Agency
- BMDO Ballistic Missile Defense Organization
- Special Operations Command

SMALL BUSINESS INNOVATION RESEARCH PROGRAM (SBIR)

FY 1993 SBIR SOLICITATION

PHASE I AWARD ABSTRACTS

NAVY PROJECTS

VOLUME II

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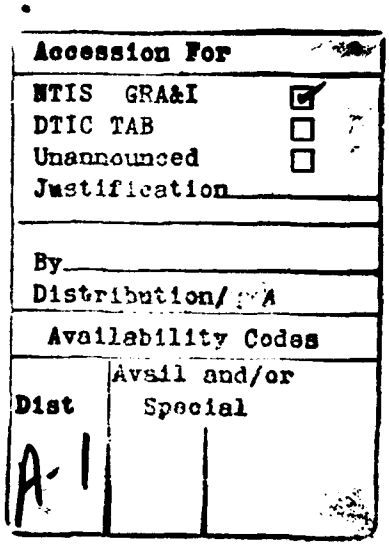

(3) 4(B)

PREFACE

This report presents the technical abstracts of the Phase I proposals that resulted in contract awards during Fiscal Year 1993 from solicitations of the Department of Defense (DoD) Small Business Innovation Research (SBIR) Program. The Army, Navy, Air Force, Advanced Research Projects Agency (DARPA), Defense Nuclear Agency (DNA), Ballistic Missile Defense Organization (BMDO, formerly SDIO), and Special Operations Command (SOCOM) are the DoD components of the SBIR Program. Two solicitations inviting small business firms to submit proposals under this program were published in FY93. Army, Navy, Air Force, ARPA, DNA, and BMDO participated in Program Solicitation 93.1 (Closing Date: 15 January 1993), and Army, Navy, ARPA and SOCOM participated in Program Solicitation 93.2 (Closing Date: 2 August 1993). The selection of proposals for funding was made from proposals received by the Military Services and Agencies.

FY 1993 SBIR PROGRAM

	Number of Topics		Proposals Received		Phase I Awards			
	93.1	93.2	93.1	93.2	91	92	93.1	93.2
Army	36	309	498	2,840	--	246	42	--
Navy	132	145	1,624	1,102	20	84	187	9
Air Force	188	--	2,996	--	--	4	466	--
ARPA	32	87	407	817	--	--	58	--
DNA	20	--	190	--	--	--	19	--
BMDO	16	--	767	--	--	--	147	--
SOCOM	--	3	--	37	--	--	--	3
Total	424	544	6,482	4,796	20	334	919	12
Grand Total	968		11,278		1,285			

As of the FY93 Annual Report (dated 15 March 1994), most of the FY93.2 proposals were selected but not yet awarded. The figures above show a quarter of the Phase I awards made in FY93 came from the FY91 and FY92 solicitations. Of the 1,285 Phase I awards made in FY93, 258 awards (approximately 20 percent) went to minority-owned or woman-owned businesses.

In order to make information available on the technical content of the Phase I projects supported by the DoD SBIR Program, four volumes containing the abstracts and contracts for the awarded projects are published. The small business information with accompanying abstract are arranged in alphabetical order by firm name. Cross reference indices appear at the back of the volume for quick reference.

- Volume I contains Army Projects
- Volume II contains Navy Projects
- Volume III contains Air Force Projects
- Volume IV contains ARPA, DNA, BMDO, and SOCOM Projects

Venture capital and large industrial firms that may have an interest in the research described in the abstracts in this publication are encouraged to contact the firm whose name and address is shown.

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INTRODUCTION

In 1982, Congress enacted and the President signed the "Small Business Innovation Development Act of 1982" (Public Law 97-219), which created the Small Business Innovation Research (SBIR) Program to give small, high-technology firms a greater share of the federally-funded research and development contract awards.

Under the SBIR Program, each federal agency with an extramural budget for research or research and development in excess of $100 million per fiscal year must establish an SBIR Program. The program is currently funded by setting aside 1.5 percent of the participating agency's extramural R&R&D contracting dollars. The agencies participating in the Department of Defense SBIR Program are the Army, Navy, Air Force, Advanced Research Projects Agency (ARPA), Defense Nuclear Agency (DNA), Ballistic Missile Defense Organization (BMDO, formerly SDIO), and Special Operations Command (SOCOM).

The objectives of the DoD SBIR Program include stimulating technological innovation in the private sector, strengthening the role of small business in meeting DoD research and development needs, encouraging participation by minority and disadvantaged persons in technological innovation, and increasing the commercial application of DoD-supported research or research and development.

The SBIR Program consists of three distinct phases. Under Phase I, DoD components make awards to small businesses, typically of up to one man-year of effort over a period of six months, subject to negotiation. Phase I is to determine, insofar as possible, the scientific or technical merit and feasibility of ideas or concepts submitted in response to SBIR topics. Proposals selected for contract award are those which contain an approach or idea that holds promise to provide an answer to the specific problem addressed in the topic. Successful completion of Phase I is a pre-requisite for further DoD support in Phase II.

Phase II awards will be made only to firms on the basis of results from the Phase I effort, and the scientific and technical merit of the Phase II proposal. Proposals which identify a follow-on Phase III funding commitment will be given special consideration. Phase II awards will typically cover two to five man-years of effort over a period of 24 months, also subject to negotiation. The number of Phase II awards will depend upon the success rate of the Phase I effort and availability of funds. Phase II is the principal research or research and development effort, and requires a comprehensive proposal outlining the intended effort in detail.

In Phase III, an innovation is brought to the marketplace by private sector investment and support. No SBIR funds may be used in Phase III. Also, under Phase III, DoD may award follow-on contracts with non-SBIR funds for products and processes meeting DoD mission needs.

Proposals received in response to a DoD solicitation are evaluated on a competitive basis in the organization which generated the topic, by scientists and engineers knowledgeable in that area. Selections for Phase I are made in accordance with the following criteria:

- The soundness and technical merit of the proposed approach and its incremental progress toward topic or subtopic solution.
- The potential for commercial (government or private sector) application and the benefits expected to accrue from this commercialization.
- The adequacy of the proposed effort for the fulfillment of requirements of the research topic.
- The qualifications of the proposed principal/key investigators, supporting staff and consultants. Qualifications include not only the ability to perform the research and development but also the ability to commercialize the results.

The "Small Business Innovation Act of 1986" (P.L.97-443) extended the "Sunset Clause" to 1993 and increased the taxation of the extramural research and development budget to 1.25 percent. The latest SBIR re-authorization law (P.L. 102-564), signed October 28, 1992, extends the program through 2000, doubles the taxation to 2.5 percent by 1997, and increases the average Phase I and Phase II award agreements.

(7) 15

ABI
5491 BEARD ROAD
SPRINGFIELD, OH 45502
Phone: (513) 526-8861
Topic#: 92-177 ID#: 92N10-034
Office: NAWCTRN
Contract #: N68355-93-C-0121
PI: Erik Buck
Title: Innovative Power Module
Abstract: At the end of Phase I, ABI will deliver a working "subscale" power module which runs on diesel fuel and has an output of approximately 25 horsepower at 3600 RPM. The overall size, exclusive of fuel pump, cooling, and 011 tank, will be approximately the size and shape of a roll of kitchen paper towels, about 15 cm diameter and less than 40 cm long, and weigh less than 20 lbs. Phase II will develop a full-scale 250 horsepower engine which weighs less than 250 lbs. and is configured for use in aerial vehicles.

ACCURATE AUTOMATION CORP.
1548 RIVERSIDE DRIVE, SUITE B
CHATTANOOGA, TN 37406
Phone: (615) 622-4642
Topic#: 92-153 ID#: 92N2D-011
Office: NSWCDDWO
Contract #: N60921-93-C-A340
PI: Robert GEZELTER
Title: Aircraft and Cruise Missile Mission and Route Planning in Near Real-time
Abstract: Aircraft and cruise missile mission and route planning is a time-consuming and inflexible operation today. This effort proposes to use cooperative-competitive neural networks and Hierarchical Scene Structures for multisource and multisensor data fusion procedures that will build flexible data structures. These structures can then be accessed by a route planning neural network to generate coordinated aircraft/missile strike plans in minutes instead of days. An innovative form of the cooperative-competitive neural network will perform matching of complex structures and determine global goodness of match measures, a valuable new technology applicable to many purposes. This is done by defining an intermediate form of data representation at the structure level to allow identification of distinctive combinations of regions and their features as well as the standard individual regions and their features.

ADA TECHNOLOGIES, INC.
304 INVERNESS WAY SOUTH, SUITE 110
ENGLEWOOD, CO 80112
Phone: (303) 792-5615
Topic#: 93-131 ID#: 93N4C-051
Office: NCEL
Contract #: N47408-93-C-7361
PI: DR. DAVID E. HYATT
Title: Rapid High Rate Lead-in-air Monitor for Use at Firing Ranges
Abstract: The development of a simple, reliable, and easily operated system to detect and measure airborne lead (Pb) to trace levels is the subject of the Phase I effort. Lead is toxic to humans at very low levels and is ingested easily by breathing air in which elemental Pb or compounds of this element are dispersed. In firing ranges there is an opportunity for shooters and range personnel to be exposed to hazardous levels of lead and its compounds. Control of Pb levels in firing ranges typically depends on adjusting ventilation to limit Pb buildup. This control strategy depends on the ability to monitor Pb levels in the air if maximum energy efficiency in use of fans and maximum heat conservation is to be achieved. The Phase I real-time monitor for Pb levels in firing range air will provide a monitor to protect human health for those using the range and provide a continuous monitor suitable for ventilation control to assure that acceptable Pb levels can be reached and maintained. After successful demonstration of the monitoring technology for trace levels of Pb in air during Phase I, the project will proceed to development and testing of a prototype analyzer at operating firing ranges in Phase II. The results of the prototype testing will serve as the basis for a commercial lead-in-air analyzer to serve a market, expanded beyond just firing ranges, in Phase III.

ADROIT SYSTEMS, INC.
209 MADISON STREET, SUITE 500
ALEXANDRIA, VA 22314
Phone: (703) 684-2900
Topic#: 93-020 ID#: 93N47-086
Office: SPAWAR
Contract #: N00039-93-C-0161
PI: JAMES T. GEIER
Title: An Innovative Software Tool to Aid Network Engineers in Planning, Upgrading, and Maintaining Multi-networks
Abstract: ASI proposes developing a novel MultiNetwork Engineering Tool which is innovative in its unique integration of several state-of-the-art technologies with established technologies. The state-of-the-art technologies include unique network data visualization algorithms, a data driven intelligent equipment database, novel network modeling tools based on graph theory

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algorithms, network planning heuristics, and the use of a constraint language which allows network planners to develop and automate their own network planning heuristics. A state-of-the-art graphical user interface and an extensive set of on-line help is also included with the system. As new technologies are developed, authorized network planners will be able to expand, upgrade, and refine both the MultiNetwork Engineering Tool and its comprehensive help system. The tool will provide the Navy with a unique, cost-effective, state-of-the-art network planning tool which will be useful in operational network planning environments throughout many years of rapidly changing network technology. It will accomplish this by streamlining the network planning process, promoting increased understanding of the subtleties of network topologies, and providing for the continual expansion and refinement of the tool by the network planners who use the tool and the tools developers.

ADVANCED PROCESSING TECH., INC.
P. O. BOX 520838
SALT LAKE CITY, UT 84152
Phone: (801) 584-2444

Topic#: 93-124
Office: NCEL
Contract #: N 7408-93-C-7313
PI: DR. YE YI

ID#: 93N4C-097

Title: Air-sparged Hydrocyclone Technology for Removal of Oil and AFFF From Waste Water

Abstract: It is difficult to remove oil and AFFF from voluminous streams. Research has been continuously carried out to develop new technologies to be employed in this field of application with little success. Air-sparged hydrocyclone (ASH) flotation technology is a new technology developed by the University of Utah and Advanced Processing Technologies, Inc. It combines the advantages from both conventional hydrocyclones and froth floatation into a single piece of equipment and may provide a unique opportunity for the fast separation of dispersed oil from significantly large waste water streams with a proven processing capacity of about 100-600 times more than that offered by other flotation machines. A research program is proposed to DOD to investigate the feasibility for the application of the air-sparged hydrocyclone floatation technology for the removal and separation of oil and AFFF waste water. If this Phase I preliminary small-scale program is proven successful, a rather more detailed and large-scale program for both fundamental study and field testing will be proposed in Phase II.

ADVANCED PRODUCT DEVELOPMENT, INC.
2500 PEARL BUCK ROAD
BRISTOL, PA 19007
Phone: (215) 785-3230

Topic#: 93-068
Office: NAVSEA
Contract #: N00024-94-C-4055
PI: Frank Ko

ID#: 93N00-142

Title: Use Of Composite Materials For MCM Aft Deck Machinery

Abstract: Use of advanced composite materials usually offers components which are lighter and stronger than conventional materials. One of the potential applications for use of such materials is mine engineering machinery since it needs light weight good mobility and high strength. Cable reels are natural candidates of braided textile composites which contain an interlaced fibrous preform as the reinforcement providing a structural integrity only developed liquid molding techniques can combine metal attachments with the composite structure during the fabrication process. Thus the strength of the structure is guaranteed. There are two main challenges in the development of high performance textile composites. One is the design and manufacturing of the textile preforms and the other is the liquid molding process for fabricating the composite parts. The key issue is to develop integrated textile preforms with the required performance for structural applications and processability for the fabrication process. The proposed work in this project is to evaluate and characterize the performance and processability of fibrous preforms and resin materials and then develop the braiding process for the reinforced preforms and liquid molding process for the composite cable reels.

ADVANCED REFRACTORY TECHNOLOGIES, INC.
699 HERTEL AVENUE
BUFFALO, NY 14207
Phone: (716) 875-4091

Topic#: 93-011
Office: MARCOR
Contract #: N60921-93-C-A356
PI: Dr. V.F. Dorfman

ID#: 93N07-161

Title: Atomic-scale Composite Protective Coatings for the Exterior Surface of Weapon Components

Abstract: A novel coating technology is proposed for the protection of naval weapon components. Diamond-like nanocomposites constitute a new class of materials that exhibit unique combinations of technologically interesting properties including high adhesion to virtually any substrate (including metals, crystalline and glass dielectrics, plastics), excellent chemical and diffusion barrier properties, good hardness, high elasticity and flexibility, high wear resistance, very high thermal-shock resistance,

extremely low friction coefficient, controllable electrical properties, controllable refractive index, and good thermal stability especially in oxygen-free environments. In earlier research, coated specimens survived a nine-month exposure to the corrosive environment at the bottom of the black sea with no degradation in structure or properties. These coatings are deposited at low temperature (300-500K), and the size of the substrate is limited only by chamber diameter (currently a substrate of maximum size 760 mm can be coated). Both interior and exterior surfaces can be coated. Additionally, the few micron thick films can be continuously graded in composition and hence properties tailored from the interface to the bulk, to attain high adhesion and desirable thermal conductivity in the same coating. The possibility of structural reinforcement of the substrate material also exists. Phase I work will be devoted to comparative evaluation of technology alternatives, empirical confirmation of the protective properties of the DLN especially for naval weapon applications, and development of a detailed technical design approach for a manufacturing technology.

ADVANCED SIGNATURE APPLICATIONS
3366 BERNARDO LANE
ESCONDIDO, CA 92029
Phone: (619) 737-5026
Topic#: 93-003 ID#: 93N40-196
Office: ONR2
Contract #: N00014-93-C-2241
PI: VIRGINIA L. AMBRUST
Title: Advanced Adaptive Multi-spectral Materials
Abstract: The U.S. Navy has a need for improving the defense of their ships and components through high risk/payoff technologies. Self-defense can be greatly improved by using measures to control the electromagnetic signatures of Navy platforms. There has yet to be developed, a truly adaptive, multi-spectral solution. This project is to develop several material options through sputtered thin film deposition; whereby the pseudo multi-layer films will modulate the signature of sea vessels from the ultraviolet to RF regions. The proposed program is to use the research we have performed in the development of physical vapor deposited thin films, to further develop innovative coatings that fulfill the Navy's needs for the year 2000 and beyond. Prototype materials will be made by a process known as vapor deposition, along with our proprietary sputtering source. The Phase I efforts will produce materials that will provide adaptive signature regulation, wide reflectance or emittance characteristics, by continuous variation of optical admittance, and test data to demonstrate proof of concept and multi-spectral compatibility. The Phase II effort will focus on optimizing performance parameters, increasing the materials data base, and development of large scale panels for an advanced technology demonstrator.

ADVANCED SYSTEM TECHNOLOGIES, INC.
12200 E BRIARWOOD AVENUE, SUITE 260
ENGLEWOOD, CO 80112
Phone: (303) 790-4242
Topic#: 93-089 ID#: 93089-06
Office: NSWCDDWO
Contract #: N60921-93-C-0139
PI: Eric BREHM
Title: System Dependability Assessment Tool
Abstract: Dependability is an increasingly critical characteristic of the Navy's mission critical computer systems. These systems must be maintained in a state of readiness to support critical mission functions, and must be able to perform these functions correctly despite the presence of faults in system hardware and software components, and in the environments in which the systems operate. Automated tools are needed to assist in specifying and evaluating dependability characteristics of mission critical computer system designs, and in balancing dependability against other system attributes such as performance and cost. Phase I research will determine the feasibility of an automated System Dependability Assessment Tool (SDAT) for assessment of mission critical computer system dependability. SDAT will consist of separate design specification, design translation, and design evaluation components. These tool components will be extendible and will be compatible with other Navy system engineering methods and tools. Quantitative dependability measures that will be produced by SDAT include mission reliability and operational availability for critical system functions. Dependability modeling capabilities provided by existing automated tools, including the START integrated reliability and performance analysis tool, as well as other reliability prediction tools such as SHARPE and ARAM, will provide a starting point for the SDAT specification to be developed in Phase I.

ADVANCED TECHNOLOGY & RESEARCH CORP.
14900 SWEITZER LANE
LAUREL, MD 20707
Phone: (301) 498-8200
Topic#: 93-098 ID#: 93098-04
Office: NSWCDDWO
Contract #: N60921-93-C-0092
PI: Valmore F DEVOST

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Title: Self Adjusting Obturator
Abstract: The performance of guided projectiles fired in smooth-bore Navy guns is progressively degraded by barrel wear: once high temperature propellant gasses start to flow (jet) between the wall of the gun barrel and the body of the projectile, barrel wear is accelerated and propellant efficiency drops off progressively degrading gun accuracy. Advanced Technology and Research Corporation (ATR) proposes that the research and experimental work conducted jointly by Codes EPA and 702 of NSWC (1974) on nonmetallic 5"/54 gun projectile rotating bands be reinstated to evaluate the same materials for use as obturators for smooth-bore, 5-inch guided projectiles. Mr. DeVost of ATR was the NSWC/WL senior engineer assigned to the EPA rotating band program. ATR will conduct research on related information obtained in the mid-1970s by Codes EPA and EPM. Also, information will be researched on modern plastics. After a selection is made of candidate obturator materials, samples will be fabricated and tested for closure plug impact, setback shock and obturator integrity. Shock tests will be conducted on the ATR, *mega g Mechanical Shock Sensor Test Apparatus*. Scale-model studies on obturators will be conducted in a shot gun. Obturators will be fired behind standard shot gun slugs in new and simulated-worn barrels; blow-by pressures will be monitored at muzzle break.

ADVANCED TECHNOLOGY INCUBATOR, INC.
31275 NORTHWESTERN HIGHWAY, SUITE 150
FARMINGTON HILLS, MI 48334
Phone: (313) 737-9132
Topic#: 92-117 ID#: 92PMT-034
Office: NAVAIR
Contract #: N68335-94-C-0068
PI: ZVI YANIV, PH. D
Title: Matrix-addressable Liquid Crystal Displays for Visual Landing Aids
Abstract: The objective of this project is to use the newest advance in the technology of Ferroelectric Liquid Crystal (FLC) displays so that they can be used for Visual Landing Aids as well as other applications. Currently FLC's suffer from serious mechanical and temperature limitations due to the fact that mechanical stress alters the structure of the liquid crystal material. We propose to stabilize the cell by the introduction in the liquid crystal material of a small amount of monomer which, upon polymerization, will produce "volume stabilization" of the cell. The feasibility of this approach will be demonstrated by the delivery of a sample cell that will have been tested under conditions of mechanical shock and vibration as well as elevated by temperature. The cell will be delivered with suitable electronics and software to demonstrate the moving slot required for the Visual Landing Aid.

ADVANCED TECHNOLOGY MATERIALS, INC.
7 COMMERCE DRIVE
DANBURY, CT 06810
Phone: (203) 794-1100
Topic#: 91-329 ID#: 91N14-393
Office: NAVAIR
Contract #: N00019-93-C-0147
PI: Edward A. Sturm
Title: Biodegradable Reflective Chaff Material
Abstract: The use of metallized glass fibers as dipoles to reflect and confuse threat radars is a long proven military technology. The simplicity of chaff and the expected long term use of weapon systems which can be defeated by chaff guarantee its utility for many years to come. Advanced Technology Materials (ATM), Inc. has already developed a process for fiber metallization which is suitable for Production of degradable millimeter wave smoke materials". Applicability of these fibers has been demonstrated by the U.S. Army CRDEC. The method of manufacture enables uniform coating on a wide variety of filamentous substrates. Thus, conductive metal coatings can be deposited onto degradable fibers permitting testing and training of personnel without concern of long term environmental impact. In Phase I, ATM will survey potentially suitable substrate materials with proven degradability. Metallization of selected materials will be investigated. Process optimization will be performed to yield a demonstration sample and long term feasibility evaluation. In Phase II, product optimization and scale-up will be addressed along with further development of stable packaging for the degradable chaff material.

AEREON CORP.
20 NASSAU STREET, SUITE 223
PRINCETON, NJ 08542
Phone: (609) 921-2131
Topic#: 93-003 ID#: 93N33-626
Office: ONR2
Contract #: N00014-93-C-9301
PI: WILLIAM F. PUTMAN
Title: Ex-aerobody (WASP/N) Technology Exploration
Abstract: AEREON'S Wide Aperture Surveillance Platform (WASP) concept represents an effective, affordable solution to

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primary problems of airborne radar surveillance: 360 degree coverage, high altitude, long endurance and high power aperture. Very large phased array antenna panels, triangularly installed within a conformal platform, deliver unique capability for Cooperative Engagement and other Joint Service opportunities. Design studies and simulations by AEREON, under a USAF/ESD SBIR Phase I and II developed a preliminary design (WASP/AF) of this 200,000 lb. aircraft stationing its three 65 x 15 foot antenna panels above 30,000 feet for over 16 hours, unrefueled. AEREON proposes to use that technology to examine a carrier-based version, "WASP/N," a potent Navy EX candidate (EX-Aerobody). Phase I first will examine EX-specific aspects of the design: aerodynamic and structural issues raised by carrier basing; reduced size; and twin-engine configuration. Second, AEREON will examine trailing edge radome configurations and performance, critically important both to WASP/N and WASP/AF. Phase I efforts will utilize available CFD, FEA and EMR codes along with AEREON's performance and stability estimating software. A Phase II program to measure and evaluate trailing edge radome aerodynamic and electromagnetic performance and to perform experimental radar/radome investigations will be proposed.

AEROCHEM RESEARCH LABORATORIES, INC.
P O BOX 12
PRINCETON, NJ 08542
Phone: (609) 921-7070
Topic#: 93-103 ID#: 93103-02
Office: NSWCDDWO
Contract #: N60921-93-C-0157
PI: William Felder
Title: Explosibility of Magnesium Coated Boron Particles in Air
Abstract: The maximum explosion pressure rate of pressure rise and oxidant consumption will be determined for an air-suspended clouds of a unique fine boron powder less than 10 micrometers in diameter. The unique powder particles are thinly coated by a process developed at AeroChem with magnesium or aluminum to aid in their ignition. The proposed method is based on extensive work at the US Bureau of Mines measuring the explosibility of dust clouds. In Phase I experiments a cloud of particles in air will be ignited inside a closed chamber. A fast-response transducer will be used to obtain the rate of pressure rise and maximum explosion pressure. An oxygen sensor will be used to determine oxidant consumption. Phase I experiments will demonstrate the enhancement of ignition and explosion by magnesium-coated particles relative to otherwise identical uncoated boron particles. The coated particles will be produced on site. Explosion measurements made under identical conditions for the coated and uncoated powders will be correlated against the coating thickness from 1-10X of the particle mass. Phase II work will be comprised of the above and other detailed measurements in a larger scale system on both Mg- and Al-coated particles. The results will be analyzed in mechanistic terms to obtain an understanding of cloud ignition and explosion for the unique coated powders. This proposed program will integrate the particle preparation and evaluation of the new generation of boron particle explosives.

AEROMETRICS, INC.
550 DEL REY AVENUE, UNIT A
SUNNYVALE, CA 94086
Phone: (408) 738-6688
Topic#: 92-178 ID#: 92N10-068
Office: NAWCTRN
Contract #: N68335-93-C-0122
PI: William D. Bachalo, Ph.D.
Title: An Advanced Laser-based Airflow Sensor for Non-intrusive Diesel Engine Characterization
Abstract: This proposal is concerned with the development of a rugged, accurate and non-intrusive electro-optical device to reliably measure the unsteady airflow into a reciprocating internal combustion engine. The principle of operation of the proposed sensor is laser Doppler velocimetry, a technique that allows for velocity measurements without interfering with the flow. The proposed sensor presents the following advantages when compared to other methodologies: it is robust; it requires no calibration; its sensitivity to changes in environmental conditions is minimal; it presents no fouling problems; it can be used to measure both the inlet and exhaust streams; it is highly accurate; and it has a very high frequency response. The sensor can be used for both laboratory and in-flight tests. New processing techniques, and recent advances in solid-state technology make the construction of this rugged sensor possible. It is expected to be competitive with existing airflow measurement technology, both in terms of performance and price. Since laser Doppler velocimetry is an interferometric technique, the presence of contaminants or other substances in the inlet stream will only affect the signal-to-noise ratio of the signals, but not the velocity measurements. Also, since the technique is optical in nature, no obstructions or foreign objects are present in the inlet stream path. These features make this unique sensor to be highly reliable and accurate, while not affecting the engine's performance.

ALLOY SURFACES COMPANY, INC.
100 LOCKE ROAD
WILMINGTON, DE 19809
Phone: (302) 762-8900
Topic#: 91-330 ID#: 91N14-460
Office: NAVAIR
Contract #: N00019-92-C-0170
PI: John A LaFemina
Title: IR/RF Expendable
Abstract: U.S. Navy aircraft face a variety of threats which use sophisticated infrared (IR) and radio-frequency (RF) devices for homing in on targets. These missiles may either be IR or RF guided or use a combination of the two. Current U.S. Navy aircraft use separate expendables for IR and RF threats. Since the quantity of expendables is limited, and the identity of the type of threat unknown, a single IR/RF expendable would provide protection from both types of threat without the concern of identifying the of threat. This will extend the protection envelope since more expendables will be available to protect the aircraft. The cost will also be reduced once one expendable performs two functions. A dual mode expendable must possess equal effectiveness as with each individual mode, be able to fit into the existing constraint volume, and be safe in its operation. Alloy Surfaces (ASC) proposes to use its activated metal (AM) as the IR component and metallized glass chaff as the RF component in this program. ASC has compiled an extensive data base of AM materials and candidate materials for this particular application have already been identified. ASC will mix candidate IR and RF materials and optimize dispensing methods and design of the IR/RF payloads.

ALPHATECH, INC.
EXECUTIVE PLACE III, 50 MALL ROAD
BURLINGTON, MA 01803
Phone: (617) 273-3388
Topic#: 92-127 ID#: 92PMT-104
Office: NAVAIR
Contract #: N00019-94-C-0006
PI: THOMAS G. ALLEN
Title: SAR/ISAR Real-time Image Processing for Air ASW Platforms
Abstract: Using SAR/ISAR imagery to detect and classify small targets in cluttered environments for ASW applications requires careful examination of the full array of image processing, computer vision, and related methods in order to identify those that are well-matched to the problem and thus offer promise to exploit the specific spatia-temporal characteristics that distinguish targets from environmental clutter. In this proposal we describe an effort to accomplish this task. We describe several recently-developed, advanced methodologies that appear to hold special promise. In particular, in addition to standard methods of image analysis, we intend to exploit i) recent advances in multi-resolution and fractal image processing, including methods based on the wavelet transform; ii) nonlinear image analysis methods based on morphological filtering that deal with particular pattern characteristics that distinguish targets and clutter; and iii) spatia-temporal image analysis methods, aimed at exploiting the differences in the temporal coherency of targets and some sources of clutter.

ALPHATECH, INC.
EXECUTIVE PLACE III, 50 MALL ROAD
BURLINGTON, MA 01803
Phone: (617) 273-3388
Topic#: 93-185 ID#: 93N50-022
Office: NPRDC
Contract #: N66001-94-C-7013
PI: Dr. Elliot Entin
Title: Linking Cognitive Styles to Instructional Strategies for Intelligent Tutoring Systems
Abstract: Computer-based instruction offers the opportunity to increase training efficiency by adapting training to the individual needs and characteristics of the operator, but insight is needed into how to make the best use of this potential. ALPHATECH proposes to design (in Phase I) and develop (in Phase II) an Intelligent Tutoring System (ITS) that adapts to intrinsic differences in the way that individual learners acquire and use information--stable, pervasive differences in cognitive styles. The proposed innovation for the project is the systematic and incremental development of conceptual links between the learner's cognitive styles and methods for organizing instruction and presenting information during training for specific tasks performed in the Combat Information Center (CIC) on Navy ships. These conceptual links will guide the development of ITS software during Phase II. We will test the effectiveness of the ITS through experiments in Phase II, and refine the conceptual links and the ITS design based on the results.

AMERICAN GNC CORP.
9131 MASON AVENUE
CHATSWORTH, CA 91311
Topic#: 93-013 ID#: 93N07-046
Office: MARCOR
Contract #: N60921-93-C-A360

Phone: (818) 407-0092 PI: Dr. C. F. Lin/Dr. C. Yang
Title: Integrated Target Acquisition and Fire Control Solution
Abstract: American GNC Corporation proposes an integrated design approach to the development of advanced target acquisition, identification, engagement, and full fire control prototype. Based on an extensive survey of current methodologies and emerging techniques, the conceptual design proposed in Phase I will include integrated automatic target recognition subsystem, maneuvering target tracking subsystem, pointing and stabilizing subsystem, and fire control simulation. Multisensor data fusion is a key enabling technology which will be fully exploited in the project. Performance specifications, design procedures, trade studies, and implementation schemes will be developed for each subsystem and delivered at the end of Phase I. In Phase II the algorithms will be fully developed and implemented on the prototype systems. The performance will be demonstrated on typical scenarios with realistic data.

AMERICAN GNC CORP. Topic#: 92-149 ID#: 92N2D-006
9131 MASON AVENUE Office: NSWCDDWO
CHATSWORTH, CA 91311 Contract #: N60921-93-C-0154
Phone: (818) 407-0092 PI: Dr Charlie YANG
Title: Integrated ATR with Fuzzy IR Image Processing
Abstract: The integrated Automatic Target Recognition (ATR) design provides a promising approach to achieving high performance based on multisensor data fusion, processing methodology integration, and target/environmental/contextual information incorporation. In this proposal, American GNC Corp. (AGNC) will take advantage of the tolerance of imprecision offered by fuzzy logic and apply it to IR image scene modeling and pattern matching. It will also investigate the integration of fuzzy logic and neural network to blend the approximate reasoning capability of the fuzzy logic and the adaptive learning feature of neural network in target recognition. Phase I will demonstrate the benefits of such a fuzzy system in the integrated ATR system for tactical applications such as cruise missile looking for relocatable targets. The main innovations of the proposed approach are: (1) Integration of methodologies in every level of automatic target recognition processing; (2) Organization of scene models and input image structures based on fuzzy membership functions and fuzzy restrictions to increase tolerance to imprecision; (3) Augmentation of robustness of scene models and matching process and reduction of sensitivity to image quality and preprocessing; and (4) Scene model generation which takes into account individual characteristics, deviations in image acquisition, and noise effects present in the training images. In Phase II, the algorithms of scene modeling and image processing for an expert system and an integrated ATR system will be fully developed, tested, and documented. The validated algorithms will be reduced to integrated circuit scale chip sets.

AMERICAN JOINING INSTITUTE Topic#: 93-140 ID#: 93N40-515
10628 DUTCHTOWN ROAD Office: ONR2
KNOXVILLE, TN 37932 Contract #: N00014-93-C-0029
Phone: (615) 675-2150 PI: Xiaoshu Xu
Title: Helicopter Tail Rotor Gearbox Fault Detector
Abstract: The Gearbox Fault Detector is an artificial neural network based defect detection system for the helicopter gearbox. This system will detect defects in the helicopter tail rotor gearbox and also classify the type of fault. Several (four) sensors will be installed on various locations of the gearbox. The data will be continuously fed into a pretrained artificial neural network system (ANS) in real time without pre-processing. The ANS will then process that raw data and indicate if a fault exists and, if so, what type of fault exists inside the gearbox. The unique significance of this system is the use of a new neural network training algorithm, called the "Delta-Activity" algorithm to train the neural network. This algorithm can accelerate the neural network learning process, overcome learning instabilities, and optimize the net configuration. It is now possible to solve much more difficult problems on a small computer, such as an IBM-PC, within a reasonable time.

AMORPHOUS ALLOY CORP. Topic#: 93-012 ID#: 93N07-070
27722 EL LAZO ROAD Office: MARCOR
LAGUNA NIGUEL, CA 92656 Contract #: N60921-93-C-A358
Phone: (714) 643-1700 PI: Dr. D. Scruggs
Title: Amorphous Refractory Alloy Coatings

Abstract: Amorphous Alloy Corp (AAC) proposes development of amorphous refractory alloy coatings that are adherent and easily applied to reduce erosion, wear, and corrosion over a broad temperature range on advanced weapon system components (such as internal surfaces of gun barrels). The proposed coatings are a spin off from a "leading edge" commercial electroplating process utilized for hard-facing of oil well drill bits, and automotive engine components. A process applicable to gun barrels will be developed utilizing the commercial alloys as baseline. Samples will be prepared and characterized, and promising candidates will be recommended for scale-up and full scale testing in Phase II.

ANALYTIC ENGINEERING COMPANY
1590 FINCH WAY
SUNNYVALE, CA 94087
Phone: (408) 737-0745

Topic#: 92-134 ID#: 92N0A-021
Office: NAWCAWAR
Contract #: N62269-94-C-0202
PI: DR. NISAR SHAIKH

Title: Thin Film Saw Devices for In Situ Monitoring of Composite Processes

Abstract: The use of fibrous composites has greatly increased in the Navy. These composites have introduced challenging problems in process manufacturing of these materials. Dielectric sensors as well as ultrasonic embedded wave guides have been successful in cure monitoring; however, they have two severe handicaps: 1. Placement is limited to trimmings since the inclusions weaken the material; 2. The region monitored by the sensors is very small compared to the size of typical parts, requiring an impractical number of sensors. Thin film sensors, capable of covering the entire part, would solve both these problems. The proposed research, drawing on the well-developed technologies of thin film deposition and acoustic devices, would advance and adopt the Surface Acoustic Wave (SAW) device technique to develop thin film/foil distributed sensor surfaces. Thus the proven technique of ultrasonic cure monitoring can ' e made noninvasive and effective over the entire surface of tools used in production. Phase I efforts will etch surface wave (Rayleigh & L-cr) devices on the tools and construct piezoelectric sensor foils that can be attached to the surface tools or placed in the lining of vacuum bags. Testing will be done on small composite plates. Phase II efforts will advance to life-size samples.

ANALYTICAL SERVICES & MATERIALS, INC.
107 RESEARCH DRIVE
HAMPTON, VA 23666
Phone: (804) 865-7093

Topic#: 92-156 ID#: 92N13-063
Office: NAWCFTEG
Contract #: N00421-93-C-0099
PI: Dr. Siva Mangalam

Title: A Novel True Airspeed Indicator for Helicopters

Abstract: A completely new approach is proposed for the accurate measurement and display of the true airspeed of helicopters in hover, low-speed and forward flight. Unlike conventional instruments, the proposed innovation will be characterized by high-frequency response and high sensitivity across the range of helicopter flight speeds. The proposed device will provide accurate speed indication both at low and at high airspeeds. The innovation items from the following significant advances made by AS&M in recent years: (a) the discovery of a direct coupling between airspeed and frequency of flow oscillations at the leading-edge stagnation region, and (b) the invention of constant voltage anemometry. A probe of specified geometry with closely-spaced, micro-thin multielement sensors will be used in conjunction with constant voltage anemometers to determine the true airspeed as well as the flow angularity. The frequency of the electrical output signals from the instrument will be related to the true airspeed of the helicopter. The one-time calibration of the airspeed indicator will be dependent on the probe geometry but independent of the installation (e.g., H-60).

ANAMET LABORATORIES, INC.
3400 INVESTMENT BLVD.
HAYWARD, CA 94545
Phone: (510) 887-8811

Topic#: 92-145 ID#: 92N0A-083
Office: NAWCAWAR
Contract #: N62269-93-C-0249
PI: ROCKY RICHARD ARNOLD, PH.

Title: Innovative Fracturing System for Thick Aircraft Canopies

Abstract: The Phase I research proposed herein provides for using the tremendous energy and pressure generated by embedded detonating cord (EDC) to not only sever an acrylic canopy but, more importantly, create and propagate cracks that weaken and fracture the canopy. The approach is firmly based on the use of fracture mechanics principles combined with tailored experimental testing to confirm important hypothesis. Prior experience of Anamet and our consultant, Dr. George C. Sib, with the fragilization of Navy canopies and the redesign of the Navy F-18 canopy and mechanical breakers has provided a good

understanding of how stretched acrylic canopies fracture. During the early part of the Phase I work, experimental testing to determine the critical strain energy density will be accomplished and used in conjunction with Dr. Sih's theoretical analysis to define potential EDC configurations and charge sizes. Subsequently, small size panels made from stretched acrylic material will be fabricated by Swedlow, Inc. and tested by ET, Inc. Correlations of test data with design predictions will allow for the creation of a design methodology which can be applied and demonstrated on full size canopies during the Phase II effort. At the end of Phase I research, the feasibility of using EDC as the basis for an improved fracturing system for thick canopies will have been demonstrated. Most notably, this new fracturing system will not obscure pilot vision and both noise and debris will be minimized by virtue of developing systems which use the minimum amount of EDC charge.

APA OPTICS, INC.
2950 NE 84TH LANE
BLAINE, MN 55449
Phone: (612) 784-4995

Topic#: 93-003
Office: ONR2
Contract #: N00014-93-C-0237
PI: W. T. BOORD

ID#: 93N33-845

Title: Wavelength Division Multiplexed Optical Modulator for Advanced Communication System

Abstract: We propose to demonstrate the design, fabrication, and performance of an integrated optic based device which provides for both multiplexing and independent external modulation of three closely spaced wavelengths emitted by a multi-longitudinal mode laser. The innovative aspect of the proposed device is the use of an integrated optics device chip to enable coupling of the dispersed laser wavelengths into separate electro-optic modulators which encode each of the carrier wavelengths with a different signal. This device could be used in data communication systems to achieve the volume of data flow required by data systems that have an integrated form where video, voice, and data are simultaneously distributed and processed. The objective of the Phase I program is to design the various components of the Wavelength Division Multiplexed (WDM) optical modulator, and to write specifications detailing critical component parameters, fabrication procedures and/or sources for procurement of components. Phase I experimental studies will provide data for the design studies through measurements of the spatial characteristics of both the light beam of the specified laser source and the guided light beam of the integrated optic waveguide structure. This Phase I effort will provide the design specifications required to fabricate and evaluate a prototype WDM optical modulator in the Phase II program.

APPLIED MATHEMATICS, INC.
1622 ROUTE 12 BOX 637
GALES FERRY, CT 06335
Phone: (203) 464-7259

Topic#: 93-075
Office: NAVSEA
Contract #: N00024-94-C-4063
PI: Dr William J Browning

ID#: 93N00-229

Title: Standard Low Cost Display Console

Abstract: The goal of the Submarine Low Cost Display Console Project is to utilize MIL-STD-2036 to tailor the technical requirements of the console thereby allowing maximum use of NDI including COTS components. This approach will allow the U.S. Navy to obtain state-of-the-art technology in the most time-efficient manner and at a substantially lower cost than previously possible. The Phase I technical objectives are: Task 1: Investigate submarine combat system display functions and determine technical requirements for the display console in the area of submarine display functions. Task 2: Develop a Unit Specification for the display console utilizing MIL-STD-2036 as a guide to address requirements.

APPLIED PHYSICS, INC.
31 HIGHVIEW AVENUE
NANUET, NY 10954
Phone: (914) 623-7258

Topic#: 92-144
Office: NAWCAWAR
Contract #: N62269-93-C-0237
PI: PAUL H. FRISCH

ID#: 92N0A-080

Title: Proposed Design of an Improved Capability Electronic Ejection Sequencer (ICEES)

Abstract: In multiplace jet aircraft the ejection problems are compounded beyond the head, neck and spinal injuries, windblast exposure and flail injuries, by now including collision probabilities with other ejectees. The problem actually becomes one of collision avoidance by timing or sequencing the ejection to optimize a clean contact free egress, and controlling the rocket thrust magnitude and/or direction. The proposed solution focuses on the monitoring of the multiple ejection seat inertial positions and controlling the sequencing of the seat firing and control of the ejection seat gimbled rocket motors to avoid overlap of the multiple ejection seat envelopes. In order to properly control the gimble or sequence the ejection the seat envelope and relative

real time position in 3D space of each seat and the aircraft and possibly the canopy must be known. The control criteria for crash avoidance must be established and finally a detailed knowledge of the ejection platform and projected ejection trajectories will be necessary. It is proposed that each ejection platform, canopy, and aircraft itself be instrumented with a microprocessor based acceleration measuring device tracking of each inertial coordinate system as measured relative to the ground. The dosimeters will measure the platform linear and angular accelerations via commercial available sensors, and attitude of each platform. The position information can be compared to the positions of the other monitored platforms and projected ejection envelope or profile. Based on the comparison the ejection sequencing can be altered to maximize impact avoidance, or the rocket thrust vector can be controlled to alter the seat ejection envelope.

APPLIED POLYMER SYSTEMS, INC.
4302 EAST 10TH AVENUE, SUITE 404
TAMPA, FL 33605
Phone: (813) 247-3065
Topic#: 93-011 ID#: 93N07-148
Office: MARCOR
Contract #: N60921-93-C-A357
PI: William W. Bristowe
Title: Advanced Weapons Material: Exterior Surface
Abstract: Applied Polymer Systems, Inc. (APS) has developed a new plasma spray process capable of applying a polymetric resin binder with high filler levels in coating form over various substrates. The process can be robotically controlled and is environmentally friendly. A vacuum collection system captures vapors, and no solvents are used in the process. The filters can be functional and contribute to surface hardness and durability. The filters can resist the absorption of chemical agents, and can be tailored to quick release if chemical agents are absorbed. Pigments can be added to assist in achieving coloration close to the environment. Stabilizers can be added to increase durability. Six resins which can be either thermoplastic or thermoset, are included in the proposal. Close attention has been paid to maintaining resistance to thermal shock. Multi-layered coatings can be created. Excellent adhesion between layers is noted.

APTEK, INC.
1257 LAKE PLAZA DRIVE
COLORADO SPRINGS, CO 80906
Phone: (719) 576-8100
Topic#: 93-114 ID#: 93114-29
Office: NUWC
Contract #: N66604-94-C-0228
PI: Anthony W Raskob
Title: Frequency and Wavenumber-specific Active Vibration Control
Abstract: A new method for silencing internal machinery generated torpedo noise is proposed. This innovative solution to the problem has the added capabilities of: controlling on a wave vector basis the acoustic signal radiated by the torpedo and simulation of boundary layer excitation on a torpedo hull. The proposed device thus offers the capability to not only suppress internally generated noise, but flow noise as well. The Phase I program encompasses an actuator design study, supported by an ongoing APTEK Navy Potential Contractor Program (NPCP) with NUWC. Also included is testing of a pro-prototype device on a simplified geometry, and a design proposal for a prototype actuator to be tested on an actual torpedo in Phase II.

ASHWIN-USHAS CORP., INC.
206 TICONDEROGA BLVD.
FREEHOLD, NJ 07728
Phone: (908) 462-1270
Topic#: 93-127 ID#: 93N1F-001
Office: NFESC
Contract #: N47408-93-C-7316
PI: Dr. P. Chandrasekhar
Title: Mineralization of TNT
Abstract: While past TNT biodegradation efforts yielded toxic metabolites through primarily reductive pathways, recent work, e.g. with the fungus P. chrysosporium has given evidence of complete TNT mineralization at typical contaminant site concentrations (e.g. 10 g/kg in soil) although only to ca. 20% over 90 days. Much data also exists showing mineralization potentials of other fungi, e.g. Lenticula edodes and Pleurotus sajor-caju, and aromatic ring breakdown capabilities of bacteria such as Aspergillus ustus and Fusarium oxysporum. The proposed work will use ORACLE 6.0 and ORACLE SQL tools to develop a database incorporating all data on TNT degradation with prediction models. ORACLE is a relational database software operating on an entity relationship model. These data will be collected from many sources. Among the several features given emphasis will be sequential degradation with bacteria known to degrade metabolic intermediates used in a Stage II degradation following a Stage I fungal degradation, use of novel sources of degradative organisms known to cleave aromatic rings, elgl sea microbes, cowdung and certain dumpsite cultures, and new organisms not previously studied. The database will

be used to arrive at models for prediction of degradation rates under a variety of scenarios. Effect of variables such as pH, temperature, nutrients and soil type for each case will be quantified if possible, Finally, a set of degradation experiments will be outlined for future work based on the database and survey.

ASTRON CORP.
470 SPRING PARK PLACE, SUITE 100
HERNDON, VA 22070
Phone: (703) 471-0600
Topic#: 93-007 ID#: 93N07-127
Office: MARCOR
Contract #: M67854-93-C-3081
PI: Hai Tran
Title: Multipurpose Tactical Antenna (MPTA)
Abstract: Monopole and dipole antennas have been determined to radiate most efficiently when the size of the antenna is proportional to the frequency being transmitted or received, i.e., one-quarter, one-half or one wavelength. As the operating frequency is varied from that ideal frequency, nulls begin to develop which threaten the integrity of the communication link. Experience has shown that small excursions (+/- 50% of the resonant frequency) can be achieved without degrading performance by use of matching devices. But, larger bandwidths are normally accommodated by active high impedance tuning devices and couplers. This investigation will evaluate new low impedance passive broadbanding techniques to produce low profile, high performance antennas. Several Astron innovative techniques are proposed which will significantly decrease size without effecting gain and efficiency.

ATLANTIC AEROSPACE ELECTRONICS CORP.
6404 IVY LANE, SUITE 300
GREENBELT, MD 20770
Phone: (617) 890-4200
Topic#: 93-038 ID#: 93N47-155
Office: SPAWAR
Contract #: N00039-93-C-0196
PI: DR. BENSON ROSEN
Title: Coherent Processing for Lofargrams
Abstract: Because narrowband submarines emissions are constantly being reduced, one is forced to use broadband information to detect and track, still relying upon narrowband tonal energy for classification. In addition, broadband energy from interfering sources such as biologics or profilers can clutter LOFARGRAM displays. As a result existing LOFARGRAM methods are of limited utility for quiet threats operating in high clutter environments (e.g., shallow water). We propose to demonstrate new signal processing methods that will allow existing LOFARGRAM techniques and displays to be used for 1) the detection of submarine transients, and 2) the discrimination of quiet submarine signatures from strong ocean clutter. Our approach is based on using directional, coherent beamforming techniques to increase the signal-to-noise ratios of possible targets, thereby exposing the narrowband signals and tonals that would otherwise be masked by the ocean noise. Beam steering information will be derived from the initial detection of transient energy which will also be accomplished via the LOFARGRAM through the use of advanced image enhancement pre-processing techniques. The follow-on Phase II program will produce a prototype pre-processor to be used in conjunction with an existing LOFARGRAM system, as a vehicle for Navy operational personnel to evaluate the effectiveness of this technology.

AURORA FLIGHT SCIENCES CORP.
10601 OBSERVATION ROAD
MANASSAS, VA 22111
Phone: (970) 336-9363
Topic#: 92-109 ID#: 92N01-020
Office: ONR
Contract #: N00014-93-C-0037
PI: John S. Langford Ph.D.
Title: Low, Cost Dual-use Platforms for Environmental Sensing
Abstract: Unmanned aircraft and lightweight instruments are a dual-use technology that offer dramatic new opportunities to both the atmospheric research community and to operational missions of the US Navy. Aurora Flight Sciences is the first company in the world to develop an unmanned aircraft, Perseus, specifically for environmental sensing missions. The purpose of this proposal is to use Perseus as a demonstration platform for lightweight environmental sensing payloads of interest to the Office of Naval Research. Two candidate payloads are discussed in this proposal (one for tropospheric research and one for operational weather reconnaissance). During Phase I, a description of the sensor/platform system, what would be measured, and why a remotely controlled platform is scientifically/fiscally superior to the present methods of making such measurements would be documented. Phase I will produce a report that identifies concepts to be tested in Phase II. In Phase II Aurora will build the system identified in Phase I and demonstrate its predicted capabilities.

AUTOMETRIC, INC.
5301 SHAWNEE ROAD
ALEXANDRIA, VA 22312
Phone: (703) 658-4137
Topic#: 93-163 ID#: 93N40-513
Office: ONR2
Contract #: N00014-93-C-0019
PI: Andrew Murphy
Title: Joint Surveillance Data Fusion: Electronic Target Folder - The Image Registration
Abstract: The proposed effort will research and prioritize the algorithms that could be used in order to facilitate registration of imagery from various sources including National Technical Means. A proof-of-concept demonstration consisting of an imagery overlay over a Precise Target Analysis (PTA) diagram will also be performed to show the application of an "Electronic Target Folder" (ETF) in a tactical imagery system. A report funded as an option to this Phase I effort will propose methodology for the integration of algorithms into existing NIEWS systems. Additionally, a plan for the integration of the existing PTA database (approximately 400 files) will also be provided.

BALLENA SYSTEMS CORP.
5820 STONERIDGE MALL ROAD, SUITE 205
PLEASANTON, CA 94588
Phone: (510) 460-3740
Topic#: 93-014 ID: -181
Office: MARCOR
Contract #: N61331-93-C-0050
PI: Brian A. Baertlein
Title: "Neural-network Based Multisensor Fusion for Mine Detection"
Abstract: We will investigate the use of multisensor data fusion in mine detection and classification. Several sensor-fusion architectures will be explored, each of which makes use of a neural network for identify fusion. A proprietary technique will be used to train the network. The Phase I effort will comprise a feasibility study of sensor fusion for mine detection culminating in a preliminary design for a prototype device. The preliminary design study will specify sensor suites, processing algorithms estimates of the system's physical characteristics (size, weight, and required power), and an operational concept. In a subsequent Phase II effort this preliminary design will be refined, and a prototype system will be developed and evaluated.

BATTERY TECHNOLOGY CENTER, INC.
UNIVERSITY OF PITTSBURGH APPLIED RESEARCH CTR 865
PITTSBURGH, PA 15238
Phone: (412) 826-3495
Topic#: 93-050 ID#: 93N00-005
Office: NAVSEA
Contract #: N00024-93-C-4049
PI: George E Mayer
Title: Lead Acid Battery Sulphation Monitoring And Reduction/Prevention System
Abstract: Batteries for nuclear submarines have traditionally been discharged to prevent sulfation. A recent attempt to float ssN21 prototype batteries in order to achieve longer battery life and reduce battery maintenance has led to sulfation of these batteries. The battery vendor has suggested the use of regulatory to allow adequate charging of weaker sulfated cells, while protecting the stronger cells from overcharge. We propose to locate the site or sites where sulfation is occurring and to provide breadboard devices for test on the ssN21 batteries to reduce the sulfaction and/or prevent the mutation from occurring. As an alternate approach to the aforementioned regulators, we propose consideration of a pulse charger which piggybacks its output on top of the normal DC charge from the motor-generator machinery.

BD SYSTEMS, INC.
385 VAN NESS AVENUE, SUITE 200
TORRANCE, CA 90501
Phone: (310) 618-8798
Topic#: 92-181 ID#: 92N13-014
Office: NAWCFTEG
Contract #: N00421-93-C-0102
PI: Dr. J. James Butts
Title: Wireless Airborne Instrumentation System
Abstract: A small self-contained "transmitter" module, consisting of a modulated optical retro-reflector, and an optical receiver module, consisting of a laser diode light source and a photodetector, is proposed. These modules together comprise a retro-communications data readout system which can easily meet the objectives of data transmission from remote parts of a test aircraft or missile to a central acquisition system without the need for connecting wiring, without the need for supplying power to the remote location, and while operating in the environment of a modern jet fighter aircraft. The retro-transmitter can be made very small, say the size of a rivet or smaller, and can be thin and flat if desired enabling easy integration into or onto the aircraft or missile skin. The power required on the remote transmitter is small, consisting only of the power needed to modulate the retro-return of the retro-reflector. A battery comparable to a wrist watch battery should suffice. Ruggedness obtains as a result

of the small size and compactness of the device and because of its insensitivity to alignment and displacement. EMI immunity is obtained because of the use of a narrow band of optical wavelengths to effect data transmission.

BELTRAN, INC.
1133 EAST 35TH STREET
BROOKLYN, NY 11210
Phone: (718) 338-3311

Topic#: 91-290 ID#: 91N4F-005
Office: NSWCIH
Contract #: N00174-93-C-0094
PI: MICHAEL R BELTRAN

Title: Removal of Combustion Gases Produced From the Thermal Treatment of Propellants From Small Motors Utilizing Gas Scrubbers

Abstract: Excellent proposed research applicable to the problem of providing scrubbers for the removal of contaminants from the exhaust of rocket motors. The company has extensive experience in the design and construction of scrubbers and understands the problems associated with clean-up procedures for the removal of toxic gases, sub-micron particulates and acidic contaminants. This proposal is excellent and shows much promise.

BENTHOS, INC.
49 EDGERTON DR.
N. FALMOUTH, MA 02556
Phone: (508) 563-1000

Topic#: 93-003 ID#: 93N33-877
Office: ONR2
Contract #: N66604-94-C-0131
PI: SAMUEL H. PATTERSON

Title: Mine Neutralization Mini-torpedo System

Abstract: Benthos has proprietary technology that can provide small, high performance thrusters for use on undersea systems. Benthos, Inc. proposes a development effort to replace the thruster technology, developed in the 1970s, currently in use on U.S. Navy undersea vehicles, with state-of-the-art thrusters based on this technology. Test prototype vehicles outfitted with thrusters incorporating this technology achieved outstanding thrust performance. Benthos proposes to apply this technology to thrusters which can inexpensively and readily be implemented on existing U.S. Navy assets. Benthos proposes a conservative, low risk, two-phase development program. A Phase I study will collect and evaluate data to determine an optimum design configuration, fully compatible with an existing vehicle. Phase I will include an analysis of the performance improvements that can be expected when thrusters of this design are applied to the selected vehicles. Phase II includes the fabrication of prototype thruster assemblies and in-water testing to verify the predicted performance improvements. Prototype thrusters would be made available for further operational testing. It is anticipated that the tooling used to produce the prototype thrusters during Phase II will be suitable for immediate use in Phase III production, allowing rapid phasing in to service of the fully developed high performance thrusters.

BENTHOS, INC.
49 EDGERTON DR.
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Topic#: 93-109 ID#: 93109-05
Office: NUWC
Contract #: N66604-94-C-0131
PI: Tom DeGroot

Title: Low Storage Volume Vertical Array

Abstract: In response to the Navy's requirement for a low storage volume vertical array, Benthos has identified several approaches which can provide a high degree of vertical directivity and an omnidirectional pattern in the horizontal plane. In shallow water, such an array would be able to detect submerged vessels even in areas where there is a great deal of surface traffic. In deep water, the proposed array can be positioned in the sound channel to detect submerged vessel movements or deliberately activated acoustic signals. Benthos, Inc. has successfully developed miniature, high sensitivity hydrophones for use in small diameter arrays, and has expert knowledge of the tradeoffs between transducer material, noise mitigation, and size. We have proven expertise in small array construction techniques that assure high reliability. Benthos proposes to use this knowledge and experience to conduct an investigation of materials, array configurations, and manufacturing techniques resulting in the development of a low-cost, efficiently packaged, highly reliable low storage volume vertical array suitable for the applications identified above.

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BLOCK ENGINEERING, INC.
164 LOCKE DRIVE
MARLBOROUGH, MA 01752
Phone: (508) 480-9643

Topic#: 92-187 ID#: 92N44-011
Office: NAWCWPTM
Contract #: N00123-93-C-0335
PI: Dr. Kevin Silk

Title: Dual Mode Infrared (IR)/Millimeter Wave (MMW) Measurement System

Abstract: Recent advances in the development of low cost components for Infrared Detection and Millimeter Wave integrated circuits have created an opportunity to develop a low cost multi-domain sensor suite for integrated air-to-ground and air-to-air data collection. The Phase I study will examine the application of dual band (3-5 um and 8-12 um) IR detection from a single sensor device or single chip; such a chip is commercially available. Tradeoffs of performance, cost, technical risk and ease of integration with ATMS III will be performed for IR systems including the present Agema 782. The ability to maintain calibration in flight by periodic self-calibration will assure precise radiometry and potential coordination with IR spectral data. Time registration for data fusion is a standard feature of our system designs. A parallel effort will examine the application of an existing 94 GHz sensor and airborne data collection system (Joint Project Chicken Little follow on) integrated with a new 35 GHz front end. This study team has in-depth IR data collection experience and has just completed over 300 hours of MMW airborne data collection. A full data collection, reduction and target analysis system is available. Methods to develop fused algorithms on target sets will be examined.

BOSTAN RESEARCH, INC.
380 SYCAMORE MILLS ROAD
MEDIA, PA 19063
Phone: (215) 565-6104

Topic#: 92-129 ID#: 92PMT-154
Office: NAVAIR
Contract #: N60921-93-C-0127
PI: NICK BOSTAN

Title: VTOL-UAV Based on the Aircraft with Circular Rotating Wing (ACRW) Concept

Abstract: The ACRW is a revolutionary new design of a high speed, VTOL aircraft with STOL and CTOL capabilities. The aircraft consists of a circular rotating wing (CRW) which is rotably mounted to the fuselage. The CRW has the shape of a specially designed disk, is free of aerodynamically active flight controls or propulsion members and provides lift for forward flight and gyroscopic stabilization of the aircraft attitude. The fuselage will house the payload and the propulsion and control means. We have researched the ACRW aerodynamic theory, performed design calculations, conducted wind tunnel tests and computer analysis of the flow about the CRW. The wind tunnel tests and the computer analysis show a significant increase in the lift over drag when the wing is rotating as opposed to the fixed wing. Recently we have built two radio-controlled models and successfully investigated some of the ACRW flight characteristics. Bostan Research, Inc. is proposing to demonstrate the ACRW feasibility as a high speed VTOL UAV by testing three radio-controlled flying models. We have already built two new models and a third will be built during Phase I R&D. The models will have an identical configuration and mode of operation as the proposed ACRW-UAVs. The test results and flying principles will be equally applicable to aircraft of larger or smaller sizes having different configuration and uses. The enhanced aerodynamic characteristics together with the wing gyroscopic stability and artificial stiffening due to centrifugal forces, could make the ACRW the first truly efficient, high speed VTOL aircraft.

BRIMROSE CORP.
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Phone: (301) 931-7200

Topic#: 91-232 ID#: 91N34-101
Office: NRL
Contract #: N00014-93-C-2131
PI: Dr. Sean L. Wang

Title: A Novel Scheme for Ultra Wideband Low-loss Radio Frequency Link Up To Hundreds of GHz by Utilizing Self-sustained Pulsation of Laser Diodes

Abstract: A novel scheme of generating millimeter wave frequency up to hundreds of GHz is proposed for ultra-wideband low-loss radio frequency links. The scheme is based on the self-sustained pulsation (SSP) of laser diodes. The millimeter wave frequency is generated by the diode itself and can be tuned widely by simply changing the DC bias. Also, the generated millimeter wave frequency is readily FM modulated for overcoming intermodulation, harmonics and achieving higher signal to noise ratio. Comparing to direct modulation techniques, there is no external millimeter wave frequency source needed and it is free from the limitations imposed by the mounting fixtures and related parasites. Compared to the optical heterodyne technique, there is no need for high quality single frequency lasers (solid state or gas lasers) and delicate frequency and linewidth control (such as stringent temperature controlling apparatus and bulky optical cavity). Overall, the scheme is relatively simple,

flexible and suitable for optoelectronic integration to achieve small size, light weight, vibration immunity and reliability under variable conditions.

CAELUM RESEARCH CORP.
11229 LOCKWOOD DRIVE
SILVER SPRING, MD 20901
Phone: (301) 593-1748
Topic#: 93-001 ID#: 93N40-009
Office: ONR2
Contract #: N00014-93-C-0241
PI: Dr. Y. M. Fleming Lure
Title: Hybrid Ship Track Detection System
Abstract: A "Hybrid Ship Track Detection System" is proposed for fast, accurate, and automatically processing multi-channel satellite cloud imagery, focusing on 3.7 and 0.63 micron to detect ship tracks. The configuration of the "Hybrid Ship Track Detection System" includes the following processing phases: (1) data acquisition and pre-processing, in order to reduce the noise and to enhance the figure-to-background contrast, (2) quick selection of ship track suspects, based upon the most prominent feature of ship track - high contrast in contiguous pixels, and (3) complete feature space determination and neural detection of tracks. The proposed R&D work is aimed on extending existing digital processing techniques, developing new ones, and introducing robust neural architectures for improving the speed and accuracy in the detection and classification of tracks. To test feasibility during Phase I, research will (1) develop, test, and automate the pre-processing and quick selection algorithms; (2) analyze the ship track suspects and to derive the additional relevant parameters and characteristic patterns, which subsequently are used for the classification task; (3) develop the neural network classification architectures; and (4) test and assess the performance of hybrid detection system using sample cloud images with typical ship track features, with special attention paid to success rate, false alarm rate, and robustness. This will lay the ground work for the developing final algorithms, with code adhering to modern programming standards, complete documentation, and final report detailing results of test cases during Phase II.

CAMBRIDGE ACOUSTICAL ASSOC., INC.
80 SHERMAN STREET
CAMBRIDGE, MA 02140
Phone: (617) 491-1421
Topic#: 92-114 ID#: 92N01-083
Office: ONR
Contract #: N00014-93-C-0045
PI: Joel M. Garrelick
Title: Proposal for Analyzing Energy Dissipation Mechanisms to Improve Fidelity of Acoustic Scattering Predictions
Abstract: Anticipated computing advances will greatly enhance the Navy's ability to compute submarine target strength. This capability can be an important diagnostic and design tool for T.S. control. While the complexity and size of the scattering problem makes it necessary to solve large sets of structural-acoustic equations, especially at mid-frequencies, it is not sufficient to achieve high fidelity predictions. A number of other outstanding issues must be resolved. One is the lack of mathematical descriptions of the dominant energy dissipation mechanisms associated with hull and internal structure vibrations other than acoustic radiation. Such mechanisms include dry friction or Coulomb damping, viscous damping, e.g., of flexural waves, isolation mounts, and at stress concentration, air damping etc. Regardless of computing power this limits the fidelity of predictions for those T.S. components affected by submarine elasticity; the launching, propagation and scattering of elastic waves. It is the purpose of the proposed Phase I work to ameliorate this situation by identifying candidate mechanisms, developing mathematical descriptions for their behavior, criteria for required input parameters, and providing solution techniques compatible with conventional structural-acoustic numerical methods.

CAMBRIDGE ACOUSTICAL ASSOC., INC.
80 SHERMAN STREET
CAMBRIDGE, MA 02140
Phone: (617) 491-1421
Topic#: 93-123 ID#: 93123-03
Office: NSWCCARD
Contract #: N00167-94-C-0015
PI: Joel M Garrelick
Title: Active Control Systems For Ship Silencing
Abstract: Survivability of naval platforms is an important component in maintaining sea control and undersea superiority. Ship silencing efforts enhance survivability by reducing acoustic signatures. Active noise control provides an approach to signature reduction that can complement other means. This approach generally requires the use of multiple sensors to observe the surface response and multiple actuators to null the noise. An active control system therefore involves not only a complex structural system but also a complex controller. Design of an active control system for ship silencing applications requires information

derived from structural acoustics models and/or measurements as well as methods to incorporate this information into a controller design. The purpose of the proposed Phase I study is to develop an efficient design procedure and design environment in which tools can be used to develop active noise control systems and solutions.

CAPE COD RESEARCH, INC.
19 RESEARCH ROAD
EAST FALMOUTH, MA 02536
Phone: (508) 540-4400
Topic#: 93-059
Office: NAVSEA
Contract #: N00024-93-C-4051
PI: Francis L Keohan
ID#: 93N00-068
Title: Ceramer IPN Adhesives For Bonding Metallic To Non-metallic Materials
Abstract: A new room temperature curing ceramic-modified silicone resin is proposed which can be readily cured to a tough water resistant interpenetrating polymer network IPN. The proposed research explores the feasibility of modifying conventional silicone resins with free radical-curing silicate ceramic precursors to produce a new class of semi-vitreous materials for bonding thermoplastic polymer alloys to metals. The polymer-modified ceramics or ceramer adhesives are designed to cure without evolving volatile byproducts and with a minimum of bond-line shrinkage and void formation. The free radical curing reaction is not inhibited by ambient oxygen or moisture which significantly simplifies bonding operations. The IPN morphology of the proposed adhesives should imbue these adhesive materials with strong affinities for both metallic and non-metallic substrates high resistance to hydrolysis and possibly with the capacity to dampen noise. In the proposed study the methodology for preparing these novel ceramic hybrids will be developed and their ability to be cured into adherent seawater resistant materials demonstrated. A literature survey of candidate materials for this room temperature adhesive bonding application will also be performed.

CAPE COD RESEARCH, INC.
19 RESEARCH ROAD
EAST FALMOUTH, MA 02536
Phone: (508) 540-4400
Topic#: 93-118
Office: NCCOSC
Contract #: N66001-94-C-7000
PI: MYLES WALSH
ID#: 93N33-897
Title: Thermally Conductive Coatings for Aluminum Hardware
Abstract: This research investigates the feasibility of producing a metal coating with the potential of withstanding the equivalent of 2000 hours in 5% neutral salt spray with no significant corrosion failure and no penetrating scratches due to handling. The following aspects of the coating procedure are experimentally evaluated: (1) Pretreatment of the aluminum hardware. (2) Use of undercoats to reduce corrosion. (3) Multilayered coating strategies. (4) Post-treatments, sealants. (5) Tests for the prediction of the coating performance.

CAROLINIAN SYSTEMS RESEARCH CORP.
714 CHURCHILL DRIVE
CHAPEL HILL, NC 27514
Phone: (919) 929-3543
Topic#: 93-003
Office: ONR2
Contract #: N00014-93-C-0268
PI: CHARLES R. BAKER
ID#: 93N33-839
Title: Improved Detection and Classification for Shallow-water ASW
Abstract: A new approach to signal detection and classification is applied to the problem of ASW and torpedo defense for shallow-water environments. The approach is particularly appropriate for applications where the statistics of the signal and the noise are unknown and highly variable. The primary goal is a significant improvement in the detection capability of sonar for ASW in coastal shallow water environments.

CASDE CORP.
2800 SHIRLINGTON ROAD, SUITE 600
ARLINGTON, VA 22206
Phone: (703) 845-9221
Topic#: 92-133
Office: NAWCAWAR
Contract #: N62269-93-C-0231
PI: CHARLES ZANIS
ID#: 92N0A-015
Title: Tooling Concepts for the Fabrication of Large, Complex Composite Structures
Abstract: The goal of this proposal is to define and evaluate several innovative tooling concepts for the effective and affordable manufacture of large, complex, high quality composite structures. An acceptable concept(s) will be thermally responsive,

dimensionally stable, durable, and easy to fabricate and repair. This Phase I effort will consist of a trade study based on the evaluation of various innovative tooling concepts to a set of defined requirements. Specific requirements of a tooling system will be defined and prioritized to create quantitative selection criteria. Details of current state-of-the-art and new innovative tooling techniques will be compiled. One innovative tooling concept that will be considered is a hybrid composite tool composed of carbon and glass fibers impregnated with a geopolymeric matrix. The geopolymer matrix is a ceramic/polymer type material that has a low CTE and can be processed at relatively low temperatures. Internal ply layers would contain a heated section made up of glass fibers surrounding a heating element made from carbon fibers. An assessment will be made of each tooling concept based on the quantitative selection criteria. The most viable tooling concepts(s) will be selected as a basis for a Phase II demonstration program.

CERANOVA CORP.
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HOPKINTON, MA 01748
Phone: (508) 435-9093
Topic#: 93-003 ID#: 93N33-838
Office: ONR2
Contract #: N00014-93-C-0162
PI: MARK V. PARISH, PH.D.
Title: Advanced Sonar Sensor Technology
Abstract: A sonar/hydrophone "coating" on submarines, ships and torpedoes would be a great asset to their defense. An aggressive program is proposed to fabricate large area transducer composite panels for hydrophone and sonar use that could be used for such a purpose. This program will develop a high volume fabrication method for piezoelectric rods for composite applications. A functional 1-3 piezoelectric composite panel will be fabricated with a scalable, innovative technique. The test composite will be tested and characterized.

CERCOM, INC.
1960 WATSON WAY
VISTA, CA 92083
Phone: (619) 727-6200
Topic#: 93-055 ID#: 93N00-028
Office: NAVSEA
Contract #: N00024-93-C-4190
PI: Andre Ezis
Title: Light Weight Syntactic Foam
Abstract: A program is proposed to demonstrate that a syntactic foam can be produced having a density of less than 20 lbs, have a 7ft high compression modulus and low water absorption. Low density will be achieved by the fabrication and use of hollow thin-walled sintered reaction bonded silicon nitride (SRBSN) macrospheres having diameters up to 3O inches. The SRBSN macrospheres will be fabricated using slip cast rotational molding improved low-density crosslinkable polybutadiene NPED3 resin systems will be evaluated to achieve a syntactic foam with high compression modulus and low water absorption. Analytically evaluated results will be used to select materials and processes for the design of production methods for statistically controlled and optimized production syntactic foams.

CHARLES RIVER ANALYTICS, INC.
55 WHEELER STREET
CAMBRIDGE, MA 02138
Phone: (617) 491-3474
Topic#: 92-174 ID#: 92N0A-088
Office: NAWCAWAR
Contract #: N62269-93-C-0434
PI: DR. GREG L. ZACHARIAS
Title: Hybrid Fuzzy Logic Flight Control Systems
Abstract: The Phase I study will develop and demonstrate a hybrid fuzzy logic controller for a high performance aircraft stability augmentation system. Our proposed approach combines genetic algorithms (GAs) and fuzzy logic controllers (FLCs) with an optimal pilot model for predicting handling qualities metrics. An FLC will be designed to deal with static/dynamic instabilities, plant uncertainties, and large variations in flight conditions, for a reduced order model of a high performance aircraft. A genetic algorithm (GA) will be used to optimize the attributes of the FLC, including membership functional form and parameters, the FLC rule base, and the defuzzification process. FLC fitness, in the GA context, will be evaluated via the use of the Optimal Control Model (OCM), an analytic model of the pilot which can support the computation of closed-loop piloted performance and handling-qualities metrics. We propose to evaluate feasibility of the approach via four tasks. We will: (1) define a limited-scope (FCS design problem), and specify the hybrid FCS architecture; (2) develop and optimize the design in CASYS, a system description language; (3) validate performance and compare with a conventional FCS approach; and (4) generate requirement specifications for full development and validation.

CHI SYSTEMS, INC.
GWYNEDD PLAZA III, BETHLEHEM PIKE AT SHEBLE LANE
SPRING HOUSE, PA 19477
Phone: (215) 674-8710
Topic#: 92-161 ID#: 92PMT-280
Office: NAWCFTEG
Contract #: N00421-93-C-0105
PI: DANIEL D. RILEY
Title: Anthropometric Guidance for E-2C Crewstation Redesign
Abstract: CHI Systems proposes to develop and exercise a methodology that will enable pilot anthropometry and eye positioning data to be used to optimize the selection and placement of electronic displays in the E-2C cockpit. In Phase I we will (1) define electronic information display options and human factor issues that impact display selection and placement, (2) identify E-2C critical pilot tasks that impact display selection and placement, (3) specify design techniques and tools that facilitate Hawkeye pilot eye position and anthropometric data collection and analysis, (4) construct Phase II plan and schedule for E-2C pilot anthropometric and eye-point data collection, analysis, and utilization, and (5) document Phase I findings and associated recommendations. In Phase II we will (1) collect actual E-2C pilot anthropometric and eye position data using fleet and readiness squadrons, (2) translate these data into a form that is meaningful to E-2C display suite development, and (3) produce guidelines for E-2C display selection and placement.

CHI SYSTEMS, INC.
GWYNEDD PLAZA III, BETHLEHEM PIKE AT SHEBLE LANE
SPRING HOUSE, PA 19477
Phone: (215) 542-1400
Topic#: 92-165 ID#: 92PMT-294
Office: NAWCFTEG
Contract #: N00421-93-C-0109
PI: ALLEN L. ZAKLAD, PHD
Title: Analysis of E-2C Long Duration Missions
Abstract: CHI Systems Inc, proposes to study the E-2C mission and to determine the conditions under which its traditional 4-5 hour duration can be extended without additional detrimental effects on aircrew performance. In Phase I we will (1) identify and assess key factors in E-2C fatigue via knowledge acquisition from current aircraft domain experts using interview, survey, and literature search, (2) make preliminary assessment of methods to reduce the aircrew fatigue effects, (3) assess the feasibility of adapting the existing PERFECT (PERFormance Effectiveness of Combat Troops) model for simulating aircrew effectiveness, (4) document the analysis of key aircrew fatigue factors, design information on the PERFECT model, a preliminary assessment of extended duration mission achievement, and a Phase II plan. In Phase II, we will (1) establish the endurance limit conditions under which Hawkeye aircrews can maintain effectiveness, (2) select and validate fatigue factor effects, procedures, (3) use the adapted PERFECT model to assess candidate procedures and technologies for reducing fatigue effects on long-duration E-2C missions.

COMPLERE, INC.
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PALO ALTO, CA 94302
Phone: (415) 321-5630
Topic#: 92-110 ID#: 92N01-034
Office: ONR
Contract #: N00014-93-C-0050
PI: F.K. Owen
Title. Laser Fluorescence Anemometer for Oceanographic Instrumentation
Abstract: Efficient and cost effective ocean out-fall dilution systems are essential to the health of the ocean environment. Unfortunately, wastefield transport and subsequent ocean out-fall dilution are complex functions of the local ocean stratification and currents and the out-fall and diffuser locations and design. Variables such as effluent discharge riser spacing, diameter and jet efflux velocity determine the depth of submergence, wastefield thickness and dilution. Detailed field measurements of out-fall performance are few and there is insufficient data with which to assess the performance of existing mathematical prediction models. Turbulence models which attempt to predict multiport riser mixing must include the influence of velocity-concentration cross-correlations. Unfortunately, little or no information is available on the form or magnitude of these cross-correlations. Extensive measurements are required to help to establish a waste water mixing data base which could be used both as a mixing modeling guide and for design purposes. Detailed, non-intrusive optical measurements of riser turbulent mixing characteristics will provide new information on riser mixing effectiveness and the effects of changes in ocean current magnitude and direction. These measurements will be made with a new optical probe which will be designed and tested in a simple water tank during Phase I.

COMPUTER & INFORMATION SCIENCE, INC.
34 TIMBERGREEN CIRCLE
DENTON, TX 76205
Phone: (817) 565-2767
Topic#: 93-033 ID#: 93N47-201
Office: SPAWAR
Contract #: N00039-93-C-0201
PI: PAUL S. FISHER
Title: Satellite Oceanographic Image Interpretation
Abstract: The idea of automated processing of imagery has been the desire of technology since devices to collect volumes of images have been in operation. In this proposal we discuss the relative merits of automated image processing in the spatial and transform domain. We suggest that with the development of wavelets and vector quantization (VQ) used in compression, the possibility exists to use the values in the transform space to perform pattern recognition. In addition, we have combined the wavelet transform with the affine transform of fractal compression to provide a means to represent features in a rotation and magnification independent format. One can use these transform coefficients or identifiers (in the case of VQ and fractals) to represent the components of the image. Using these values, it is possible to apply finite inductive sequences (FI) to strings of these identifiers for the purpose of pattern recognition. The FI technique is briefly explained and its application to this process is described. The proposed data structure for storage and communication is the coefficients from the transform space, whatever they turn out to be.

COMPUTER & INFORMATION SCIENCE, INC.
412 RIDGECREST CIRCLE
DENTON, TX 76205
Phone: (817) 565-2630
Topic#: 93-187 ID#: 93N50-028
Office: NPRDC
Contract #: N66001-94-C-7011
PI: Bruce J. West
Title: Rapid Measures of Brain Activity to Assess Learning Effectiveness
Abstract: We propose the application of newly developed data processing techniques to ERP time series obtained under laboratory conditions in which subjects are engaged in learning tasks of varying degrees of difficulty. The techniques will enable us to further develop and refine quantitative measures of brain activity associated with knowledge acquisition and the development of skills. We have established the various conditions as described by West (1990). Herein we propose to extend these preliminary studies in such a way as to assess the state of a normal subject in situations with high data flow and requiring rapid decisions. We have designed a set of vigilant experiments from which to obtain the appropriate ERP data base. Existing data will be processed using present techniques and the quantitative measures so obtained will be compared with those resulting from the proposed modifications of those methods. Such questions as the length of the data record, sampling rate, use of mutual information, resolution, stationarity, stability of dimension, etc., will be addressed in Phase I of this program.

COSOFT DESIGNS, INC.
10300-54 CAMINITO CUERVO
SAN DIEGO, CA 92108
Phone: (619) 281-3009
Topic#: 93-120 ID#: 93N33-924
Office: NCCOSC
Contract #: N66001-93-C-7008
PI: NATHANIEL L. COHEN
Title: Integrated Broadband Radar Technology
Abstract: The capabilities of conventional state-of-the-art radar systems are inadequate for many of the present and anticipated requirements, such as location and tracking of sea skimmer and cruise missiles and other stealthy targets, and for FOLPEN applications. The use of Ultra-Wideband radar for this purpose shows significant promise. Development of a practical radar depends on the development of new techniques of design for antennas, receivers and microwave power generating equipment. This proposal describes a new and novel antenna which combines the features of a broadband antenna and a microwave power generator. New approaches to receiver design for this class of system are also addressed, and a performance estimate is planned to validate the design approach.

COVALENT ASSOC., INC.
10 STATE STREET
WOBURN, MA 01801
Phone: (617) 938-1140
Topic#: 93-086 ID#: 93086-08
Office: NSWCDDWO
Contract #: N60921-93-C-0131
PI: Dr Victor R KOCH
Title: New Turbostratic Mesocarbon Microbeads and Low Temperature Electrolytes for LIxC6/LIXCO02 Cells
Abstract: The Navy requires high energy density batteries to power underwater vehicles. The Li/LiX Co O2 cell has been

identified as a promising redox couple for this particular application. A formidable stumbling block to the advancement of this technology resides in the inability of non-aqueous electrolytes: to enable the anode to be charged without Li dendrite formation; and to withstand the highly anodic potentials required by the cathode on charge. In order to circumvent these problems, we have identified two new turbostratic mesocarbons which will be substituted for the Li anode during Phase I. In addition, we will test two new high rate electrolytes which should provide both a high anodic window with good low temperature performance. The combination of a mesocarbon anode with high rate electrolytes is expected to advance rechargeable LiX C6/LiX Co O2 battery technology, specifically for U.S. Navy application.

COVOFINISH CO., INC.
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NORTH SCITUATE, RI 02857
Phone: (401) 568-9191
Topic#: 93-118 ID#: 93N33-818
Office: NCCOSC
Contract #: N66001-94-C-7001
PI: DR. GEORGE HRADIL
Title: Nickel Coating of Aluminum Alloys
Abstract: An investigation of nickel coating processes to provide corrosion protection for 6061-T6 aluminum alloy in a marine environment is proposed. The effects of aluminum preparation and pretreatment steps will be investigated. Additionally, strategies which utilize multiple layers of nickel of different compositions will also be explored.

CREARE, INC.
P.O. BOX 71
HANOVER, NH 03755
Phone: (603) 643-3800
Topic#: 93-109 ID#: 93109-04
Office: NUWC
Contract #: N66604-94-C-0250
PI: Dr Mark R Kennedy
Title: Low Storage Volume Integrated Hydrodynamic Deployment System for Vertical Line Arrays
Abstract: Vertical Line Arrays (VLAs) have the potential of significantly improving the performance of underwater acoustic systems in shallow water scenarios. Realizing this improved performance in a low storage volume, cost effective system is dependent on an Integrated Hydrodynamic Deployment System which ensures optimal acoustic performance of the Navy's VLA. Creare proposes to develop such a system which will provide for constant and optimal VLA configuration over the range of operational conditions. Specifically, Creare's system will utilize a Buoyant Lifting Body (BLB) with a flared VLA. The BLB will provide a vertical tension force on the VLA which increases with current speed resulting in a constant lift-to-drag-ratio and a constant array configuration, for the range of currents. For optimal survivability, the BLB will be inflated with ployurethane foam. Creare's integrated approach to VLA deployment system hydrodynamics in synergy with the Navy's acoustic sensor package will allow the superior performance of VLA acoustic sensors to be realized in shallow water scenarios.

DANIEL H. WAGNER ASSOC., INC.
2 EATON STREET, SUITE 500
HAMPTON, VA 23669
Phone: (804) 727-7700
Topic#: 93-084 ID#: 93084-10
Office: NSWCDDWO
Contract #: N60921-93-C-A355
PI: W R MONACH
Title: Near Real-time Data Fusion
Abstract: This proposed Phase I research will prove basic concepts of a Near-Real-Time Data Fusion and Resource Allocation System, called OPEN EYES, which promises significant expansion of the range and effectiveness of today's sensors and weapons. This performance improvement will be achieved by real time processing of the threat picture using a high fidelity, nonlinear model. In this unified model, we will represent not only the positive information represented by the sensor contacts but the intelligence information received from all sources, negative information across sensor systems and across platforms, threat level information produced by simulated tactical projections, and real-time environmental information from fleet predictions. This improved picture will achieve real tactical advantage by rescheduling radar resources optimally in real time and by optimally assigned weapons systems to threat sectors.

DATAMAT SYSTEMS RESEARCH, INC.
13944 SO. SPRINGS DRIVE
CLIFTON, VA 22024
Topic#: 92-157 ID#: 92PMT-249
Office: NAVAIR
Contract #: N00019-94-C-0072

Phone: (703) 222-5996 PI: B. K. GOGIA
Title: Training Systems Domain Modeling Process
Abstract: A major problem in reusability is the creation of components that can be reused in applications other than the application for which they were originally designed. Software reusability has long held out the unrealized promise of increased productivity. It is accepted that within product development, reusing of software components will greatly reduce time and thus save money. It is our belief that the process to generate the domain model, and the techniques and tools necessary to develop the models are not understood by the software engineering community as a whole and even less so in the flight simulation community. We feel it is necessary to first understand the methodology and its ramifications which promotes the software reusability. The domain models will promote the reusability of software artifacts, other than code, which could be used in development of the next generation of flight simulation systems. This is a proposal to develop the process for domain modeling for flight simulation domain. The proposal will take into account the modeling techniques appropriate for software reusability for future flight simulators.

DCS CORP. Topic#: 92-166 ID#: 92PMT-297
1330 BRADDOCK PLACE Office: NAWCFTEG
ALEXANDRIA, VA 22314 Contract #: N00421-93-C-0110
Phone: (703) 683-8430 PI: MICHAEL MASSIMI
Title: Use of Helmet Mounted Displays on the E-2C
Abstract: The objective of this SBIR project will be to research the applicability of helmet mounted displays to the E-2C mission. Specifically, since almost all helmet mounted displays are developed for the fighter/attack fixed-wing mission or the attack/scout rotary-wing mission, the question as to whether the available and near-term technology is readily adaptable to the E-2C AWACS mission requirements. To answer this question, in-depth analysis of mission related operational requirements will be performed to determine minimum performance requirements for any display system to meet. Research into helmet mounted display technology will then be performed to determine if current technology can meet these requirements. As part of this analysis, helmet mounted displays will be compared to flat panel displays to assess the effectiveness of the two technologies in meeting the operational requirements. Finally, a research road map will be proposed for further study in the effective display of information for the E-2C crew. The combined research, analysis, and assessments will form the basis for a recommended approach in meeting the needs of the E-2C cockpit crew.

DECISION DYNAMICS, INC. Topic#: 93-004 ID#: 93N33-744
8601 GEORGIA AVENUE, SUITE 806 Office: ONR2
SILVER SPRING, MD 20910 Contract #: N00014-93-C-0220
Phone: (301) 565-4040 PI: LOUIS EDWARD ALFELD, D.SC
Title: Technology for Affordability
Abstract: To support its future mission capabilities, the U.S. Navy needs affordable acquisition programs and a responsive industrial base. To achieve a "technology for affordability" will require advances in science and technology, both hardware and software. Models and simulations represent a key thrust area. This proposal describes how a "family" of interrelated system dynamic models will be able to simulate the behavior of engineering, production, manufacturing and life cycle processes. Understanding the dynamic behavior of these processes will enable planners to reduce the cost of weapons systems acquisition. Modeling and simulation stands at the threshold of a new breakthrough in control over complex feedback systems. This proposal shows how that breakthrough can occur. The proposed project explores the development of linkage among models so that engineers can directly test the producability and cost of their designs. The result will provide the USN with more cost effective, reliable and maintainable weapons systems.

DECISION DYNAMICS, INC. Topic#: 93-042 ID#: 93N47-011
8601 GEORGIA AVENUE, SUITE 806 Office: SPAWAR
SILVER SPRING, MD 20910 Contract #: N00039-93-C-0218
Phone: (301) 565-4040 PI: LOUIS EDWARD ALFELD, D.Sc
Title: Logistics Technology Forecast Tool for Hardware and Software Including NDI
Abstract: The proposal describes a method for developing a dynamic simulation model of the operational and aging processes

of Naval weapons systems. The simulation model will forecast the logistics requirements for alternative technology choices, including life cycle costs. The model will capture, in as much detail as desired, each of the critical systems and components within a weapons system and track their aging and obsolescence over time. For each system, the model will compute performance deterioration as well. Periodic maintenance and refitting will reset model parameters to reflect increased performance levels. Logisticians and program managers will be able to test a variety of operational "what-if" technology scenarios in order to discover the optimal policies that best meet mission requirements and, at the same time, satisfies both short-term and long-term logistical budget constraints. Model output will provide cost and performance curves as well as the present value of cumulative costs for new technologies to upgrade ships, weapons systems and support facilities.

DECISION SCIENCE ASSOC., INC.
10980 POPLAR FORD TRAIL
MANASSAS, VA 22110
Phone: (703) 754-0284

Topic#: 93-089
Office: NSWCDDWO
Contract #: N60921-93-C-0145
PI: Jacob W ULVILA

ID#: 93089-10

Title: A Quantitative Method for Trading Off Dependability with Other System Attributes

Abstract: This research is aimed at producing a dependable system design prototype. It will serve as a testbed for research on the integration of dependable automation support into the systems design process by assisting designers in quantifying tradeoffs between dependability and other system attributes. Phase I consists of three tasks. In Task 1, we will identify the important factors in systems design that lead to tradeoffs among attributes. This will involve: Identifying system design features, specifying dependability, performance, and other system attributes, and identifying the relationships between design features and system attributes. In Task 2, we will develop a methodology for quantifying tradeoffs. This will most likely be based on the principles of multiattribute utility analysis, but may include features from other methods as well (such as the analytic hierarchy process, fuzzy decision analysis, or imprecisely defined multiattribute utility analysis). In Task 3, we will specify the requirements and design of a prototype system to implement the methodology. We will also prototype any critical risk areas of the design. The dependable systems design prototype will be fully developed and demonstrated in Phase II.

DEFENSE RESEARCH TECHNOLOGIES, INC.
354 HUNGERFORD DRIVE
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Topic#: 93-114
Office: NUWC
Contract #: N66604-94-C-0248
PI: Tadeusz M Drzewiecki

ID#: 93114-18

Title: Acousto-fluidic Active Vibration Isolation for Torpedoes

Abstract: Active cancellation of low frequency hull-transmitted noise due to machinery-induced vibrations from torpedo hulls in the 0-1500Hz regime is of significant interest to the Navy, as it would lead to significant decreases in detection range. This proposed SBIR effort takes advantage of the availability of low cost computers and microprocessors coupled with a unique innovative adaptation of acousto-fluidic technology to provide high resolution, high signal-to-noise ratio, low harmonic distortion control of pneumatic isolating mounts that are between the hull and the machinery. Acousto-fluidic amplifiers will provide a direct electro-acoustic interface with a commercially available electronic noise cancellation controller. Preliminary experiments under R&D funding have already demonstrated that fluidic amplifiers can drive a pneumatic mount with sufficient control authority low harmonic distortion and frequency response to beyond 1500Hz. Canceling forces greater than have ever been possible with electro-mechanical valves have been demonstrated for suppressing machinery noise and thus it is apparent that similar performance will be possible for the suppression of torpedo machinery noise. This Phase I effort will demonstrate a full closed-loop noise cancellation system using an off-the-shelf noise controller coupled with conventional sensors with a unique and innovative application of acousto-fluidic amplifiers to drive an elastomeric pneumatic mount in a laboratory environment. A Phase II effort would take this technology and provide a technology demonstration on an actual torpedo under nominal operating conditions.

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Topic#: 92-183
Office: NAWCFTEG
Contract #: N00421-93-C-0104
PI: Mark Yager

ID#: 92N13-043

Title: A Hybrid Expert System And Neural Network

(30)

Abstract: A difficult problem of software configuration control is to determine the effects of a contractor's change to "frozen" software. The test team must ascertain the extent and nature of changes and how much regression testing may be needed. A hybrid integration of an artificial neural network (ANN) and knowledge-based expert system (KBE) is proposed to provide parameterized estimates for effects due to software changes. The ANN will be constructed automatically from documentation (i.e. specifications, CASE tools, etc...). Each neuron will represent a module with interconnections representing functional dependencies. The ANN will "learn" cause and effect relationships of software changes by being trained on examples describing actual changes and their effect (failure or non-failure). An operator will perturb the system based on a proposed software change; the KBE will determine pertinent information, utilize the ANN to obtain probabilistic estimates of failure, and determine the following parameters: 1. number of modules indirectly affected; 2. probability a failure will occur within the module(s); 3. probability a failure will occur in other modules; 4. minimum amount of testing time needed to reach an operator input confidence level; and 5. optimal testing strategy given an operator input amount of test time available.

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4561 SW 34TH STREET
ORLANDO, FL 32811
Phone: (407) 648-9036

Topic#: 93-033 ID#: 93N47-153
Office: SPAWAR
Contract #: N00039-93-C-0193
PI: SHUWU SONG

Title: ATDA Structure and Architecture for Automated Image Interpretation

Abstract: The goal of this project is to develop new approaches and innovative ideas, which are needed to represent oceanographic satellite imagery using data structures of software architecture that facilitate storage, transmission, processing throughput and accuracy of automated analysis results. Wavelet representation provides a unified framework for techniques including image features analysis, image compression and recognition. Wavelet bases are more attractive than traditional hierarchical bases because they are orthonormal, linear, continuous, and continuously invertible. Choosing wavelets that are simultaneously localized in both space and frequency, and decomposing a signal into a multiscale hierarchical basis with orientation selectivity, can provide a powerful methodology for automated analysis. Neural network will be used in pattern classification for the wavelet representations. The research of this proposal, which takes advantage of the latest image analysis and recognition methods, wavelet transform and neural network, shall lay a solid foundation for the development of an image analysis workstation for oceanographic satellite imagery. The first objective of our investigation is to identify those methods of wavelet representation that perform best in terms of interpretation and automated analysis. The second objective is to develop an image analysis workstation which integrates the most effective image interpretation methods and most advanced image processors for the oceanographic satellite imagery analysis.

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Topic#: 93-037 ID#: 93N47-131
Office: SPAWAR
Contract #: N00039-93-C-0158
PI: DAVE DEFATTA

Title: Adaptive Processing for Shallow Water LFA Operations

Abstract: The overall objective of the proposed research is to develop effective monostatic and bistatic adaptive processing techniques for shallow water Low Frequency Active (LFA) operations. The focus of our proposed research is to achieve spatial reverberation cancellation for the complex shallow water environment using adaptive beamforming techniques. Our efforts will extend the favorable results we achieved for a deep-water, wideband active sonar adaptive beamformer to the shallow water environment. The previous work resulted in two promising adaptive algorithms: Cholesky Factorization - Minimum Variance Distortionless Response (CF - MVDR) and Constraint Preprocessor/Joint Process Least-Squares Lattice Adaptive Filter (CP/JPLSL). We will apply a beam-space adaptive filter to provide Coherent Spatial Discrimination (CSD). The adaptive filter operates on beam data whereby, in addition to the selected primary beam, one or more adjacent reference beams are selected on each side of the primary beam. The reference beams are constructed such that they receive the interference, but are essentially prevented from receiving signals coming in from the primary beam look direction. The adaptive filter uses the reference beams to provide a good estimate of the interference contaminant in the primary beam. It then subtracts the adaptive filter output from the primary beam output to obtain the desired "interference canceled" beam.

DIGITAL SYSTEM RESOURCES, INC.
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Phone: (703) 263-2892
Topic#: 93-076 ID#: 93N00-232
Office: NAVSEA
Contract #: N00024-93-C-4067
PI: Stu Adams
Title: Passive Automation
Abstract: The Phase I objective is to generate the technical basis for creating an automated computer aided combat command system (ACCS) that will provide various levels of automation dependent on the amount of time remaining before critical decisions must be made. The operator will have access to various types of displays depending upon the situational response time requirements. An additional feature of the ACCS will be that the amount of automation will be operator controllable. This innovative research focuses on a decision making process aboard the submarine that creates a hierarchy of information through the use of knowledge based expert systems that can be monitored by the watch stander. The level of detail provided the watch stander will vary from top level recommendations automatically executed to information summaries. The level of automation utilized will be operator selectable. Previous and on-going programs being implemented by DSR are developing passive automatic acoustic detection tracking and contact classification techniques; these techniques will provide results that can be symbolically displayed in geosit format as part of the watch stander's data base. Other techniques and research results will be incorporated as they become available.

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Phone: (703) 263-2826
Topic#: 93-077 ID#: 93N00-247
Office: NAVSEA
Contract #: N00024-94-C-4048
PI: Fred Bloch
Title: COTS Supportability in Military Systems
Abstract: To get the maximum benefits of commercial technology DoD must act like a commercial customer. It must therefore rely on competition to establish fair prices, and the best technology product improvements; and rely on the marketplace to define standards of quality to weed out noncompetitive suppliers. DoD expends considerable resources acquiring MKL-SFEC systems that come free in commercial systems. Increased use of COTS hardware and software may require logistic strategies that are different from those used to support traditional military systems. These strategic changes must address specific functional elements of COTS support as well as the traditional logistics process. While there are multiple functional elements of Life Cycle Support, increased use of COTS requires a new assessment of three critical support areas: configuration management, field support and data rights. The objective of the proposed Phase I effort is twofold. First, COTS insertion into a fielded system, specifically the ANBQ2-5 sonar system, will be investigated especially as it impacts the logistics support aspects of the system. Secondly, the proposed effort will develop an innovative approach to life cycle support for DoD systems with a high content of COTS products. This approach referred to as Materiel Readiness Guarantee (MRG) will be developed as a means of focusing the logistics process on the ultimate objective - affordable operational readiness and system availability. In the process DSR will effectively deal with process improvements for the traditional logistics support configuration management field support and data rights.

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Topic#: 93-078 ID#: 93N00-262
Office: NAVSEA
Contract #: N00024-94-C-4044
PI: Fred Bloch
Title: Utilization of High Resolution Color Displays For Sonar Data
Abstract: The objective of the proposed effort is to improve time to detection and probability of detection for contacts such that the results are suitable for direct application to current sonar systems. The proposed approach is to use color for providing additional information content and not merely annotating existing information from the work already completed. We have high confidence that operator performance can be enhanced by the proper use of color. The proposed effort is an important step leading to the realization of the benefits through fleet deployment. Color display technology has become readily available for military applications in the last several years. The issues of resolution environmental shock and vibration have been overcome with technologies such as tension mask CRTs. It is now feasible to update existing military systems with color technology at a cost less than that required to extend the life of the end-of-life monochrome displays currently installed. The research proposed in this task will address the development of cost effective approaches for migrating systems from monochrome to color. This

migration will result in improved operator recognition of events and reduced reaction time to events. Because it is costly to rewrite or update existing code in existing processors for color display formats, this research will focus on using the existing system display data that would be present at the display input and enhancing it for color presentation.

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Topic#: 91-331 ID#: 91N0A-169
Office: NAWCWAR
Contract #: N62269-93-C-0523
PI: Fred H. Bloch
Title: Single Channel Sonobuoy Modular Acoustic Processor (MAP)
Abstract: The proposed Phase I effort will define a single channel sonobuoy processor that is capable of processing any of the current and planned sonobuoys. In addition to the pure processing function, the processor will be capable of storing a significant amount of display data and of being reconfigured, to process data from different sensors, in a short amount of time. The processing system must also be capable of performing auxiliary functions, such as synchronizing with sonobuoy downlink commands, and performing I/0 to display, post processing, and control functions. Synchronization between sensors, for cross correlation, for instance, will also be provided. In essence, these analyses will result in the determination of a system architecture, allocating functions between the single channel Modular Acoustic Processor (MAP) and the common support functions and defining inter-function interfaces. As a precursor to definition of the processor, the initial Phase I effort will determine what functions the processor must implement, and what functional and physical performance is needed to meet the operational requirements. This will result in a specific recommendation for the internal structure of the processor, including interfaces, processing resources, and storage. Also included in the processor design will be the run time software structure, and the assignment of functions among the various levels of software that will execute on the processor.

DORNE & MARGOLIN, INC.
2950 VETERANS MEMORIAL HIGHWAY
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Phone: (516) 585-4000
Topic#: 93-119 ID#: 93N33-907
Office: NCCOSC
Contract #: N66001-93-C-7009
PI: JOHN COSENZA
Title: Multi-octave Passive VHF/UHF Monopole Antenna
Abstract: A multi-octave (30-500 MHz) passive monopole antenna design is proposed. The design concept is based upon the combination of 2 new techniques. A proven sectoralized radiating element, combined with the self complementary antenna principle as defined by Y. Mushiake. Ultra broadband radiation pattern performance and impedance characteristics are anticipated. The performance goals are to achieve 0 dB gain across the specified frequency band in the minimum size package. Very low loss materials shall be studied to determine survivability in a field deployment. The technique may be expanded to determine minimum size antennas over any specified band of operation. Only materials that are commercially available shall be used.

EAST, INC.
5419 SOUR GRUM DRIVE
CENTREVILLE, VA 22020
Phone: (703) 968-9855
Topic#: 92-159 ID#: 92PMT-262
Office: NAVAIR
Contract #: N00019-94-C-0071
PI: DR. JERRY L. WEST
Title: Environmental Degradation Model for Infrared Acquisition and Tracking
Abstract: Topic N92-159 stated a NAVAIR requirement for environmental degradation models to enhance the effectiveness of PC-based training devices. The purpose of this Phase I SBIR effort is to demonstrate feasibility of upgrading NAVAIR training devices with environmental degradation models using real world infrared video of target and background scenes. Phase I objectives will seek to (1) identify efficient PC-based degradation algorithms for environmental modelling (2) investigate real scene database and computer processing requirements for simulating infrared weapon performance in varying environmental conditions, (3) determine architectures for upgrading NAVAIR training devices for infrared Maverick and SLAM with environmental degradation modules. Multimedia technologies will be considered to optimize PC configuration for video storage, image processing, dynamic simulating and graphic realism. PC-based training devices for the laser and infrared Maverick will provide proof of concept opportunities for the proposed Phase I and Phase II SBIR effort.

EDGE TECHNOLOGIES, INC.
4455 W 62ND STREET
INDIANAPOLIS, IN 46268
Phone: (317) 293-2165
Topic#: 92-118 ID#: 92N37-043
Office: NAWCMUGU
Contract #: N68936-93-C-0248
PI: George Kim
Title: Finishing of Optical Domes
Abstract: Edge Technologies, Inc. (ETI) proposes the investigation of the tribological machining phenomena between single crystal sapphire and plasma deposited amorphous silicon oxide (a:SiOx) in the presence of free oxygen. This phenomena, originally developed, has never been modeled. It is believed to incorporate high asperitite energy generated from sliding tribological contact with resulting oxidation of the hard and brittle material, the silicon playing a catalytic role: Chemical machining (RCA's solid state machining) properties of a:SiOx films have been empirically developed and optimized by ETI for the commercial production of precision single crystal diamond, cBN, ceramic and alumina tooling and chemical vapor deposited diamond polishing/finishing. ETI proposes a statistically based experimental plan to help optimize film material growth conditions, chemical composition, material properties and the down-stream machining parameters of surface speed and pressure to rapid material removal rates, smooth surface finishes and minimized sub-surface material damage. Single crystal sapphire, with a propensity to r-plane fracture, suffers significant sub-surface damage from the sliding abrasive contact normally associated with abrasive shaping/finishing. It is believed that non-abrasive chemical shaping/finishing will reduce sapphire sub-surface damage and enhance crystal strength and integrity.

EIC LABORATORIES, INC.
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Phone: (617) 769-9450
Topic#: 93-082 ID#: 93082-02
Office: NSWCDDWO
Contract #: N60921-93-C-0104
PI: Trung H NGUYEN
Title: New Cathode Materials for Long Life Lithium Thermal Battery Technology
Abstract: The Navy has several military applications that require portable power sources capable of delivering a succession of repeatable high power pulses for a spectrum of devices. At the present time Li-alloy/FeS2 battery with molten salt electrolyte has the desired characteristics of fast transport and reaction kinetics of the activated materials allowing for the achievement of ultra high specific power from the battery. However, the thermal decomposition of the Fe2 cathode material within the operating temperature range results in loss of obtainable capacity and limited battery lifetimes. We propose to develop new cathode materials with increased thermal stabilities and high discharge rate capabilities compared to FeS2. The cathode materials will consist of single phase mixed transition metal disulfides with the compositions FeX Co(1-X)S2, CoX Ni(1-X)S2 and CuX Ni(1-X)S2. The improved thermal stability, electrode kinetics, and conductivity of the single phase mixed transition metal disulfides are expected to increase the energy and lifetime of the lithium thermal battery. The goal of the Phase II program will be the fabrication and testing of practical cells incorporating the mixed metal disulfide cathode materials with the optimum composition.

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Phone: (201) 808-9033
Topic#: 92-172 ID#: 92N0A-119
Office: NAWCAWAR
Contract #: N62269-94-C-0508
PI: MURRAY W. ROSEN
Title: NCTR/ECCM Approaches for Aircraft Target Identification in an ECM Environment
Abstract: The Phase I project investigates and defines new and improved NCTR/ECCM algorithms that will counter and negate the effects of sophisticated countermeasures. The project examines radar, NCTR, EGM and ECCM issues and alternate implementation approaches. Candidate NCTR/ECCM include: natural target and spectral redundancy algorithms; and homodyne signal processing in multiple bandwidths. In Phase I the following radar NCTR processing and ECM research will be conducted: define NCTR/ECCM objectives and constraints; investigate and define new and modified ECCM techniques; conduct trade offs and select techniques; determine NCTR/ECCM performance and technical feasibility; outline prototype implementations to evaluate the techniques; and develop a plan for future NCTR/ECCM demonstration.

ELECTROCHEMICAL TECHNOLOGY CORP.
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Phone: (206) 285-7404
Topic#: 92-139 ID#: 92N0A-041
Office: NAWCAWAR
Contract #: N62269-94-C-0200
PI: DR. THEODORE R. BECK
Title: Electrodeposition of Polymer Coatings in Aircraft Fuel Tanks
Abstract: This proposal is in response to the topic objective to apply and control the application of multilayer seal coatings on all surfaces of integral fuel tanks. An alternate polymer deposition method is proposed to meet the objective without the need for expensive, complex sensors and controls. A polymer coating, composed of Teflon and a second resin, is to be deposited electrochemically from an aqueous solution. This polymer coating process automatically gives a uniform coating free of pinholes. A pretreatment prepares the surface of aluminum tanks for polymer electro-deposition. The polymer coating process can be adjusted to obtain any coating thickness desired. The polymer coating process uses an aqueous system which obviates expensive environmental and safety constraints associated with the organic solvents currently-used in coating fuel tanks. Corrosion, fuel-compatibility, and adhesion tests will be carried out to evaluate the coatings. Deliverables from Phase I will be test data and a demonstration small-scale simulated fuel tank. A successful process from Phase II will be licensed to manufacturers.

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Phone: (909) 371-4707
Topic#: 93-118 ID#: 93N33-829
Office: NCCOSC
Contract #: N66001-94-C-7002
PI: GLENN MALONE
Title: Development of Improved Thermally Conductive Coatings for Aluminum Hardware
Abstract: Many shipboard systems and components are fabricated from aluminum alloys because of the high strength to weight ratio, relatively low cost, and ease of manufacturing associated with such materials. Disadvantages in the use of these materials are encountered when a marine service environment is involved - particularly when the aluminum component is in direct contact with a dissimilar metal and large galvanic currents which cause severe corrosion. Hard anodizing has been beneficial in deterring corrosion but it has poor thermal conductivity. Thick electroless nickel has met with significant success as a corrosion deterrent and has good abrasion and wear resistance. It has much poorer thermal conductivity than most electrodeposited metal coatings and suffers poor ductility when impacted. This proposal offers a unique program for fabrication of families of protective coatings on aluminum alloys where outstanding thermal conductivity can be obtained while providing excellent adhesion to the substrate and ability to conform to damages by surface impact - still retaining good corrosion protection and wear resistance. The process is based on the dilute phosphoric acid anodizing process which provides a very thin galvanic insulator to deter corrosion while forming a bonding media for metallic coatings having properties being sought.

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2830 WILDERNESS PLACE, UNIT E
BOULDER, CO 80301
Phone: (303) 440-8008
Topic#: 93-051 ID#: 93N00-009
Office: NAVSEA
Contract #: N00024-93-C-4207
PI: James S Bowers
Title: Diffusional Coating of A-625 Alloy By Reactive Plasma Surfacing For Arresting Crevice Corrosion
Abstract: This investigation addresses an exploratory development effort which applies an innovative adaptation of plasma arc surfacing technology to facilitate the convenient introduction of a diffusional coating layer out of the surface of A-625 alloy flanged pipe connections. Such a strategy will be expected to arrest crevice corrosion and related phenomenon. The approach will be to modify plasma arc surfacing technology so that selected volatile reactants can be simultaneously introduced into the plasma arc region where as a consequence of the highly energetic conditions present, in situ formation of diffusional coatings will proceed. The proposed surfacing technology is expected to be particularly compatible for the simultaneous treatment of raised flat and recessed alloy surface topologies. The wide treatment swath, the convenient modification of existing plasma arc welding technology the resistance to mechanical damage, the low application temperatures, the ability to visually determine the presence of the converted surface layer, and most significantly the ability to apply the treatment in situ as or just prior to the final step in assembly of a shipboard piping system makes this corrosion prevention surfacing treatment more economic and effective than other strategies currently available

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Phone: (303) 972-1191
Topic#: 93-031 ID#: 93N47-141
Office: SPAWAR
Contract #: N00039-93-C-0183
PI: JOHN K. REECE
Title: Multiple-beam Multi-mission Broadband Reflector of Lens Antenna
Abstract: This study will investigate the feasibility and complexity involved with the development of a shaped parabolic reflector antenna system for the formation of multiple simultaneous azimuth beams for use in a high rate (300MHz) data transmission system for the U.S. Navy. Each antenna system will form multiple simultaneous beams within a 90 degrees azimuth coverage area over a 2:1 frequency bandwidth. Elevation coverage will be obtained from pedestal rotation for gross adjustments and beam dither/multiple beams for near boresight elevation agility. Four such systems will be used to provide a full 360 azimuth coverage about the ship. The proposed study will concentrate on the design and analysis of the components required to fulfill the mission objectives including a broadband multi-beam phase array feed with a rotman lens beam forming network and a shaped reflector surface for optimum performance. The study will also recommend a proposed course of investigation for a Phase II demonstration of the concept performance through measurements and detailed analytical processes.

ENVIRONMENTAL & LIFE SUPPORT TECH.
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Phone: (303) 987-1322
Topic#: 93-131 ID#: 93N4C-035
Office: NCEL
Contract #: N47408-93-C-7362
PI: CLIFFORD D. JOLLY
Title: Development of an Automatic, Auto-sampling Atmospheric Lead Monitor
Abstract: Lead is a widespread environmental contaminant occurring in airborne, soil, and aqueous media. It is a deleterious, cumulative body poison and its health effects are usually not reversible. Indoor and outdoor small arms firing ranges may contain serious airborne contamination from lead and other heavy metals that potentially threaten the safety of personnel that use these facilities as part of their training regimen. The purpose of this effort is to develop a compact, portable, cost-effective lead in air monitor that allows personnel to use the range undisturbed, but provides a record of ambient lead concentration and warns of a potential health risk. The instrument will be capable of both AC and DC operation. Innovations proposed will allow air samples to be taken automatically, potentially from several locations within the range so that one instrument can service an entire facility. The unit will also be autocalibrating to allow long-term operation without requiring maintenance nor disrupting the concentration of field personnel. The proposed designs will also permit expansion of instrument capabilities to other metals and soil/water analyses. The proposed technology will also be applicable as the basis for an inexpensive process for removing lead from the surrounding air as it is produced, thereby reducing or eliminating the health hazard in real time. This would also decrease contamination of surrounding soil and water, saving immense clean-up costs.

EPION CORP.
4R ALFRED CIRCLE
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Phone: (617) 275-3703
Topic#: 93-092 ID#: 93092-18
Office: NSWCDDWO
Contract #: N60921-93-C-0116
PI: Allen R KIRKPATRICK
Title: Integral Silicon Carbide Layers on Diamond
Abstract: Vapor deposited diamond possesses excellent characteristics as a protective material for the infrared windows and radomes of high speed missiles. At high temperature, diamond is itself subject to rapid erosion when exposed to oxygen. In order to protect diamond against oxygen a thin layer of the diamond surface can be transformed into silicon carbide. Silicon carbide is hard, thermally stable and highly resistant against oxidation. As an integral layer formed upon the diamond below, the silicon carbide will not be subject to adherence failure problems.

FARACHEM TECHNOLOGY, INC.
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Phone: (513) 325-4191
Topic#: 92-111 ID#: 92N01-055
Office: ONR
Contract #: N00014-93-C-0066
PI: Dr. E. Jennings Taylor
Title: Remote Sensing of Crevice Corrosion
Abstract: Crevice corrosion is a form of localized corrosion that occurs within crevices or at shielded surfaces where a stagnant

solution is present. Crevice corrosion is particularly problematic for the Navy in networks of seawater piping where the numerous gasketed junctions are susceptible to crevice corrosion. Since the crevice corrosion is almost always confined to within the crevice itself, the pipe joints must be periodically disassembled and visually inspected for evidence of crevice corrosion. This process is time consuming, tedious, and expensive. Based on the mechanistic aspects of crevice corrosion, we will investigate three novel remote sensing concepts for crevice corrosion. These concepts are applicable to pipes of varying sizes and are capable of being developed into a remote diagnostic procedure for crevice corrosion. Such a procedure is adaptable to portable instrumentation for the detection of crevice corrosion within an assembled gasketed pipe joint. This instrumentation will eliminate the requirement for disassemble and visual inspection of pipe joints and will be of great benefit to the Navy.

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Phone: (703) 231-4224
Topic#: 92-140 ID#: 92N40-245
Office: NAWCAIND
Contract #: N00016-94-C-0013
PI: Kent A. Murphy
Title: Composite Embedded Optical Fibers for Communication Links
Abstract: Optical fibers have been embedded in polymer and metal matrix composites for fourteen years; this work has identified methods for embedding and limitations due to fiber-matrix interactions and interconnection methods. Concurrently, breakthroughs in fiber-based local area networks have led to reconfigurable fault tolerant architectures. By embedding the elements of such networks into advanced composites, structurally-integrated avionic circuit modules and intra-aircraft high speed communications may be supported onboard future military aircraft. Such systems require the sequenced development of methods for the integration of fibers, fiber components and supporting electronics and optics into composite material systems and structures. The objective of the proposed SBIR program is to study the first phase of this development process-the integration of fibers and first-level fiber interconnect capability into polymer and metal matrix composites. Fiber & Sensor Technologies (F&S) and its university subcontractor, the Fiber & Elec Optics Research Center (FEORC) at Virginia Tech, are major innovators in the smart materials and structures field. Together, they have performed more than 100 relate embedded fiber/composite materials research programs for government agencies and aerospace companies. The proposed program will build directly upon their substantial experience embedding optical fibers and fiber communication system elements in polymer and metal matrix composites.

FLAM & RUSSELL, INC.
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Phone: (215) 674-5100
Topic#: 93-104 ID#: 93104-08
Office: NSWCDDWO
Contract #: N60921-93-C-0108
PI: Richard P FLAM
Title: Electromagnetic Millimeter Wave Nondestructive Evaluation of Radomes
Abstract: Radomes protect antennas from the weather and other hazards, but they degrade antenna performance, especially in low side lobe antennas, precision DF antennas, and monopulse tracking antennas. Minor fabrication defects like changes in density, inhomogeneities, anomalies, voids, or delaminations can worsen these effects. The key to finding these defects in radomes is nondestructive evaluation (NDE) techniques that have high resolution capability. Flam & Russell, Inc. (FR) proposes a program that will use millimeter waves, with their small wavelengths and potential for wide frequency bandwidths to create a diagnostic system that can isolate small anomalies in radomes with thin and non-planar surfaces. FR will be able to produce such a system because it has nearly 10 years of experience in radar measurements and it is exploiting new technologies such as stable and accurate microwave instruments, powerful signal processing algorithms for imaging and low-cost computers with enormous computational speed. This technology will result in a non-contact NDE system capable of imaging or characterizing radomes up to a few meters in size with submillimeter resolution.

FLUOROCHEM, INC.
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Phone: (818) 334-6714
Topic#: 93-006 ID#: 93N37-046
Office: NAWCMUGU
Contract #: N68936-93-C-0322
PI: Kurt Baum
Title: Laser Discrimination
Abstract: Rocket propellants with NF groups to oxidize hydrocarbon or metal fuels provide performance advantages over

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oxygen-based systems. Such applications have been restricted because of difficulties in using difluoramine as a reagent. Under this program, new reagents for the introduction of difluoramino groups in organic molecules will be investigated.

FOSTER-MILLER, INC.
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Phone: (617) 890-3200
Topic#: 93-010 ID#: 93N07-013
Office: MARCOR
Contract #: DAAK70-93-C-0061
PI: Roger L. Demler
Title: Jet Fueled 500 Watt Micro-Generator
Abstract: The goal is to quietly provide 500W of electrical power for 6 hours from 8 kg, including fuel. Each additional kg of fuel, be it jet, diesel, or gasoline will provide another 3 hours of power. Foster Miller has developed technology for starting and running small spark ignition engines on jet and diesel fuels. The new art in electrical machinery and electronics makes the project possible and practical. The small .8 cubic inch displacement, 4 cycle engine is easy to silence and consumes one half as much fuel as a 2 cycle engine. The emphasis of the program will be on engine durability and performance testing. The overall system preliminary design package will be based on the test results and a detailed study of the electrical components. All major components, including the micro-engine, already have a production base to build on.

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Phone: (617) 890-3200
Topic#: 93-013 ID#: 93N07-047
Office: MARCOR
Contract #: N60921-93-C-A361
PI: Arthur D. Jackson
Title: Visual Targeting System
Abstract: Foster-Miller contends that with the recent developments in the state-of-the-art of man-machine interfaces, that weapon system developers should start to develop systems that augment the soldier's natural abilities. Research indicates that there is no mechanical tracker now or expected in the far reaching future which can surpass the human eye in acquisition, recognition and tracking. Efforts should be aimed at taking maximum advantage of this capability. Foster-Miller proposes a research and development effort which has the principal objectives of: 1. Fielding an advanced target acquisition and weapon control system which uses the gunner's tracked line of gaze as the man-machine interface and target acquisition method building upon the user's inherent skills. 2. Further developing the Visual Trackball System which in recent Navy development programs and testing has proven to be faster and more accurate than conventional systems based on hand and eye coordination skills. 3. Designing the VTS with the intention of integrating advanced options as the state-of-the-art in weapons, battlefield management, and IFF techniques continue to advance. The Foster-Miller Visual Targeting System (VTS) uses a gimbal mounted camera, infrared light source and computer algorithm to determine where on a standard monitor that the gunner is looking and then forms a reticle at that point. The VTS requires that nothing be mounted on the gunner's head and will be feasible for the control of individual, crew served or vehicle mounted line-of-sight weapon systems, as well as indirect fire weapons. The VTS will provide for rapid, on the move target acquisition limited only by the range of the sensor suite used. Development of this type weapon control system was started under a NSWC program for the AEGIS workstation. Tests conducted under this program indicate that this type system, even when not optimized for this task can decrease the reticle positioning time in excess of 50 percent on moving targets.

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Phone: (617) 890-3200
Topic#: 93-055 ID#: 93N00-036
Office: NAVSEA
Contract #: N00024-93-C-4193
PI: Dr Robert F Kovar
Title: Energy Absorptive Lightweight Syntactic Foam
Abstract: Syntactic foam is used to increase buoyancy in submarines by filling void spaces. However current foam is too low in buoyancy and transmits acoustic energy to seawater making the vehicle detectable. Coatings absorb the noise but are heavy and bulky. The Foster-Miller team which includes experts in syntactic foam and a microballoon supplier will combine computer modeling with innovative materials and processing to completely redesign the syntactic foam. We will combine high packing efficiency polymodial MACROsphere and MICROsphere size distributions with a proprietary highly damped low-density resin and innovative processing to produce a 20 lb, 7ft syntactic foam that is hydrophobic, exhibits a compressibility inefficient of

200 ksi and is intrinsically energy absorbing and shock-resistant. In Phase I we will identify syntactic foam designs that show potential for achieving these properties along with a 40 percent increase in acoustic noise absorption. A low-cost method for manufacture and test plan for measuring syntactic foam properties will be submitted with a detailed Phase II plan schedule and cost estimate. In Phase II we will manufacture test and deliver sample materials that exhibit target properties.

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Topic#: 93-128 ID#: 93N4C-063
Office: NCEL
Contract #: N47408-93-C-7317
PI: JOHN F. MCCOY

Title: Multistage Bio-reactor for Bio-remediation of Soils Contaminated with TNT and RDX

Abstract: Remediation of soils at ordnance sites contaminated with TNT and RDX pose unique scientific and engineering challenges. Bio-remediation has potential advantages over thermal processing of incineration for these explosive materials. However, the biological pathways for degradation of nitro-substituted compounds have only recently begun to be understood. The economic and effective processing of a slurry containing contaminated soil introduces further practical and mass transfer considerations. An innovative multistage bio-reactor is proposed, incorporating a high-solids fluidized bed first stage followed by a series of anaerobic and aerobic systems to further degrade the solubilized contaminants to completely mineralize the ordnance products.

FOSTER-MILLER, INC.
350 SECOND AVENUE
WALTHAM, MA 02154
Phone: (617) 890-3200

Topic#: 92-138 ID#: 92N0A-035
Office: NAWCAWAR
Contract #: N62269-93-C-0245
PI: DR. MARK A. DRUY

Title: Novel Fiber Optic Infrared Spectroscopic NDI Technique for Galvanic Degradation of Composites

Abstract: Foster-Miller proposes to develop a novel fiber optic infrared spectroscopic nondestructive inspection (NDI) technique which will provide quantitative information on the severity of galvanic induced degradation of composites. This new infrared NDI system will enable the Navy to detect and track any galvanic degradation of graphite/polyimide composites in use on naval aircraft so that appropriate maintenance actions can be performed. Specific goals of the program are to demonstrate that the infrared technique can detect the onset of corrosive attacks before loss of mechanical properties and quantitatively correlate progressive degradation to loss of bearing strength. A conceptual design of a portable system suitable for in field use by Navy maintenance personnel will be presented in Phase I. This will serve as the basis for scale-up and implementation of this NDI technique and actual field testing by the Navy during Phase II.

FOSTER-MILLER, INC.
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Topic#: 92-142 ID#: 92N0A-053
Office: NAWCAWAR
Contract #: N62269-93-C-0235
PI: RAMKI IYER

Title: A Smart NDE Technique for Metallic Aircraft Structures

Abstract: As the existing aircraft fleet ages, concerns over fatigue failure become more urgent. Frequent inspection intervals become necessary as dictated by the worst case aircraft of that make/model. These inspections usually require aircraft tear-down which could cause damage itself. Individual aircraft monitoring would eliminate the need for fleet-wide grounding and inspection and allow for a tailored inspection/repair program. The concept proposed consists of tagging the aircraft structure with magnetostrictive particles which would generate signatures based on the loading history of the structure. This concept allows for quick, accurate, easily accessible inspection of the aircraft structure. The individual aircraft's health could be determined in real-time, thereby lowering inspection/repair costs while increasing operational readiness.

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Topic#: 92-148 ID#: 92PMT-215
Office: NAVAIR
Contract #: N00014-93-C-2048
PI: ROBERT F. KOVAR

Title: Environmentally Degradable Chaff Packet
Abstract: Chaff dispensed from under the aircraft wing in plastic packets is effective against radar threats and provides added space for protection against IR threats. However, falling packets can strike the wing causing damage, and the release of non-degradable packets that might be toxic to fish and wildlife causes environmental problems. Foster-Miller proposes to develop technology for 100 percent biodegradable chaff packets that are compatible with the D-46/ALE-39 dispenser and will not cause impact damage to the aircraft. We will select a biodegradable polymer and control its impact strength. Chaff packets will be fabricated that withstand normal handling and g-forces, but disintegrate upon impact with a wing. The packets will sink in seawater, be edible to fish and wildlife and biodegrade into harmless products within weeks of environmental exposure. In Phase I, we will deliver 16 biodegradable chaff packets and a final report that includes a scale-up plan. In Phase II, we will refine the process and scale up to produce 20 sets of packets. Commercialization will begin in Phase I, since our team includes a chaff packet manufacturer. The principal investigator and this Foster-Miller facility have Secret clearance status and extensive experience in polymer processing.

FOSTER-MILLER, INC.
350 SECOND AVENUE
WALTHAM, MA 02154
Phone: (617) 890-3200
Topic#: 92-151 ID#: 92PMT-234
Office: NAVAIR
Contract #: N00019-93-C-0143
PI: ARTHUR D. JACKSON
Title: AH-1W Ballistic Tolerance Improvement Project
Abstract: The problem - The AH-1W requires additional armor protection to improve the aircraft and aircrew ballistic tolerance. Foster-Miller proposes to develop a solution to this problem through an analysis of three interconnected variables which will result in an AH-1W ballistic tolerance system. The three interconnected variables are: 1. The projected threat to the airframe/aircrew as well as the vulnerability of the airframe. 2. The materials available to increase the AH-1W's ballistic tolerance. 3. The attachment technique to be used to apply the selected material to the aircraft. To this end, Foster-Miller proposes a two-part Phase I effort with the principal goals of: Part 1 - Analysis of (a) vulnerability; (b) ballistic materials; (c) attachment/integration techniques. Part 2 - Demonstration of (a) ballistic performance and (b) mock-up kit installation. Please note that one of the integration techniques that will be evaluated is a patented system known as LAST Armor - U.S. Patent No. 4,928,575 which has been certified for flight safety by U.S. Army AVSCOM.

FOSTER-MILLER, INC.
350 SECOND AVENUE
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Phone: (617) 890-3200
Topic#: 92-186 ID#: 92N37-017
Office: NAWCWPNS
Contract #: N68936-93-C-0245
PI: Dr. Arthur Nelson
Title: Laser Beam Steering Via the Pockels Effect
Abstract: Nonlinear optical polymer (NLOP) materials offer important advantages over ferroelectric (LiNbO3) and semiconductor (GaAs) materials for the fabrication of very high speed electro-optic devices, including modulators, switches, and multiplexers. The basic electronic interaction in NLOP yields high electro-optic coefficients with low dielectric constant resulting in potential device operation at speeds exceeding 100 GHz. For this effort Foster-Miller proposes to develop a unique integrated optic structure in NLOP materials which is capable of near instantaneous steering of an input laser beam. The device consists of a channel waveguide/electrode array, which will be computer modeled in Phase I. Also during Phase I, channel waveguide structures will be developed in NLOP material and completely characterized for the beam steering application. During Phase II a complete breadboard integrated optic chip will be fabricated in NLOP and completely characterized for microwave operation. The team of scientists from Foster-Miller and the University of Lowell assembled for this project are uniquely qualified for this effort with many years of experience in NLOP preparation, NLOP optical and electrical measurements, characterization of very high speed integrated optic devices.

G H GILLESPIE ASSOC., INC.
P O BOX 2961
DEL MAR, CA 92014
Phone: (619) 792-0222
Topic#: 93-088 ID#: 93088-02
Office: NSWCDDWO
Contract #: N60921-93-C-0151
PI: John L ORTHEL
Title: Neutral Hyperthermal Atomic Oxygen System for Low Earth Orbit Environment Simulations

Abstract: We propose the development of a Low Earth Orbit Environment Simulation System. Such a system can be envisioned by combining the recent advances and proven technologies in radio frequency excited, high current density, oxygen beam generation; multiaperture beam acceleration and focusing; beam bending for beam focusing and purification; and beam neutralization by laser photoneutralization. Our concept constitutes a unique and innovative incorporation of state-of-the-art equipment and techniques that will result in a system that can produce a neutral oxygen environment similar in all respects to an actual low earth orbit environment. Phase I effort will lead to a complete system design and test plan for the verification of oxygen beam purity, energy and fluency. The six month Phase I program and resulting system design, will significantly benefit from our expertise in beamline design, beam transport modeling, systems engineering and computer control systems. Phase II will focus on the construction and characterization of the Low Earth Environment Simulation System.

GENERAL PNEUMATICS CORP.
7662 E. GRAY ROAD, SUITE 107
SCOTTSDALE, AZ 85260
Phone: (602) 998-1856
Topic#: 93-009 ID#: 93N07-035
Office: MARCOR
Contract #: DAAK70-94-C-0001
PI: Mr. K. Randall Kohuth
Title: Compact Freon-free Stirling Refrigeration System
Abstract: Research and Development is proposed of a novel form of compact freon-free refrigeration system. The proposed unit operates on the Stirling cycle using air as the working fluid. The refrigerator has an innovative arrangement of four double-acting pistons which will permit a compact, rugged system of high thermodynamic efficiency fabricated from commonly available materials. Another innovative feature is the drive linkage which gives the pistons the correct phase relationship which a near straight line motion to minimize side forces and wear. The use of ambient air as the working fluid eliminates the need for special refrigerants, such as chlorofluorocarbons, and the hazard of leakage in confined environments and pollution of the atmosphere. The refrigerator may be driven by an electric motor or other forms of prime mover. One possibility is to use a second Siemens-Stirling engine powered by the combustion of diesel fuel, natural gas, biomass, waste heat, or solar energy to develop the mechanical power necessary to drive the refrigerator.

GENERAL SCIENCES, INC.
205 SCHOOLHOUSE ROAD
SOUDERTON, PA 18964
Phone: (215) 723-8588
Topic#: 91-330 ID#: 91N14-466
Office: NAVAIR
Contract #: N00019-92-C-0158
PI: Michael A Riely
Title: IR/RF Expendable
Abstract: GSI proposes the development of an IR/RF expendable utilizing chemical energy to produce both signals. Current studies have shown that GSI'S patented intermetallic fuels are capable of producing extremely high in-band intensities for most military bandwidths, even under high flow conditions. In addition, chemical seeding of the fuel produces high electron cross-section plumes across a variety of radar wavelengths. Critical issues identified for study in this proposal include plume length tailoring and its effect on RCS gerierated, mass flow of the fuel necessary to provide required IR and RF signatures. These areas will be explored utilizing the facilities available at GSI. Due to the space savings created by the use of the Hi-Therm fuels, a back-up design is planned combining conventional RF chaff in a module attached to an un-seeded Hi-Therm IR fuel. Potential benefits from a successful effort include a lightweight, low cost expendable capable of multispectral simulation. Use of the GSI fuels holds potential for safer manufacturing processes since all materials involved are rated as flammable solids. Potential military spinoff uses include ground based decoys for armored vehicle protection, as well as fixed site aircraft (airfield) protection.

GEOSYNTEC CONSULTANTS
5775 PEACHTREE DUNWOODY ROAD, SUITE 200F
ATLANTA, GA 30342
Phone: (404) 705-9500
Topic#: 93-130 ID#: 93N4C-076
Office: NCEL
Contract #: N47408-93-C-7319
PI: DR. RUDOLPH BONAPARTE, P.
Title: Subsurface Landfill Barrier
Abstract: This proposal describes a study to identify, develop, and evaluate state-of-the-art methods and materials which can be used as subsurface barriers between landfills containing hazardous waste and an aqueous environment such as coastal areas subject to higher groundwater tables or tidal variations. The study will consider physical barriers, induced barriers, and a

combination of both. This study will evaluate ways of taking advantage of site specific geohydrologic conditions to contain specific wastes, thereby enabling efficient remediation. Both existing technologies and innovative solutions will be considered. Questions of effectiveness, feasibility, costs, standardization potential, safety, usability, and implementation will be answered. A comprehensive final report including a guide to proper selection of containment systems for Navy sites and recommendations for follow-on field and laboratory testing will be published.

GINER, INC.
14 SPRING STREET
WALTHAM, MA 02154
Phone: (617) 899-7270

Topic#: 93-003 ID#: 93N40-211
Office: ONR2
Contract #: N00014-93-C-0215
PI: LARRY SWETTE

Title: Advanced Cost-effective Navy Oxygen Generator Electrolyzer and System Development

Abstract: Giner, Inc., proposes to develop advanced components leading to a high-current-density (2000 ASF or greater) electrolyzer that provides the same level of voltage efficiency and oxygen delivery as the present Navy OGP high-pressure electrolyzer that typically operates in the range of 1000 to 1200 ASF. This would lead to significant cost, volume and weight advantages since only half the number of cells would be required. The feasibility of operating over the pressure range of 20 to 1000 psi without a pressure vessel and the use of lower-cost materials/processes will be evaluated. Systems studies will be conducted on the integration of this advanced electrolyzer with other life-support subsystems and systems. The Phase I studies will provide projected size, weight, and performance for the high-current-density electrolyzer in Phase II. If successful this work will ultimately lead to the development and demonstration of a significantly more cost-effective, smaller (weight and volume) electrolyzer module for integration with other Navy life-support systems and subsystems. This development should enhance the Navy's future warfare capabilities.

GIORDANO AUTOMATION CORP.
230L JEFFERSON DAVIS HWY.
ARLINGTON, VA 22202
Phone: (703) 418-3658

Topic#: 93-053 ID#: 93N00-022
Office: NAVSEA
Contract #: N00024-93-C-4233
PI: Michael N Granieri

Title: Fault Tolerant Processor (FTP) Life Cycle Maintenance

Abstract: The objective of this effort is to determine Seawolf FTP maintenance requirements and outline a plan of action. A concurrent engineering approach is used to determine these requirements via assessing FTP test and maintenance requirements across all levels of test and design verification, factory test and depot maintenance test. From a total life cycle perspective, feasibility of Navy organic support is analyzed at the assembly and Ship Control Processing Unit and FTP channel electronics and line replaceable unit levels of system indenture. A common hardware and software approach for supporting all levels of FTP test and maintenance is investigated for feasibility. This innovative approach uses commercial off-the-shelf VXI instrumentation modules, presentation manager software and a model-based diagnostic reasoning run-time software system. The proposed approach for effecting total life cycle support is innovative because a common hierarchical diagnostic model of the FTP will be used on the same test system architecture to support all the possible levels of FTP test and repair.

GLOBAL ASSOC., LTD.
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ARLINGTON, VA 22201
Phone: (703) 812-5241

Topic#: 93-041 ID#: 93N47-174
Office: SPAWAR
Contract #: N00039-94-C-0039
PI: JENIFFER L. BENEFIELD

Title: Generalized, Data Adaptive, Time-frequency Representations for IUSS Classification

Abstract: An investigation into the radially Gaussian, signal dependent time-frequency representation to the detection and classification of acoustic transients is proposed. The above distribution will be calculated for various types of synthesized transient signals, and the resulting distribution will be evaluated with regard to time resolution, frequency resolution, accuracy of start and stop times of the signal, accuracy of identified harmonic lines, suppression of interference terms, and general feasibility of classification. The properties of the distribution will be compared to those of the common spectrogram.

GMF, INC.
6104 QUEENS BRIGADE COURT
FAIRFAX, VA 22030
Phone: (703) 830-2050
Topic#: 93-079 ID#: 93N00-280
Office: NAVSEA
Contract #: N66604-94-C-0177
PI: Dr John F Green
Title: Recognition of Skywave Propagated Hf Signals
Abstract: GMF proposes that skywave propagated HF signals can be discriminated from groundwave propagated signals received on a small beamline antenna by means of ionospherical effect imposed on the former. GMF believes that these effects which are often easily discernable aurally can be automatically detected, measured and used to support the required propagation mode decisions in real-time. This proposal contains a brief theoretical analysis concerning the origin of and graphic examples of some of these effects. Display formats are used which directly reveal the influence of these effects. Signal processing approaches and techniques are discussed which GMF believes should be quite suitable for this application. In addition a preliminary signal processing system concept is defined. This is done in order to examine potentially suitable implementation methods for a skywave discrimination system and for its possible integration with conjectured existing submarine deployed HF collection equipment.

GULF WEATHER CORP.
MTTO, BUILDING 1103, SUITE C-2
STENNIS SPACE CEN, MS 39529
Phone: (601) 688-3398
Topic#: 93-002 ID#: 93N40-023
Office: ONR2
Contract #: N00014-93-C-0240
PI: Dr. Robert Pickett
Title: Metadata Base for Automated Oceanographic Imagery Information
Abstract: Proposed is the innovative solution for the development of a unified information structure for a system of automated information tools and methodology to efficiently provide output to oceanographic and meteorological forecast models. Involved is the development of metadata fields using sets of automated information tools. The metadata bases will use existing algorithms for browsing, visualization, and diagnostic analysis. New rules, based on the manual identification/analysis system, will be developed. The metadata fields portraying specific oceanographic/ meteorological features will be updated as new information becomes available. From the sequential analysis of specific systems, information on past movement, shape, and intensity can be shown. From this information, using diagnostic analysis rules, the driving physical forces affecting these systems can be inferred, providing what may be a major breakthrough in oceanographic and meteorological forecasting.

GUMBS ASSOC., INC.
11 HARTS LANE
EAST BRUNSWICK, NJ 08816
Phone: (908) 257-9053
Topic#: 92-141 ID#: 92N0A-043
Office: NAWCAWAR
Contract #: N62269-93-C-0247
PI: DR. P. C. SEKHAR
Title: Novel Conducting Polymers as Efficient Corrosion Scavengers and Anti-corrosion Coatings
Abstract: This proposal targets the design and synthesis of functionalized conducting polymers as effective corrosion inhibitors and as scavengers useful for the advanced needs of naval aircraft and other equipment. The novel materials will be able to poise the mixed potentials of metals in the most stable region therefore preventing the corrosive degradation process. The existing coating schemes involve very stringent conditions during manufacturing and do degrade in due time. We propose a new approach to this problem, which consists of using suitably designed conducting polymer coatings. The advantages of the novel conducting polymer based coatings include: (1) applicability to wide variety of metals, (2) improved stability towards naval environment, (3) durability, (4) lightweight, and (5) cost effectiveness. A combined theoretical modeling and experimental approach will be adopted to investigate and optimize the influence of functional groups on the electrochemical properties of conducting polymers, redox potentials, and the metal/polymer interface interactions.

HEALTH EFFECTS GROUP, INC.
305 EAST FT. LOWELL ST.
TUCSON, AZ 85705
Phone: (602) 649-1827
Topic#: 91-358 ID#: 91N33-004
Office: NTSC
Contract #: N61339-93-C-0053
PI: Clifton D. Crutchfield
Title: Identification of a System to Measure Gas Mask Leakage
Abstract: The goal of the proposed research effort is to develop a cost-effective system capable of measuring leakage into gas

masks being worn by Navy personnel. The ability to measure gas mask leak rates will greatly enhance chemical warfare training effectiveness, thereby increasing the level of protection that gas masks provide. The proposed system will also provide a sound basis for proper gas mask selection and issue. A new method for measuring leakage rates into industrial respirators has been developed. The method employs a controlled negative pressure (CNP) technique to eliminate many of the problems associated with systems based on the use of aerosol challenge agents, and is significantly faster and more precise. The objectives for Phase I are to conduct a comprehensive review of technologies that can be applied to the mask leak measurement problem. A specific set of criteria will be used to analyze advantages and limitations of each identified technology relative to the CNP concept. Information needed to define an acceptable leak criterion for gas masks will also be identified during Phase I. The product of Phase I research will provide a comprehensive basis for evaluating and selecting the most cost-effective system for measuring gas mask leakage.

HI-Z TECHNOLOGY, INC.
6373 NANCY RIDGE DRIVE
SAN DIEGO, CA 92121
Phone: (619) 535-9343
Topic#: 93-010 ID#: 93N07-065
Office: MARCOR
Contract #: DAAK70-93-C-0062
PI: John C. Bass
Title: Miniature Electric Generator
Abstract: A proposal is made to design an air-cooled 500 Watt thermoelectric generator for use by the USMC. This generator can have a low noise and IR signature. It can be operated either locally by a single switch operation or as a remote unit. The generator will be based on the use of a lead-telluride module currently under development for a larger generator application. Its external combustion source will be capable of operating the Diesel, gasoline, or any of the JP fuels. Since thermoelectrics are a solid state energy conversion device, the system reliability should be very high. It is proposed that some of the components being currently developed for a 1.5KW thermoelectric generator be used in the 500 W generator. The components include the bonded lead-telluride thermoelectric module, the micro-processor-based control system, and the air-aspirated fuel atomizer.

[illegible]ER POWER ENGINEERING
[illegible]WHITESIDES ROAD SUITE 100
[illegible]STONIA, NC 28052
Phone: (470) 418-6885
Topic#: 93-054 ID#: 93N00-023
Office: NAVSEA
Contract #: N00024-93-C-4195
PI: Ronald C Cooper PE
Title: Remote Battery Disconnect
Abstract: Proposal to assess state-of-the-art Dc Switch System for isolating battery voltage in emergency conditions provides a conceptual design interface with ship's battery and Phase II development schedule and cost estimate.

HITTITE MICROWAVE CORP.
21 CABOT ROAD
WOBURN, MA 01801
Phone: (617) 933-7267
Topic#: 93-062 ID#: 93N00-092
Office: NAVSEA
Contract #: N60921-93-C-A353
PI: Mitchell Shifrin
Title: Microwave Matching/Tuning Network
Abstract: Transmit and receiver modules for broadband radar items are designed for optimum performance over a broad frequency radar. The power output efficiency of the broadband TAR module may be optimized at a selected frequency within the band by tuning on varying output match conditions. This selective tuning for maximum power output and efficiency will extend the useful range of radars. This proposal describes a technique for the selective tuning. The proposed method is based on design experience for automatic matching networks high-power amplifiers resident at Hittite Microwave Corporation. The proposed configuration makes use of MMIC technology for compactness and field effect transistors for fast response time with no DC power requirements. It also has the ability to handle greater than 40 dBm of power through the use of a novel circuit technique. Tuning is accomplished over typical 5 - 6 module bandwidths in a switchable manner across the desired 50s frequency band. The proposed technology is fully compatible with the module electrical and mechanic interface requirements.

HITTITE MICROWAVE CORP.
21 CABOT ROAD
WOBURN, MA 01801
Phone: (617) 933-7267
Topic#: 93-065 ID#: N93-065-1
Office: NSWCDDWO
Contract #: N60921-93-C-A351
PI: Peter Katzin
Title: Frequency Synthesizer

Abstract: Frequency synthesizers at microwave frequencies rely on a complex architecture of microwave circuits for multiplication and up-conversion of low frequency standards generated by more conventional synthesis techniques. Because of the large volume occupied by the microwave components, synthesizers covering a wide range of frequencies in small steps cannot be accommodated in small platforms, such as smart munitions, and expandables. This proposal describes a novel synthesizer design approach based on an innovative MMIC concept for microwave filters recently demonstrated at Hittite Microwave Corporation. The most significant aspect of Hittite's MMIC filter concept is its unique "self-compensation" circuit designed to compensate for variations in design and process parameters as well as environmental conditions. Using this circuit technique, it was shown that a filter can automatically track a reference frequency input. This "self-tuning" MMIC filter concept is the key element of the proposed synthesizer architecture. Using the self-tuning filter chips in converters and frequency expanders, all microwave circuit functions required for the synthesizer can be built into a handful of MMIC chips, thus, reducing the over-all synthesizer size. The proposed synthesizer architecture combines performance of direct digital synthesizers (DDS) of Stanford Telecom and the size advantage of Hittite's MMIC converters and expanders including the self-tuning filters. The proposed synthesizer will be no larger than 50 cubic inches in volume, and its performance will be equal or superior to the requirements outlined in the SBIR Topic No. N93-065.

HORIZONS TECHNOLOGY, INC.
3990 RUFFIN ROAD
SAN DIEGO, CA 92123
Phone: (619) 292-8331
Topic#: 91-075 ID#: 91N14-398
Office: NAVAIR
Contract #: N00019-92-C-0176
PI: Alan Billings
Title: AH-1W Attack Helicopter Maintenance/Manpower Reduction

Abstract: As the USMC continues to field the AH-1W, it must ensure that maintenance, processes, manpower, skill levels, training and documentation will support operational flying hour requirements into the 21st Century. The dilemma clearly recognized by AH-1W program managers is the requirement to properly maintain a growing fleet of aircraft under constrained budgets and anticipated reductions in manpower. Maintenance is a manpower intensive activity and reductions in manpower, unless anticipated and provided for, will result in an unacceptable reduction in material readiness and war-fighting capability. There are two areas in which this reduction in manpower might be effectively countered; the application of automation to the maintenance process, and improvements in training. There are four general areas in which the proper application of micro-coprocessor technology (automation) can improve the maintenance process: workload reduction, error reduction, increased productivity, and the adding of new capabilities. Application of this same technology can also be beneficially applied to training resulting in improved training while at the same time realizing an overall reduction in training requirements and time. The combined effect of these benefits is improved maintenance with a concurrent reduction in the manpower required.

HOWLAND ASSOC.
207 MAIN STREET, P.O. BOX 999
DANVILLE, NH 03819
Phone: (603) 382-5781
Topic#: 93-178 ID#: 93N1C-507
Office: NAVSUP
Contract #: N00600-94-C-1435
PI: John S. Howland
Title: Commercial Pallets for Cargo Transfer at Sea

Abstract: The objective of the proposed project will be to eliminate the need for "winged" cargo pallets in Naval underway replenishment operations. The project will establish the requirements for an improved transfer device through a study of current connective underway replenishment procedures. All types of standard commercial pallets proposed or now in use will be studied to determine the interface requirements for the transfer device. A conceptual design and development study will be conducted to identify, develop and evaluate concepts to the point where several feasible alternatives can be presented to the Navy. This work will form the basis for further design and development of the most promising alternative in later phases for eventual incorporation into the Naval inventory.

I-KINETICS, INC.
19 BISHOP ALLEN DRIVE
CAMBRIDGE, MA 02139
Phone: (617) 661-8181

Topic#: 93-002 ID#: 93N40-022
Office: ONR2
Contract #: N00014-93-C-0196
PI: Dr. Bruce H. Cottman

Title: A Framework for Integrated Oceanographic Information Systems

Abstract: The accelerated power of PCs and Unix workstations is encouraging a new generation of advanced oceanographic analysis and forecast tools for both basin and mesoscale problems. However, greater "associatively" (i.e. workflow integration), is required to take full advantage of available tools and data. Workflow integration is needed so that "raw" satellite sensor data can be processed and integrated with other oceanographic data, models and simulations. The goal is to create a seamless framework that automates the processing of data from different types of sensors, transforms them to different coordinate and time reference frames, applies any necessary model-based corrections or imaging enhancements, and then feeds them to anyone of several model-based simulations or forecasting programs. The Phase I approach addresses three major areas: 1. Oceanographic Data Interoperability: uniform access to oceanographic data across different data formats, data models and vendor platforms. 2. Oceanographic Tool Interoperability: ability to communicate with and control existing oceanographic tools and databases. 3. Oceanographic Database Management: ability to manage and share large amounts of data.

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Topic#: 92-112 ID#: 92N01-062
Office: ONR
Contract #: N00014-93-C-0054
PI: Dr. Bruce H. Cottman

Title: A Module Interconnection Framework for Collaborative Workflow

Abstract: Modern team-based collaborative workflow requires the ability for applications to communicate and control each other. Interoperability of applications requires a common module interconnection framework (MIF). Phase I will extend the design and development of an existing MIF, called Catalyst. Catalyst emphasizes enabling large scale, organization-wide information systems. The MIF will include facilities for application integration, reliable data management, and collaborative workflow automation and management. The key components of Catalyst are: 1. I-Gates enable the integration of in-place vendor and proprietary in-house applications into a MIF. 2. An I-Bridge enables applications that support one MIF standard to interoperate with applications that support another MIF standard. However, an I-Bridge can be developed for approximately the same cost as integrating two different applications. Integrating frameworks instead of individual applications realizes a significant reduction in system lifecycle costs. 3. FrameScript workflow specifications assist different work groups in automating complex series of control and data flow transactions between different applications. This key innovation enables the management of domain-specific methodologies with explicit workflow scripts that can be developed, shared, and evolved.

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Phone: (804) 296-7000

Topic#: 93-003 ID#: 93N33-882
Office: ONR2
Contract #: N00014-94-C-0003
PI: DAVID W. GERDT, PHD

Title: Acoustic Direction and Range Transducer for Divers

Abstract: The contractor has patented technology for a unique process that directly converts a two-dimensional acoustic disturbance, such as a wavefront, into an intensity-mapped visible image in real-time without electronic circuitry; i.e., it is a direct pressure gradient imager. This device can allow a small, battery powered acoustic source to be easily located and ranged using a small flashlight sized imager. The imager relies on the piezo-dichroic properties of a continuous layer of a dichroic material thin film that serves as both the sensor and the display. The image can be viewed directly or remotely by using a CCD camera. The source would be placed at a location as a position marker. A diver, using a hand held locator, could identify or signal several other divers with a slight sophistication of the basic device. The phenomenon used allows sensitivity levels of 10^{-14} w sec/cm^2. In Phase I the contractor will investigate the engineering specifications applicable to the design of a small, hand-held, real-time, ranging acoustic imager for diver location and signaling in conditions of limited optical visibility. A breadboard model will be produced for the later prototype versions anticipated in Phase II. The extension of this concept to a full acoustic imager for use as a remote mine locator would allow the viewing of mines submerged in low or zero visibility water.

INDUSTRIAL QUALITY, INC.
19634 CLUB HOUSE RD
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Phone: (301) 948-2460
Topic#: 93-108 ID#: 93108-02
Office: NUWC
Contract #: N66604-94-C-0535
PI: Dr Eric Lindgren
Title: Melt Spinning Procedures for Optimization of Terbium-Dysprosium Alloy Transducers
Abstract: The discovery of the large magnetostriction in Terbium-Dysprosium alloys at liquid nitrogen temperatures has created the possibility of constructing high performance transducers for Naval applications. Before such transducers are made this stris of the alloy with the proper crystalline orientation which maximizes the anisotropic magnetostrictive behavior must be manufactured. An innovative and novel approach using a melt spinning technique is proposed. With this approach it is believed that the cooling rate in the ribbons can be adequately controlled to generate a columnar microstructure of hemagonal crystals with the o axis oriented along the thickness of the melt spun ribbons. The m or b axis, the axis of maximum magnetostriction, will be aligned along the length or width of the ribbon allowing the ribbon to be stacked to form a very sensitive magnetostrictive transducer. This is contrasted to conventional melt spinning methods where the existence of thermal gradients in the ribbons limits the degree of orientation. The degree of optimal orientation can be further enhanced and controlled by appropriate additional processing.

INDUSTRIAL QUALITY, INC.
19634 CLUB HOUSE ROAD
GAITHERSBURG, MD 20879
Phone: (301) 948-2460
Topic#: 92-185 ID#: 92N37-004
Office: NAWCWPNS
Contract #: N68936-93-C-0274
PI: Harold Berger
Title: Improved Thermal Neutron Imaging Method
Abstract: Improved neutron imaging methods, to couple with the new availability of non-reactor sources for neutron radiography, are needed to expand the use of this nondestructive testing method. This proposal addresses the development of improved scintillators for thermal (and cold) neutron imaging and the development of a complete imager employing new solid state cameras. This new approach for neutron imaging offers the promise of improvements in terms of signal-to-noise ratio, dynamic range, contrast and spatial resolution. The imaging detector can be used for both prompt response and static situations. The program will include a comparison of neutron scintillators, including new materials such as boron nitride and gadolinium oxide-based ceramic scintillators. Comparisons of selected scintillators used with a 12-bit CCD camera system will be made with present state-of-the-art thermal neutron imaging systems. These evaluations will point the way toward the development of an improved neutron imaging system for development in Phase II, one that will couple well with new accelerator neutron sources. Although the major emphasis in Phase I will be thermal neutron imaging, attention will also be given to neutron imaging in other energy ranges.

INFRARED FIBER SYSTEMS, INC.
2301-A BROADBIRCH DRIVE
SILVER SPRING, MD 20904
Phone: (301) 622-9546
Topic#: 92-182 ID#: 92N13-038
Office: NAWCFTEG
Contract #: N00421-93-C-0103
PI: Danh C. Tran
Title: Low Loss Infrared Fiber Imaging Bundles
Abstract: Imaging bundles of infrared fibers will be developed for use in an IR scene generation system. The fibers will be made from zirconium fluoride glass for the 3-5 micron region, and chalcogenide glass for the 8-12 micron region. Low loss chalcogenide glass fibers will be developed by improving the perform and fiber processing techniques, and using high purity starting materials and glasses. In particular, optimized cladding will be developed, scattering defects minimized, and purification improved to achieve lower loss. The fibers will then be formed into coherent bundles for image relay applications.

INNOVATIVE BIOSYSTEMS, INC.
121 SWEET AVENUE
MOSCOW, ID 83843
Phone: (208) 885-5979
Topic#: 93-128 ID#: 93N4C-058
Office: NCEL
Contract #: N47408-93-C-7359
PI: LEE DEOBALD
Title: Soil Slurry Bioreactors for Ordnance Compounds
Abstract: Disposal of explosives waste residues is an ongoing problem for federal and private manufacturers of ordnance

(47)

containing these chemicals. The need for new disposal technology has been heightened by discovery of ordnance compounds in soils and groundwaters at military sites across the United States. To prevent further contamination from improperly stored munitions wastes and industrial waste streams, and to remediate environments already contaminated by ordnance compounds, improved treatment processes must be developed for nitro-substituted chemicals. Recent work at the University of Idaho by the founders of Innovative BioSystems, Incorporated (IBS) has shown complete degradation of TNT and RDX to innocuous products under strictly anaerobic conditions. Conditions for fermentative degradation of TNT and RDX have been optimized using anaerobic soil slurries. Using this and other available information, IBS will design soil slurry bioreactors for the bioremediation of soils contaminated with high levels of TNT and RDX. IBS will perform a survey of existing data and identify and analyze results from previously performed studies of TNT/RDX biodegradation. Contacts with the Army and Argonne National Laboratory will be established in order to obtain information already generated from their efforts. IBS will also prepare preliminary designs for aerobic and anaerobic soil slurry bioreactors.

INTEGRATED COMPUTER SYSTEMS, INC.
215 SOUTH RUTGERS AVENUE
OAK RIDGE, TN 37830
Phone: (615) 482-1999
Topic#: 93-022 ID#: 93N47-160
Office: SPAWAR
Contract #: N00039-94-C-0038
PI: JAMES GOLDSTON
Title: Composability Constraints of Multilevel Systems
Abstract: The NCSC evaluates the trustworthiness of computing systems and places them on the Evaluated Products List (EPL). Rare is the time when a monolithic computing system will meet an organization's needs. Rather, systems integrators are called upon to integrate differing hardware platforms and software suites. The EPL is composed on monolithic systems. There is no list of trusted integrated products. This makes the accreditor's job difficult, because a DAA can rarely implement a system directly from the EPL. The Trusted Database Management Interpretation of the TCSEC (TDI) was produced partially as a result of this problem. Although the TDI is geared primarily to DBMSs, it can also be used to evaluate parts of the systems. Putting those parts together is difficult because there is no guidance for accreditors on how these TCB subsets can be securely connected. How does one compose a collection of trusted systems? This is the composability problem. A model is needed for system developers, integrators, accreditors, and others who must take trusted system components (some of which may be multilevel) and create a system that not only operates but operates securely. This proposal addresses composability from the viewpoint of an integrator, an evaluator, and an investigator.

INTEGRATED SOFTWARE, INC.
P.0. BOX 060295
PALM BAY, FL 32906
Phone: (407) 984-1986
Topic#: 91-321 ID#: 91N14-479
Office: NAVAIR
Contract #: N00019-93-C-0135
PI: Steven A. Von Edwins
Title: Artificial Intelligence Data Generation Unit
Abstract: Integrated Software, Inc. and SAIC propose a Phase I project to determine the system characteristics and demonstrate the feasibility of an Artificial Intelligence Data Generation Unit (AIDGU). The AIDGU will employ artificial intelligence techniques to generate scenarios and data for engagement training systems. The AIDGU will automate training scenario generation, facilitate scenario modification and present an easily used interface to instructors. The AIDGU will be designed to interface with currently deployed engagement training aids. The proposed project (Phase I and Phase II) will result in a detailed task analysis of the automatic data generation process, a requirements specification for an AIDGU and a system to demonstrate the feasibility of building such a system. The Phase I effort will research, and analyze the current data generation process. It will evaluate, quantify and describe current and emerging hardware and software technologies with which to implement the AIDGU. The Phase I effort will also define an AIDGU product to be prototyped in Phase II. Phase I objectives will be accomplished in four tasks: 1) Research data generation requirements; 2) Derive AIDGU system level requirements; 3) Research and analyze alternative technologies; and 4) Define alternative approaches and designs, and produce the final report.

INTELLIGENT REASONING SYSTEMS
647 CREED AVE.
LAS CRUCES, NM 88005
Phone: (505) 527-1317
Topic#: 92-113 ID#: 92N01-076
Office: ONR
Contract #: N00014-93-C-0118
PI: Mark R. DeYong

Title: A High-speed Object Recognition Chip Based on a Biologically-realistic Hybrid Temporal Processing Element
Abstract: Intelligent Reasoning Systems (IRS) is developing an integrated active vision system (AVS) based on design principles derived from experimental analysis of mammalian visual systems. The AVS design is based on a asynchronous analog encoding of location and motion data, and a custom VLSI Hybrid Temporal Processing Element (HTPE) developed by and available solely to IRS (patent pending). The HTPE can operate on analog data at frequencies in excess of 100 MHz, allowing rapid over sampling methods to be used for resolution enhancement, motion detection, and multiple-template matching. HTPEs have low device count and power dissipation, and can be fabricated in small layout areas. The AVS is intended for eventual on-board application in robots, intelligent machine tools, and other autonomous sensory-motor systems that require visible, IR, or similar input. Binocular fusion will be used to derive depth information by comparing the primary-feature maps generated by feature detectors for two spatially-separated retinas. The goal of this Phase I proposal is to evaluate the feasibility of a binocular object recognition system for the AVS based on the HTPE.

INTELLISENSE CORP.
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BOSTON, MA 02115
Phone: (617) 266-6222

Topic#: 93-004
Office: ONR2
Contract #: N00014-93-C-0212
PI: DR. FARIBORZ MASEEH

ID#: 93N40-119

Title: A New CAD Software for the Development of Microelectromechanical Systems
Abstract: The aim of the proposed multiphase program is to develop and commercialize MEMCAD, a family of computer-aided design (CAD) tools to assist in the design and manufacture of microelectromechanical (MEM) structures. MEMCAD tools should drastically reduce the development time and cost for MEM devices, resulting in more devices being available at lower prices. Developers of MEM devices such as microsensors and microactuators rely on trial-and-error methods in laboratories to develop new devices. This significant cost of prototype development is now reflected in the high prices which the Navy and others must pay for these devices. MEMCAD integrates simulators, databases, and solid modeling tools into a system which mimics the fabrication and performance of microstructures, allowing a designer to conceptualize, simulate, and iterate the micromachining fabrication process on a workstation, thus making MEM devices more affordable. The first prototype of the MEMCAD family of tools, referred to as MEMCAD_p (MEMCAD for pressure sensors), is expected to provide the core technology for the development of additional MEMCAD tools for other sensors and microstructures, including eventually integrated circuits.

INTERNATIONAL BUSINESS ASSOC., INC.
9245 SKY PARK COURT, SUITE 100
SAN DIEGO, CA 92123
Phone: (619) 560-8584

Topic#: 92-154
Office: NAVAIR
Contract #: N60921-93-C-A342
PI: WANG TANG

ID#: 92PMT-245

Title: Terrain Contour matching (TERCOM) Map Placement
Abstract: A cruise missile mission planner has to select a route with a high probability of inflight survivability and to assure enroute navigational accuracy. The objective of this study is to develop automated tools to help cruise missile mission planners determine the optimum route and best reference sites so that viable TERCOM maps can be constructed to meet tactical requirements. The specific objective during the Phase I work is to develop a technique to determine the feasibility of the proposed approach for identifying the best combination of factors for the development of TERCOM maps to meet tactical objectives. The terrain roughness can provide only an indirect index to predict the suitability of TERCOM site selection. A more direct approach is to use the Monte Carlo simulation technique for the purpose. In the direct simulation proposed herein a reference terrain map and a sample realistic map error will be combined to create the on-board TERCOM map. The measurements of a radar altimeter and a baro-damped inertial navigation system will be generated. Four different trajectory orientations and three different sizes of on-board maps will be evaluated, each of which consists of 441 trials uniformly placed on the map. A performance table that summarizes the results of the simulation will be used to determine the suitability of the area under consideration as a TERCOM site and to support two modes of operation: (1) mission specific, and (2) non-mission specific.

INTERNATIONAL DYNAMICS CORP.
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Phone: (407) 862-6313
Topic#: 93-095 ID#: 93095-06
Office: NSWCDDWO
Contract #: N60921-93-C-A338
PI: Jay LIPELES
Title: Miniature G-Hardened Fast Acquisition GPS Inertial Navigation Sensor GPS/INS
Abstract: A preliminary design of a gun launchable GPS will be developed. The proposed design will utilize off-the-shelf components. It will avoid the need for an accurate muzzle velocity measurement. The antenna will be a modification of a proven design. The electronics package will be made from a single flex-circuit which will include several printed circuit boards (PCBs) folded into a stack. The stack will be encapsulated to make a rigid assembly. The resulting package will be extremely inexpensive, strong and lightweight.

INTERSCIENCE, INC.
105 JORDAN ROAD
TROY, NY 12180
Phone: (518) 283-7500
Topic#: 93-006 ID#: 93N07-216
Office: NSWCDDWO
Contract #: N60921-93-C-0146
PI: Dr. Eduardo Saravia
Title: Accurate Laser Discrimination Device Based on Electron-Trapping Phosphors
Abstract: The development of a compact, accurate and reliable laser beam discrimination device is proposed. The concept is based on a novel and improved Electron-Trapping (ET) material developed at the Naval Surface Warfare Center (NSWC), capable of discriminating between NIR, Far-IR, and UV laser sources used for the tracking and ranging of moving objects in the field. This ET phosphor emits visible radiation when stimulated by such laser sources. The time response, spectral discrimination and sensitivity of the NSWC's phosphor make it a very attractive candidate for the proposed concept. A small size, compact and lightweight device can be achieved by using state-of-the-art miniature electronic optical components. The proposed Phase I effort includes the development of the optimum ET material for the application, and the development of a basic prototype device to demonstrate the functional capabilities of the concept.

INVOCON
9001 I-45 SOUTH, STE. 560
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Phone: (713) 364-1291
Topic#: 92-181 ID#: 92N13-019
Office: NAWCFTEG
Contract #: N00421-93-C-0101
PI: Karl Kiefer
Title: Wireless Airborne Instrumentation System
Abstract: During flight testing, an aircraft's performance is evaluated using data obtained from sensors placed throughout the airframe. The data is transmitted to a central data acquisition center via hardware connections. This hardware system has been found to be unsatisfactory due to high costs incurred from installation and removal. The ideal solution to reducing costs would be a data collection system that could be easily installed and removed. Invocon has developed a system which satisfies the above criteria. Consisting of both hardware and software, the system is an Artificial Intelligence (AI) data communications network that incorporates remote sensor units which can be easily installed without wiring. They can also be powered for extended periods of time with internal batteries or can connect to the aircraft bus power. Utilizing data gathering units that communicate via radio, the network implements both narrow and wide band communications to obtain the efficiency of a high speed system with very low power consumption. At the data analysis center, an operator can program the data gathering units to respond to specific instructions. We propose to demonstrate the capabilities of this AI data communications network in a non-flying airframe test. At the conclusion of Phase I, the viability of a wireless airborne instrumentation system will be proven.

IONEDGE CORP.
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FORT COLLINS, CO 80526
Phone: (303) 223-0665
Topic#: 93-004 ID#: 93N40-112
Office: ONR2
Contract #: N00014-93-C-0193
PI: MANDAR SUNTHANKAR
Title: Process Modeling of a Novel Plasma Assisted Alloy Plating
Abstract: Zinc and cadmium electroplating in cyanide baths is known to generate large quantities of hazardous solid and liquid waste. As a consequence, an innovative dry plating process has been developed. This process would eliminate liquids, and minimize solid waste using situ reclaim. This plasma assisted dry plating would be an economical alternative to electroplating.

In recent years, zinc-cadmium alloy plating has shown promise for reducing toxic cadmium plating. This zinc-cadmium alloy can be plated using the dry plating process. However, a basic understanding of the process and its effects could be explored. A systematic research using statistical experimental design method is proposed to develop this understanding. In addition, the frictional properties of the alloy as a function of composition will be studied for potential application. Successful completion of this research could lead to substantial reduction in hazardous waste in many defense plating operations.

IRI CORP.
19562 VENTURA BLVD., SUITE 209
TARZANA, CA 91356
Phone: (818) 996-9805
Topic#: 93-020 ID#: 93N47-013
Office: SPAWAR
Contract #: N00039-93-C-0186
PI: DR. IZHAK RUBIN
Title: Multi-network Engineering Tool
Abstract: Recently, the U.S. Navy has provided SBIR Phase I and II funding to IRI Corporation to develop a SAFENET and FDDI Performance Evaluation Tool. This unique tool is able to provide for the planning, analysis, design, calibration and configuration of SAFENET and FDDI networks using analytically based and analytical-expert-oriented approaches. Its structure is based on the related standards and on the actual hardware devices and modules involved in the implementation of such network systems. It is highly user friendly, incorporating an effective graphical user interface. While this tool is able to provide for the modeling, planning and analysis of SAFENET and FDDI networks, it is currently recognized that many naval (including NTCS-A, OSS, NGCR and Copernicus programs) and commercial implementations require the installation of a multi-network system which interconnects multiple such networks. The purpose of this proposed work is to develop in Phase I, through integration into the existing IRI tool, efficient analytical and combined simulation-analytical methods that can then be used in Phase II for the development of a software based engineering tool for the specification of the multi-network system topology, selection of hardware configuration and the engineering of system performance.

ISOTHERMAL SYSTEMS RESEARCH, INC.
PO BOX 1184
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Phone: (206) 833-7283
Topic#: 92-136 ID#: 92N40-237
Office: NAWCAIND
Contract #: N00016-94-C-0014
PI: Donald E. Tilton
Title: Spray Cooled Avionics Rack
Abstract: ISR, Inc. proposes to develop an innovative direct liquid cooled electronics rack for high power avionics using high efficiency spray cooling technology with dielectric fluids. Under past SBIR Phase I and II efforts, ISR invented custom miniature atomizers which can be packaged compactly in arrays to cool multichip modules. This approach has yielded higher heat flux capability and higher heat transfer coefficients than any other approach. Successful integration of this approach into an electronics rack bring size and mass reductions to aircraft thermal management systems while improving reliability and simplifying servicing procedures. The Phase I program will experimentally investigate the potential of incorporating direct contact condensation in the walls of the rack by injecting jets of subcooled liquid. This will be accomplished by modifying the previous SBIR Phase II apparatus. The new results will be compared to past results to determine the level of performance improvement. Performance should improve because the jets will aid in "pumping" the vapor from the module, enhancing excess liquid and vapor removal which limited performance in past systems. This will allow a reduction in liquid subcooling requirements and raise the heat rejection temperature and reduce the system size and mass. This also simplifies the system design as all flow outside the rack will be single phase. In Phase II, a complete rack will be designed and tested. The rack will demonstrate important features such as effective sealing and easy servicing. A system study will be conducted to determine the most efficient way to apply the technology to realistic avionics packages, and to determine the level of performance improvement and mass reduction in comparison to standard cooling approaches.

JRS RESEARCH LABORATORIES, INC.
1036 WEST TAFT AVENUE
ORANGE, CA 92665
Phone: (714) 974-2201
Topic#: 93-039 ID#: 93N47-008
Office: SPAWAR
Contract #: N00039-93-C-0179
PI: ROBERT J. SHERAGA
Title: Automatically Retargetable Ada and C Compilers for Multiprocessor Networks
Abstract: JRS is proposing to provide a software tool that will demonstrate efficient mapping of Ada and ANSI Standard "C"

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onto Uni-processor architecture, based on VHDL models of the target architecture. This demonstration will utilize the JRS IDAS tool set, which has been effectively applied to this problem, for several very high performance signal processing systems, over the past few years. JRS is also proposing to perform a design study and to define an approach for extending the Uni-processor capability, demonstrated above, to a multi-processor (i.e., network) capability. The approach will be based on the Navy PGM toolset and the capabilities of Ada 9X. The study will be performed around a general Attached Processor System Model that was developed in an earlier study for NAVSEA. This model has been found by JRS to be applicable to most modern military signal and image processing systems. In Phase II, the multi-processor capability will be implemented within the IDAS framework and the resulting prototype will be demonstrated on a Navy provided algorithmic processing chain.

KARTA TECHNOLOGY, INC.
1892 GRANDSTAND
SAN ANTONIO, TX 78238
Phone: (210) 681-9102

Topic#: 93-116
Office: NAWCTRE
Contract #: N68335-93-C-0222
PI: Dr. Satish M. Nair

ID#: 93N10-110

Title: Nondestructive Measurement of Residual Stresses in Anti-friction Bearings Using Magnetic Methods

Abstract: Higher performances from gas turbines by increasing turbine speeds, loads and temperature place increased emphasis on the operation and reliability of engine components such as bearings and gears. The fatigue lives of such components are severely reduced by the presence of residual tensile stresses, introduced by the grinding and finishing processes during component manufacture. There is acute need for nondestructive methods which can perform routine inspections of these components and detect these near-surface stresses reliably and accurately. Three different magnetic methods for the nondestructive measurement of residual stresses in rolling element bearings are proposed. These methods consist of the Barkhausen Noise Analysis (BNA, also called MBE for Magnetic Barkhausen Emission), the Magnetically Induced Velocity Change (MIVC) and the Stress Induced Magnetic Anisotropy (SMA) measurement techniques. These three methods along with other candidate technologies will be evaluated in the process of developing prototype instrumentation for stress measurement.

KLEIN ASSOC., INC.
582 E. DAYTON-YELLOW SPRINGS ROAD
FAIRBORN, OH 45324
Phone: (513) 873-8166

Topic#: 93-184
Office: NPRDC
Contract #: N66001-94-C-7008
PI: Gary Klein

ID#: 93N50-008

Title: Generic Strategy for Performing Cognitive Task Analysis

Abstract: The project is to derive a model for Cognitive Task Analysis (CTA), which is the use of knowledge elicitation methods to probe the decisions, inferences, and situation assessment of people performing tasks, along with the use of representation techniques to convey the knowledge gained by personnel responsible for training or responsible for system design. CTA is a deeper account than is provided by procedural descriptions of the steps needed to complete a task. A variety of information sources will be synthesized to formulate the model, including a limited literature review, compilation of lessons learned from CTA projects, and interviews with CTA specialists. The result of Phase I will be a comprehensive model of the factors affecting the application of knowledge elicitation and knowledge representation methods.

LASER POWER CORP.
12777 HIGH BLUFF DRIVE
SAN DIEGO, CA 92130
Phone:

Topic#: 91-348
Office: NAWCWAR
Contract #: N62269-93-C-0204
PI: GRAHAM FLINT

ID#: 91N0A-081

Title: High Realism Filter for the Simulation of Instrument Meteorological Conditions in the T-45 Front Cockpit

Abstract: The scope of our proposed Phase I engineering development program includes full-scale laboratory testing of a wraparound filter, followed by ground testing of a conformal prototype within the cockpit of a T-45 aircraft.

LEXICON SYSTEMS
BEAVER MEADOW ROAD
SHARON, VT 05065
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Topic#: 93-183
Office: NPRDC
Contract #: N66001-94-C-7009
PI: Dr. Michael Hillinger

ID#: 93N50-036

(72)

Title: Issues in Hypermedia Design
Abstract: This project will design and evaluate software prototypes to examine three issues in hypermedia design. 1. What is the proper balance between user and system control? 2. What strategic knowledge is needed to take advantage of the new dimensions of information available and how can the system's design aid in the acquisition of the knowledge? 3. What is the most effective way to integrate information from different presentation modalities? Specifically, how can we take advantage of the complementary information characteristics of text, sound, and video when presented in an interactive format?

LINCOM CORP.
4420 HOTEL CIRCLE COURT, SUITE 200
SAN DIEGO, CA 92108
Phone: (619) 297-0094
Topic#: 93-032 ID#: 93N47-063
Office: SPAWAR
Contract #: N00039-93-C-0206
PI: GRANT MILLER
Title: Artificial Intelligence Tools for EHF SATCOM Management
Abstract: EHF SATCOM is designed to provide centralized planning with distributive execution. Communications planning includes the process of CINC and Component Commands generating network requirements and requests to the central planner. The central planner is responsible for developing an apportionment of EHF service resources, which is approved by the Joint Chiefs of Staff, for each CINC which in turn can suballocate those resources to the Component Command or allocate them to specific EHF services. The Component Commands must develop specific resource utilization plans and distribute these to the fielded EHF terminals. Implementation of the EHF services is accomplished by the terminal operators and ensuing management of the services and resource utilization is required. Due to the complexity of the EHF SATCOM systems the planners, implementers and managers require software support tools. These software tools should contain artificial intelligence (AI) algorithms to perform integration of a wide variety of input data and provide optimum planning, implementation and management decisions. AI tools or algorithms can be developed to integrate information of associated, but not necessarily directly related topics to ensure that the planning, implementation and management aspects of EHF SATCOM do not violate resource allocations and provide optimized coverage, performance, network configuration and resource utilization.

LNK CORP.
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RIVERDALE, MD 20737
Phone: (301) 927-3223
Topic#: 91-357 ID#: 91N33-003
Office: NTSC
Contract #: N61339-93-C-0070
PI: Gretchen D. Bailey
Title: Low-cost, Knowledge Tool for Rapid Prototyping and Deployment of Intelligent Tutoring Systems
Abstract: LNK Corp proposes to design a low-cost, domain-independent, knowledge-based, tabletop Intelligent Tutoring System (ITS) tool that will enable rapid prototyping and deployment of domain-specific ITS applications. This design will include a Teacher Module that can dynamically adapt its teaching strategies and styles in response to the user profile. It will include a Student Profile Module to maintain a dynamic model of the student throughout the course of each instruction session and will enable such profiles to be stored for future sessions. In addition, an Expert Module will be included for modeling the domain of each ITS developed. An adaptive authoring environment will be designed to facilitate rapid development of domain specific ITSs. To demonstrate the feasibility of the proposed ITS tool, a preliminary prototype will be developed and presented. Based on the Phase I recommendations, design, and demonstrations, Phase II will entail the development of the ITS toolkit prototype.

LYNNTECH, INC.
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Phone: (409) 822-3149
Topic#: 92-111 ID#: 92N01-046
Office: ONR
Contract #: N00014-93-C-0067
PI: Mihaly Novak
Title: Portable Electronically Based Method for the Nondestructive Remote Sensing of Crevice Corrosion
Abstract: Corrosion in the crevices of gasketed joints in the presence of seawater have been particularly troublesome for the Navy and may cause serious damage in assembled seawater pipe joints. The disassembling of numerous pipe joints comprising gasketed flanges is tedious, slow and is a costly way for crevice corrosion inspection. Therefore, a need exists for new nondestructive techniques of crevice corrosion detection. Some of the existing nondestructive techniques, e.g., electrochemical techniques, scanning current probe, and scanning potential probe, are based on corrosion examination from the water side, i.e., sensors have to be introduced inside the pipelines. These are impractical and not necessarily relevant to localized crevice

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corrosion. Techniques which may be used without penetrating the pipeline system include ultrasonics, radiography, eddy current measurements and neutral radiographic spectroscopy. However, most of them suffer from low signal-to-noise ratios. The innovative approach proposed here is based on the application of four probe resistivity measurements for the detection of pit formation and thickness changes of flange alloys in gasketed pipe joints caused by crevice corrosion. This approach has the dual advantages of being nondestructive and very simple. The probe is attached on the outer surface of the flange, and there is no need for disassembling a flange. If shown to be successful in the detection of thickness changes due to pits formed at the metal part of the gasket/flange crevices, this technique has the potential to be easily designed as a fast remote sensing technique for crevice corrosion detection of gasketed pipe joints. The main advantages would be that the sensing probe apparatus can be easily adapted for inspection of different sizes of flanges, quickly mounted and dismantled, easily maneuvered on the outer side of the joint, and the costs for development and application of this technique will be very low. By means of multiple and repeated resistivity measurements of the whole area of possible attack by crevice corrosion, and after graphical data processing by computer, an image may be obtained.

M.L. ENERGIA, INC.
P.O. BOX 1468
PRINCETON, NJ 08542
Phone: (609) 799-7970
Topic#: 92-175
Office: NAWCALKE
Contract #: N68335-94-C-0013
PI: Dr. Moshe Lavid
ID#: 92N0E-047
Title: Environmentally Benign Disposal of Substances
Abstract: Research into the possible unconventional engine candidates that exclude the use of pistons, rotors (Wankel type), lever arm mechanisms, and conventional aerodynamic turbine components, reveals a surprisingly vast array of pumping machinery. Therefore, this Phase I feasibility study will provide the opportunity to investigate a variety of design approaches potentially capable of meeting the current RPV/UAV heavy fuel propulsion requirements. Inherent specific performance limitations of piston and turbine engines which dictates scale reduction will demand greater design discipline relative to the physics that govern their performance. The preferred system concept incorporates a combination of innovative translations of rotary to reciprocating motion resulting in a compact design of high mechanical efficiency. High thermal efficiency will be achieved by the incorporation of low surface/volume geometry. The design makes extensive use of synergism.

MAINE RESEARCH & TECHNOLOGY
P.O. BOX 353
SANFORD, ME 04073
Phone: (617) 233-5628
Topic#: 93-056
Office: NAVSEA
Contract #: N00024-94-C-4050
PI: DR Milan Tekula
ID#: 93N00-047
Title: Galley Exhaust Hood Improvement
Abstract: Abstract available from the NAVY SBIR office. Contact Vinnie Schaper at (703) 696-8528.

MARISYS, INC.
131 NW 43RD STREET
BOCA RATON, FL 33431
Phone: (407) 361-0598
Topic#: 93-049
Office: NAVMED
Contract #: N00014-93-C-0158
PI: Daniel R. Hanes
ID#: 93N19-011
Title: Non-invasive in Vivo Tissue Bubble Detector
Abstract: Development of safe and efficient procedures for humans working under hyperbaric conditions requires a thorough understanding of decompression physiology and gas dynamics. Some current theoretical decompression models consider free gas phases in tissue; however, there is as yet no reliable mechanism for direct experimental verification of tissue gas bubble formation and growth. In this project, candidate technologies which are most likely to lead to the deployment of an instrument for the routine quantitative detection of gas bubbles in animal tissue in vivo are to be evaluated. Acoustical, radiographic, electromagnetic and potentially other approaches will be examined based upon first principals. Potential measurement techniques will be evaluated in terms of measurement accuracy, calibration requirements, ease of use in a clinical setting, equipment size and ruggedness, and cost. The most promising technology will be the focus of in depth engineering evaluation, leading to a product development and manufacturing plan should a practical instrument appear feasible.

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MARYLAND TECHNOLOGY CORP.
10210 SUNWAY TERRACE
ELLICOTT CITY, MD 21042
Phone: (410) 461-3158
Topic#: 93-015 ID#: 93N07-138
Office: MARCOR
Contract #: N00164-93-C-0157
PI: James T. Lo
Title: Neural Filtering for Fusing TV and Thermal Images
Abstract: The image fusion problem is formulated as a least-squares estimation problem, using the TV and thermal images as the measurements and the corresponding "perfect" image as the signal to the estimated. To overcome the difficulties associated with the conventional estimation-theoretic approach, a neural filter is proposed. The neural filter, which was recently developed at the Maryland Technology Corporation, is a recurrent multilayer perception synthesized from experimental data without the need for a mathematical model for the data. It was analytically proven to be optimal for the given architecture and to converge to the least-squares estimator as the filter size increases. General purpose neural network chips (eg Intel's 80170NX, 45mm by 45mm, 1.5W in active mode) are commercially available for prototyping real-time (3 microseconds/layer) neural filters for image fusion. Therefore, the production model, which will be one or more special purpose chip(s), is expected to be small and energy-frugal, making it ideal for military and commercial applications.

MATERIALS SCIENCES CORP.
930 HARVEST DRIVE, SUITE 300
BLUE BELL, PA 19422
Phone: (215) 542-8400
Topic#: 92-171 ID#: 92N0A-123
Office: NAWCAWAR
Contract #: N62269-93-C-0252
PI: BRIAN J. SULLIVAN, PH.D.
Title: Detection of Thermal Damage in Composite Materials
Abstract: Fiber reinforced composites are being used increasingly as primary structural components in avionic application. The organic matrix composites used in these applications, when exposed to extreme thermal environments, undergo chemical and physical changes which adversely impact their mechanical properties. Therefore there is a critical need for reliable and effective NDE methods to assist in determining the integrity and serviceability of these composites. Of particular interest here is thermal damage of a dispersed nature, along with overall matrix degradation due to a change in the resin glass transition temperature, both of which are difficult to detect by conventional methods, and thus "advanced" NDE techniques must be applied in attempts to detect them. To assist in the feasibility assessment of NDE methods for detecting such damage, specific analytical problems must be addressed. These include the interpretation of NDE data in characterizing the type and extent of thermal damage, and the quantification of the effect or the thermally induced damage on load carrying capability of the composite. The primary objective of the Phase I technical effort will be to identify those NDE methods which demonstrate the greatest potential for detecting non-isolated thermally induced damage in graphite epoxy composites. As a secondary objective, the techniques will be classified according to the degree of damage quantification they provide, and the difficulties associated with assigning levels of damage based on the interpretation of the NDE signals.

MATHTECH, INC.
5111 LESSBURG PIKE, SUITE 702
FALLS CHURCH, VA 22041
Phone: (703) 824-7429
Topic#: 92-167 ID#: 92PMT-304
Office: NAWCFTEG
Contract #: N00421-93-C-0111
PI: JO ELLEN HAYDEN
Title: Engineering Economy Analysis of an Inter-communications System Conversion for the E-2C
Abstract: In this SBIR proposal, Mathtech describes the current and proposed Intercommunication Systems (ICS) for the E-2C aircraft, and demonstrates its technical competence in this area. A discussion of Life Cycle Cost analysis, including information on types of models, types of costs, usefulness of various costing methodologies in the various life cycle phases, and brief descriptions of analogy, parametric, and engineering estimate cost estimating methodologies are then provided. Possible sources of input data for the analyses are listed, and deliverable products are described. This project contains a clear benefit to the government in that a rational basis for either retention of the current ICS or selection of a replacement ICS, will be demonstrated and documented.

MATSI, INC.
430 TENTH ST NW, STE S-007
ATLANTA, GA 30318
Topic#: 93-113 ID#: 93113-11
Office: NUWC
Contract #: N66604-94-C-0311

Phone: (404) 876-8009 PI: Ronald A Putt
Title: Zinc Oxygen Propulsion System For Underwater Vehicles
Abstract: The Navy needs high energy density, safe, cost effective propulsion systems for underwater vehicles such as torpedoes, mines, and unmanned undersea vehicles. Systems currently in development (the PEM fuel cell and the aluminum-oxygen semi-cell) present an engineering challenge for scale-down to fit the 21 inch (and smaller) hull diameters for these applications. MATSI proposes to develop a zinc-sodium chlorate system, using an ultra-high specific energy (450 wh/kg) zinc-oxygen technology the company has developed under a NASA contract, in combination with sodium chlorate oxygen delivery technology developed by NUWC. MATSI's zinc-oxygen technology uses a lightweight, efficient, safe zinc electrode (similar to that used in consumer alkaline batteries), a high performance fuel-cell type oxygen electrode, and lightweight plastic cell frames. The system has no moving parts, and because of its high thermal efficiency, only passive modes of heat transfer (free convection and conduction) are required for thermal management. The preliminary estimate or a 19 inch clear hull diameter, is a 110 kWh system, weighing 800 pounds, and occupying 9 cubic feet (55 inches of hull length). The Phase I effort includes a detailed system design study, and delivery of a 10 cell, half-scale, 4 kWh demonstration battery for testing at NUWC.

MCNAMEE, PORTER & SEELEY, INC. Topic#: 93-128 ID#: 93N4C-062
3131 S. STATE Office: NCEL
ANN ARBOR, MI 48108 Contract #: N47408-93-C-7358
Phone: (313) 665-6000 PI: KEVIN P. OLMSTEAD, PH.D.,
Title: Development of an Integrated Soil Slurry Reactor System for Biological Treatment of Soils Containing TNT and RDX
Abstract: The ordnance compounds 2,4,6-trinitrotoluene (TNT) and hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX) are major soil contaminants in locations of interest to the United States Navy. This project will develop a system based on a soil slurry reactor that will use microorganisms to effect complete remediation of such contaminated soils. McNamee, Porter, and Seely has teamed up with Dr. Robert L. Irvine of SBR Technologies, forming a group of engineers and scientists with specific experience in bioreactor development and treatment of soil contaminated by nitro compounds. In this study, recent literature and laboratory results will be updated to determine the most promising microorganisms and reactor configurations for complete degradation of these compounds. The scope also includes a workshop at which leading researchers on biological reactors and ordnance-degrading microorganisms will participate in data evaluation and development of research plans. This information will be employed in desktop studies to design experiments which will be used in Phase II to complete the development of a pilot-scale slurry treatment system. The experiment design will include detailed examination of reactor systems previously shown to be effective in biologically treating nitro compounds, including anaerobic soil slurry sequencing batch reactors and aerobic sequencing batch biofilm reactors.

MECHANICAL SEAL TECHNOLOGY, INC. Topic#: 93-066 ID#: 93N00-135
3600 OSUNA ROAD NE, SUITE 40L Office: NAVSEA
ALBUQUERQUE, NM 87109 Contract #: N00024-94-C-4047
Phone: (505) 345-5122 PI: Alan O Lebeck
Title: Mechanical Seals For Contra-rotating Propulsion Shafts
Abstract: Contra-rotating propellers offer efficiency advantages but one disadvantage to their use is the complexity of the seals and bearings required for contra-rotating coaxial drive shafts. One must seal between the two contra-rotating shafts as well as between the outer shaft and the stern tube. A program to develop a practical seal system for contra-rotating shafts is described herein. Using a removable shaft segment and inflatable seals the shaft seals can be readily replaced without dry docking the ship. Using segmented replaceable wear parts with solid supports gives the needed alignment with on-the-shaft repairability. Using new materials and innovative design, the segmented seals will have long life and high reliability but can be made relatively inexpensively. A detailed plan of analysis and design is given.

MELLER OPTICS, INC. Topic#: 92-118 ID#: 92N37-042
P.O. BOX 6001 Office: NAVAIR
PROVIDENCE, RI 02940 Contract #: N68936-93-C-0247
Phone: (401) 331-3717 PI: TED TURNQUIST
Title: Deterministic High Speed Grinding of Sapphire Domes

Abstract: Sapphire, and other hard brittle materials, are highly regarded as missile domes because of their high mechanical strength and thermal characteristics. Conventional finishing processes used to provide for the final configuration of the domes can be as much as 50 percent or more of the total cost. A new fabrication process for sapphire domes is proposed to reduce the cost of grinding from a scooped dome blank to a prepolished stage by 20 to 30 percent. Specialized sapphire grinding tools and abrasives will be integrated with the high speed, statistically controlled CIM prototype system currently in use at the University of Rochester. The OPTICAM System has already demonstrated a 20 to 30 percent reduction in the fabrication times for several common glasses. A new fabrication process for grinding a sapphire dome to a prepolished condition will be developed and tested. We seek to prove that a similar time reduction can be achieved in sapphire. A second sapphire dome will be fabricated from a scooped blank to the same accuracy using conventional methods. These times will be used as a baseline for evaluation of the high speed technique.

MGMT COMMUNICATIONS & CONTROL, INC.
2000 NORTH 14TH STREET, SUITE 220
ARLINGTON, VA 22201
Phone: (703) 522-7177

Topic#: 93-043 ID#: 93N47-099
Office: SPAWAR
Contract #: N00039-93-C-0177
PI: CHRISTOPHER B. ROBBINS

Title: Automatic Detection and Tracking of Acoustic Signals of Low SNR Using Innovative Beamforming and 3-Dimensional Tracking Algorithms

Abstract: Management Communications and Control Incorporated (MCCI) proposes development of an innovative approach to acoustic signal full spectrum direction finding. The approach is based on describing full spectrum signal arrival structure as a distribution of energy about a single spatial frequency. Spatial frequency is defined as the wave number of a reference frequency and reference array sensor pair. Wave numbers of all spectral components of the signal are normalized to the spatial frequency. Their sum is the spatial frequency power density. Development of three complimentary non-conventional techniques for resolving full spectrum spatial frequency power density are proposed: (1) Super CODAR, a signal subspace decomposition direction-finding method; (2) steered covariance beamforming; and (3) open loop adaptive side lobe canceled split beam correlation. While the proposed methods are sub-optimum, they offer superior array gain to spatially resolve the full spectrum of signals from directional interference. Further, because temporal phase is demodulated from spatial frequency observations, processing may be extended over greater time and bandwidth apertures limited by spatial frequency stability considerations only. Spatial frequency power density estimates may be tracked, displayed as time, bearing, or power histories, and smoothed with existing methods. Bearing sorted spectra associated with a spatial frequency track are displayed and smoothed to form unambiguous track sorted target PSDs. MCCI proposes development of Phase I kernel algorithms using the Processing Graph Method (PGM). Algorithms will be executable on MCCI's laboratory signal processing system and Navy commercial and standard resources. Phase I PGM implementation will support transition of algorithms to a commercial software and hardware system supporting PGM.

MISSION RESEARCH CORP.
735 STATE ST., P.O. DRAWER 719
SANTA BARBARA, CA 93102
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Topic#: 93-001 ID#: 93N40-016
Office: ONR2
Contract #: N00014-93-C-0197
PI: Dr. Mark D. Fisk

Title: Automated Detection of Ship Tracks in Multispectral Satellite Data

Abstract: Under a variety of conditions, effluents from ship stacks can enhance reflectively off shallow layer clouds in such a way that the presence of ships can be detected in daytime satellite images. Multispectral observations from AVHRR abroad NOAA polar orbiting satellites have been used to identify ship tracks through enhanced cloud reflectivity at 3.7 microns, and to a lesser extent 0.63 microns. Nonetheless, some difficulties remain associated primarily with the high variability of cloud reflectivity which results from large variations in liquid water amount and droplet sizes at small spatial scales. Further, the age of the tracks can lead to signatures that are weak and, hence, can pose problems for automated detection, even though the tracks are apparent by visual inspection. In this proposal we address the problem of developing an automated ship track detection system. To do so, we propose to perform the following: 1) optimally enhance satellite images using multispectral signals; 2) determine features that best characterize higher reflectivity and curvilinearity of ship tracks; 3) apply rule-based and cluster analysis techniques to reduce the data stream to a limited number of subscences with potential tracks; 4) apply state-of-the-art neural net and statistical discriminant analysis methods as final detection filters; 5)assess detection success and error rates; 6) develop an automated prototype system design. The algorithms used here are ones that have exhibited success on this or similar

problems. We will adopt the approach of applying a sequence of tests or detection filters to optimize the benefits of each and to minimize detection error rates of both types.

MISSION RESEARCH CORP.
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SANTA BARBARA, CA 93102
Phone: (703) 339-6500
Topic#: 93-097 ID#: 93097-05
Office: NSWCDDWO
Contract #: N60921-93-C-0113
PI: John A PASOUR
Title: Modifications of THOR for IR FEL
Abstract: The goal of the proposed program is to perform a feasibility study and develop a design for modifying the THOR electron accelerator at NSWC. The modification is required to enable THOR to drive a high-power free-electron laser (FEL) in the infrared. Research is underway to use THOR to drive a 94-GHz high-power FEL. If this program is successful, the 94 GHz radiation could be used as a wiggler field for a second stage interaction that could generate powerful, coherent IR radiation. However, a very high quality electron beam is required for the second stage of the FEL. During Phase I, we propose to use detailed measurements of the electron beam quality on THOR (both voltage flatness, which is determined largely by the Marx circuitry, and beam emittance, which is controlled by the beam diode and transport system) along with FEL simulations to quantify the degree of improvement that is required. Modifications to the Marx will be analyzed using a SPICE model. Beam diode modifications will be guided by numerical simulations, using MAGIC and E-Gun. The designs will maintain compatibility with an optimized two-stage or dual-mode FEL that can couple out either the first stage output (millimeter wave) or the second stage output (IR). The fabrication and testing of these modifications and their installations at NSWC will be performed during Phase II.

MISSION RESEARCH CORP.
735 STATE STREET POST
SANTA BARBARA, CA 93102
Phone: (805) 963-8761
Topic#: 91-231 ID#: 91N34-100
Office: NRL
Contract #: N00014-93-C-2107
PI: Dr. Robert J. Puskar
Title: Millimeter-wave Chaff
Abstract: The development of millimeter wave threat radar systems has led to a requirement for millimeter wave chaff. Most recent attempts to develop millimeter wave chaff concentrated on cutting shorter dipoles, and using corner reflectors. The new approach proposed here uses arrays of reflecting elements printed on a thin substrate. The arrays can be designed to enhance the Radar Cross Section over that of an equivalent number of dipoles, as well as direct the scattered energy in angular directions of interest. This control is achieved by proper design of the dipole shape, dipole spacings, and orientations.

MOUNTAIN OPTECH, INC.
4775 WALNUT STREET, SUITE A
BOULDER, CO 80301
Phone: (303) 444-2851
Topic#: 92-137 ID#: 92N0A-025
Office: NAWCAWAR
Contract #: N62269-93-C-0560
PI: D. TIM PENNEY
Title: Military-grade 3.5-inch Rewritable Optical Disk Drive
Abstract: The objective of the proposed effort is to identify and investigate the technology status of suitable digitally-adaptive electronics and 3.5-inch rewritable optical heads, which will operate in severe environments, for incorporation into a SEM-E package. Mountain Optech intends to examine the outcome of its seven years of development experience with 5.25-inch military and rugged optical disk drives for synergy with the smaller form factor military requirements. It is believed that much of the MOI-developed digitally-adaptive electronics, which allow a drive's focus and track servos and read/write electronics to compensate for environmentally induced effects, will be capable of functioning in the smaller form factor with minor modifications. Mountain Optech also intends to investigate the possibility of utilizing the latest innovations in sub-micron chip technology which are evolving from the commercial optical disk drive industry.

MSNW, INC.
P.O. BOX 865
SAN MARCOS, CA 92079
Topic#: 93-087 ID#: 93087-11
Office: NSWCDDWO
Contract #: N60921-93-C-0115

Phone: (619) 489-8522 PI: Dr James E SHEEHAN
Title: Refractory Diboride Composites
Abstract: The diborides of hafnium and zirconium are highly resistant to ablation at extreme temperatures under oxidizing conditions but are brittle and have poor thermal shock resistance. A potential solution to this problem is reinforcement with diboride fibers to create tough, thermal shock resistant diboride fiber-diboride matrix composites. The proposed work will involve the fabrication of ZrB2-Zrb2 composites by the forced-flow chemical vapor infiltration (CVI) of low density carbon fiber mat preforms. The 40 to 50 um diameter fibers will be formed in situ by depositing ZrBf2 onto the 9 um diameter carbon fibers to give final fiber volumes of 40 to 50%. This will be followed by depositing thin layers of BN on the fibers to promote the debonding needed for toughness and them forming the ZrB2 matrix by CVI. The experimental work will be guided by thermodynamic and transport analytical modeling methods developed in a previous program. In addition to the ZrB2 CVI development, experiments will be performed to determine if SiC particulate can be added to the composites by slurry infiltration to improve oxidation resistance. Specimens will be characterized by light and scanning electron microscopy, and toughness and strength will be evaluated by pressurized ring tensile tests.

MUDAWAR THERMAL SYSTEM, INC. Topic#: 92-136 ID#: 92N40-240
1217 DRAWBRIDGE Office: NAWCAIND
LAFAYETTE, IN 47905 Contract #: N00016-94-C-0012
Phone: (917) 463-5258 PI: Wolfgang Leidenfrost
Title: Subcooled Liquid Change of Phase Thermal Management for Electronic Packaging
Abstract: The proposed work involves assessment of the feasibility of removal of large, concentrated heat fluxes from multi-chip circuit boards in high performance aircraft by means of liquid jet impingement cooling with subcooled change of phase. Previous studies have shown that, unlike many other types of liquid immersion concepts, the thermal performance of the proposed concept is more sensitive to coolant velocity than to flow rate. Thus, performance can be greatly enhanced by reducing jet width (in order to increase jet velocity) without increasing the coolant flow rate. Key features of the proposed jet impingement concept are its ultra high heat dissipation capabilities, up to 660 Watts per device using FC-72, small pressure drop and simplicity of design and fabrication. The key objectives of the proposed project are designing a single multi-jet manifolding plate which can be accommodated within the geometrical constraints of avionics cooling modules, modeling the development of vapor bubbles on the device surface (to establish design guidelines for preventing dry-out and ensuring complete condensation of the bubbles prior to exiting the module), and designing the module itself, maximizing the use of commercially available hardware.

MULTISPECTRAL SOLUTION, INC. Topic#: 91-068 ID#: 91N14-396
444 N. FREDERICK AVENUE SUITE 306 Office: NAVAIR
GAITHERSBURG, MD 20877 Contract #: N00019-92-C-0138
Phone: (301) 590-3978 PI: Dr. Robert J. Fontana
Title: Radar ECCM Techniques
Abstract: ECM systems incorporating repeater, transponder and noise jamming techniques can produce a plethora of extraneous false targets which then give rise to bogus target track files. False target detections and subsequent false tracks can so overload a radar's processing hardware/software that the normal functioning of the system can be brought to a virtual standstill. The goal of this Phase I SBIR program is to develop and investigate novel ECM techniques to detect and eliminate ECM noise, repeater and transponder signals from radar track files. To accomplish this goal, we have selected an approach which exploits the shortcomings of conventional techniques for ECM signal generation. In particular, a radar modulation technique is proposed which can conceptually defeat digital RF memory (DRFM) and nonlinear amplifier devices used in ECM systems.

MYSTECH ASSOC., INC. Topic#: 93-106 ID#: N93-106-1
ROUTE 184 N. STONINGTON PROFESSIONAL CTR Office: NAVSEA
NORTH STONINGTON, CT 06359 Contract #: N66604-94-C-0129
Phone: ( ) - PI: Mary A Valk, PhD
Title: Visualization of Complex Active Sonar Information
Abstract: Abstract available from the NAVY SBIR office. Contact Vinnie Schaper at (703) 696-8528.

(59)

N.TEXAS RESEARCH & DEVELOPMENT CORP.
1315 TWO TURTLE CREEK VILLAGE
DALLAS, TX 75219
Phone: (817) 565-4679
Topic#: 92-107 ID#: 92N01-003
Office: ONR
Contract #: N00014-93-C-0051
PI: Jose M. Perez
Title: Experimental Nonlinear Dynamics of Laser Systems
Abstract: We propose an experimental study of controlled regimes in an Nd-doped yttrium aluminum garnet (Nd:YalG) laser and in small ensembles of coupled CO2 lasers (2-4) modules coupled according to different schemes). Nd:YA1G lasers are believed to display an intrinsic chaotic behavior-1 at sufficiently high pumping power. Long experimental time series from such a system will be re-examined and the reliability of the numerical estimation of the Lyapunov spectra checked against recently proposed criteria. Some other criteria of distinguishing chaos from an "amplified noise" will be used. An attempt will be made to obtain the chaotic regime of lasing for this laser by different means such as periodic modulation of some system parameters, radiation injection from another lasing unit and different feedback schemes. Being sure that the system indeed resides on a low-dimensional attractor for some of the tested regimes, we intend to reexamine the technique of stabilization of unstable periodic orbits embedded in an attractor by the occasional proportional feedback method already demonstrated effective for the Nd:YA1G laser in the autonomous chaotic regime. The experience from this series of experiments will be used in an attempt of controlling intrinsic and/or induced chaos in small arrays of up to four coupled CO-2 lasers. Different coupling schemes and array geometries will be used. There is a theoretical and restricted experimental evidence that at least some coupling schemes (e.g., two CO2 lasers optically coupled by a semitransparent mirror) are indeed chaotic and can be described by low dimensional systems of ODE's. The same as above methods of testing chaos will be used and the stabilization of the periodic orbits attempted for some of the realizations of coupled arrays.

NAVMAR APPLIED SCIENCES CORP.
65 W. STREET ROAD, SUITE C-200
WARMINSTER, PA 18974
Phone: (215) 675-4900
Topic#: 92-170 ID#: 92N0A-007
Office: NAWCAWAR
Contract #: N62269-94-C-0002
PI: ELLEN MCGRODY
Title: Ladar Identification Technology Demonstration
Abstract: The Phase I effort will provide an integrated design for a CO2 LADAR that meets the performance criteria of: (a) maximum volume = 3 ft. 3, (b) minimum power = 75 watts, cw, (c) laser stability < 20 Hz (see discussions in Section III) over 1 msec and 20 KHz over 1 sec, (d) maximum weight = 200 lbs: and to provide a real-time demonstration plan for performing long-range identification. Phase I will examine the new IR&D design of a stable laser oscillator (STALO) to determine its ability to meet the revised stability requirement of 20 Hz over 1 msec. The impact of this new design on overall system parameters, i.e. size, weight, and volume will be assessed. Current laboratory equipment has demonstrated 100 watts at less than 100 lbs. and a volume of 2 ft. 3, all of which presently meet the remaining requirements for the SBIR. Phase I will also examine methods of providing accurate pointing and tracking for the LADAR equipment. Standoff ranges (> 50 nmi) impose stringent requirements for such equipment. Existing facilities and equipments will be investigated to determine feasibility of interfacing the LADAR equipment to achieve required performance for the ground-to-air demonstration. The design of these equipments will be such that they can be incorporated into aircraft for subsequent Phase III development by the Navy. Issues of standoff ranges against airborne targets will be assessed as to their impact on the design of a stable oscillator laser power output and optical aperture. Modifications to existing equipments will be defined in Phase I for implementation during Phase II. Phase II will demonstrate the capability of a LADAR to perform standoff against aircraft type targets.

NEPTUNE SCIENCES, INC.
1181 ROBERT BOULEVARD
SLIDELL, LA 70458
Phone: (714) 492-8129
Topic#: 93-043 ID#: 93N47-012
Office: SPAWAR
Contract #: N00039-93-C-0178
PI: JAMES H. WILSON
Title: Automatic Detection and Tracking of Acoustic Signals of Low Signal-to-noise Ratio (SNR) Using Innovative Beamforming and Three-dimensional Tracking
Abstract: Conventional Beamforming (CBF) provides optimum signal detection under ideal ocean conditions (single plane-wave in isotropic, spatially incoherent noise). These conditions never exist in real ocean environments. In order to improve on CBF's performance, Neptune Sciences, Inc. (NSI) has developed and Inverse Beamforming (IBF) method which consists of four algorithms: 1) the Fourier Integral Method (FIM) / Fourier Series Method (FSM) beamforming, 2) noise normalization, 3) an

eight nearest neighbor peak picker and 4) a three-dimensional M of N tracking algorithm. The theoretical development for each algorithm is given in detail in this proposal. The IBF method has been tested using several different data sets and has produced extremely successful results for narrowband, SWATH and broadband energy detection and bearing estimation. The results have been obtained for many different arrays, including a real-time experiment on board a US submarine during RANGEX 1-92. NSI proposes to take this innovative and successful theory, apply it to Navy supplied data from the Fixed Distribution System (FDS), the FDS Deployable (FDSD), or the Advanced Deployable System (ADS) and compare the IBF methods' performance to a baseline performance selected by the Navy.

NEURODYNE, INC.
8 MARLBOROUGH ST, SUITE 4
BOSTON, MA 02116
Phone: (617) 437-9106

Topic#: 92-128
Office: NAVAIR
Contract #: N60921-93-C-0122
PI: THERESA W. LONG

ID#: 92PMT-128

Title: Learning-optimal Control for Unmanned Supermaneuverable Technologies (LOCUST)

Abstract: The development and implementation of nonlinear, learning control systems for Unmanned Air Vehicles (UAVs) will have three major impacts upon their capabilities; increased survivability, extended range of operations, and reduced development costs. The Learning Optimal Control for Unmanned Supermaneuverable Technologies (LOCUST) system will team Neurodyne, Inc. and Sikorsky Aircraft in the utilization of neural network based system identification techniques and optimal control methods to rapidly learn changes in a vehicle's aerodynamic behavior and adapt to sudden meteorological effects while ensuring flight stability. The combined use of neural networks and nonlinear supermaneuverable flight control approaches will also utilize the nonlinear characteristics of the vehicle's dynamical response to increase maneuverability and thus increase survivability. In this effort, Neurodyne and Sikorsky will leverage current research programs in neural networks, nonlinear control, and UAV technology to ensure successful development of LOCUST. The investigators will further leverage in-house and commercially developed on-board sensors and processing techniques to increase both autonomy and range. LOCUST development will also benefit from the investigator's experience in research and development of neural network based reconfigurable flight control systems for the McDonnell F-15 aircraft and RC UAVs to ensure development of a cost-effective, robust adaptive control system.

NORTH STAR RESEARCH CORP.
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ALBUQUERQUE, NM 87112
Phone: (505) 296-3596

Topic#: 93-102
Office: NSWCDDWO
Contract #: N60921-93-C-0106
PI: Dr Richard J Adler

ID#: 93102-05

Title: A Nested High Voltage Generator For Pointer-Tracker Radar Applications

Abstract: The use of DC accelerators with energy storage capability and grid control of the cathode can provide a low cost high confidence means of generating high quality pulsed electron beams for pointer-tracker radar applications North Star's Nested High Voltage Generator (NHVG) technology is well suited to the production of such in the 0 - 50 HeV 0-2 kA range with pulse durations of 0.05 - 10 microseconds. These generators are compact and inexpensive and are capable of very high power grid to beam efficiencies. In Phase I we propose to study how this technology can be adapted to low emittance pulsed beam operation with further decreases in overall system size. By using the EGUN simulation mode we will demonstrate that low emittance beam generation is feasible in this configuration. These studies will determine the optimum electrode geometries for low emittance operation. A single module testing program will be used to minimize the length of an individual module in that the ultimate size of a 5 MeV 20 ampere machine will be less than 2 meters long and 3-4 meter in diameter. We will also estimate ultimate system sizes and costs in Phase I.

NOVA ENGINEERING, INC.
4747 DEVITT DRIVE
CINCINNATI, OH 45246
Phone: (513) 860-3456

Topic#: 93-007
Office: MARCOR
Contract #: M67854-93-C-3037
PI: Keith L. Rowe

ID#: 93N07-176

Title: Miniature Multi-band Antenna Techniques

Abstract: Over the past two decades many new and improved man-pack and vehicular radios have reached the production phase and are now available to troops in the field. Although a variety of antennas have been designed for the new radio systems,

extensive attention has not been devoted to solving tactical user problems confronting troops in the field. Such aspects as size, weight, visibility, transportability and survival under field handling conditions have not been adequately addressed. Moreover, in the case of some mechanically complex designs, antenna cost begins to approach or exceed that of the transceiver. This proposal presents a number of techniques which are available to reduce weight, size and associated visibility while maintaining or increasing existing bandwidths.

NOVA ENGINEERING, INC.
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Phone: (513) 860-3456
Topic#: 93-028 ID#: 93N47-066
Office: SPAWAR
Contract #: N00014-93-C-2011
PI: TERRANCE J. HILL
Title: An Adaptive Multi-rate Vocoder
Abstract: Tactical communications, as they currently exist, stress the available channel bandwidth to support the enormous amount of information that is communicated. To ease the burden on the communication channel, the amount of data being exchanged must be reduced. In speech communications, there are many techniques implemented which compress a voice signal into a data stream; various speech encoding algorithms offer different advantages with respect to alternative performance criteria. The proposed Adaptive Multi-Rate Vocoder (AMRAV) architecture allows dynamic selection of the best communication strategy from a list of predefined techniques; in certain scenarios in which the grade or rate of service can be controlled, the source coding strategy can be chosen automatically. The objective of the Phase I program is to refine the baseline set of candidate algorithms (presented in this proposal) and demonstrate the feasibility of the architecture by implementing a subset of the final AMRAV system to be constructed under the Phase II effort. A system breadboard will be constructed and tested during the Phase I effort to demonstrate the feasibility of the system. This will ideally position Nova for Phase II of this program which will culminate with the delivery of several AMRAVE engineering units.

NOVA ENGINEERING, INC.
4747 DEVITT DRIVE
CINCINNATI, OH 45246
Phone: (513) 860-3456
Topic#: 93-035 ID#: 93N47-067
Office: SPAWAR
Contract #: N00039-93-C-0172
PI: TERRANCE J. HILL
Title: A Flexible Environmental Data Base Compression Unit (EDAC)
Abstract: The need to distribute information from localized data bases to remote sites efficiently has become increasingly important. Due to the reaction time constraints, latency on the information must be held to a minimum. A solution is described which will interface with existing data base equipment and automatically classify from a basis set of information formats, termed "Environmental Data" in the solicitation, and apply an appropriate compression algorithm in response to that determination. The Environmental Data Base Compression (EDAC) applique is transparent to the user and non-intrusive with respect to the existing software, allowing identification and selection of subsets of the information as requested. A system breadboard will be constructed and tested during the Phase I effort to demonstrate the feasibility of the system. This will ideally position Nova for Phase II of this program which will culminate with the delivery of several EDAC engineering units.

NOVEX CORP.
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Phone: (714) 966-9377
Topic#: 93-014 ID#: 93N07-114
Office: MARCOR
Contract #: N61331-93-C-0049
PI: Dr. Alfred D. Goldsmith
Title: Multisensor Mine Detection Using Neural Networks
Abstract: Novex Corp. proposes to apply its neural network expertise and its ground penetrating radar knowledge and technology in order to develop a preliminary system design that properly combines IR sensors, ground penetrating radar and active radar for mine detection and classification. This system design will use neural networks in order to fuse the data from this multisensor suite and result in a real-time detection system which can be easily attached to the Unmanned Ground Vehicle (UGV) and used for the assault breaching of minefields. The system design of Phase I should result in hardware fabrication in Phase II that will have an increased ability to detect all mine types and a drastic reduction/elimination of false alarms. The final output of this Phase I effort will be a system concept Document (SCD) that describes the proposed hardware design including materials, sensors, fusion strategy, neural network programming, mine/countermine detection techniques, tactical deployment, storage and

use as well as size and weight estimates.

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Phone: (508) 369-5410
Topic#: 93-107 ID#: 93107-03
Office: NUWC
Contract #: N66604-94-C-0485
PI: Peter R Roberts
Title: Composite Periscope Mast
Abstract: U.S. submarine periscope outer tubes are manufactured from Type 304 or 316 stainless steel. It would be desirable to have configurations that are lighter and with a higher strength to weight ratio. Composite plastic tubes have been studied but these can absorb water and suffer from delamination. This proposal describes a composite tube structure of concentric layers of beryllium (inner layer; 70% of total section), 304 stainless steel (intermediate layer; 15% of total section) and titanium (outer layer; 15% of total section). The tube will be fabricated by co-extrusion of the three principal materials held in an evacuated steel canister. After extrusion over a mandrel, the steel envelope will be removed. 9 to 15 feet of tube at approximately 2 inches O.D. x 1-3/4 inches I.D. will be formed and available for testing. Testing of the finished model tube will include tensile tests, bending tests and optical metallography and SEM inspection of the component material interfaces. Test results will indicate whether this construction has merit and what modifications may be needed to improve the structure.

ONYX SCIENCES CORP.
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Phone: (617) 576-5768
Topic#: 93-034 ID#: 93N47-150
Office: SPAWAR
Contract #: N00039-94-C-0044
PI: DR. BRAHM A. RHODES
Title: UMLTI Sensor Data Visualization of Meteorological Features
Abstract: Military weather forecasting tasks are becoming more difficult because of the increasing sophistication and weather sensitivity of modern weapon systems, and the large (and increasing) volumes of meteorological data now available to the forecasters for their analysis, especially during periods of bad weather when the demands on the humans in the loop are at a maximum. This is exacerbated by the future prospect of a decrease in the pool of qualified personnel brought about by force reductions. Furthermore, as the weapons become more complex and tactical choices multiply, the operational decision-makers will find it more difficult to deal with the increasing variety of meteorological input data that they must consider in selecting the optimum combination of weapons and tactics. In response to these challenges, the rapid growth of computational speed and memory available at a reasonable cost and in smaller physical volume, makes it possible to envision higher levels of automated data fusion and advanced visualization schemes to accomplish two objectives: (1) Reduce the amount of human intervention required for data fusion while increasing the quality of weather support; (2) Improve the speed and effectiveness of the communication of significant weather information to both the forecasters and their operational users through the use of advanced visualization techniques. We propose to evaluate, select and develop advanced and innovative techniques for data fusion and visualization in order to develop a Meteorlogical Visualization Environment (MVE). The proposed MVE will provide Navy meteorologists with visualization tools necessary to efficiently produce timely, highly accurate tactical weather predictions tailored, simultaneously, for a wide variety of specialized users.

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Phone: (805) 373-9340
Topic#: 91-346 ID#: 91N0A-086
Office: NAWCWAR
Contract #: N62269-93-C-0538
PI: ROBERT E FISCHER
Title: Multipurpose IR Optical Scanner
Abstract: There is a demonstrated need for a new multifunction infrared line scanning imaging system to provide high spatial resolution of targets as well as high thermal resolution of the scene. This SBIR will develop the optical and optomechanical system to work in conjunction with the reconfigurable detector array currently under development in a separate Phase I SBIR to provide the Navy with this important system capability. Furthermore, there would be significant advantages to be able to use the resulting system in a FLIR mode in addition to the line scan mode in order to serve both important system functions, and the system proposed herein has this dual purpose capability. An optical system concept is proposed which will satisfy the above needs for both a line scan system as well as a FLIR system, interchangeably.

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Topic#: 93-036
Office: SPAWAR
Contract #: N00039-93-C-0217
PI: Mr. Gerald C. Moons

ID#: 93N47-208

Title: Automated Acoustic Information Classification System (AAICS) for ASW

Abstract: The mission of passive undersea surveillance is to classify potential threats by examining the acoustic signatures of detected sources. Current methods are based on visual examination and operator translation of the acoustic scene. With the ongoing reduction in Navy personnel, an automated system requiring minimal operator interaction with improved classification capabilities will be needed to support current and future automated surveillance requirements. In the past many attempts have been made to develop and automate classification systems. These systems generally failed, primarily due to lack of acoustic expert involvement in the development of these classification systems. Additionally, front-end processors were inappropriately designed and did not provide information required by the classifier to produce high-confidence results. ORINCON has successfully developed and demonstrated prototype automated undersea surveillance systems utilizing expert processors on both SPAWAR and DARPA programs, such as the Automated Surveillance Information Processing Systems (ASIPS) and the 7100 Site Evaluation System. In Phase I we will apply our extensive experience in developing automated detection and classification systems to design an information processor (IP) and utilize in-house experts to develop the associated rule bases required to perform automated classification. In Phase II, a prototype system will be developed to demonstrate this concept.

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Topic#: 93-040
Office: SPAWAR
Contract #: N00039-93-C-0197
PI: LARRY L. BURTON

ID#: 93N47-179

Title: Acoustic Warfare Management System

Abstract: The U.S. Navy requires a tactical decision aid to integrate information from IUSS with information from tactical forces. This system must include resource allocation/optimization, communications management, all-source data fusion battle management, advanced graphics, and a tactical metric. Some of these functions are performed manually while others involving close coordination with tactical forces are generally not a substantial part of current IUSS responsibilities. Some automation will be added with FDS and SDS. However, these systems do not fully manage active/passive interoperability of even the available surveillance sensors and the information from these systems will still not be tightly coupled with tactical ASW information. ORINCON's proposed research will carry out a requirements definition and a high-level and detailed design for this tactical decision aid, building on our DARPA Acoustic Warfare Decision Support System experience. As a result of these efforts, substantial innovative technology can be brought to bear on the design of this decision aid. Our Phase II efforts will involve implementation of the Phase I design to demonstrate a proof-of-concept system. ORINCON is uniquely qualified to perform this research because of our substantial DARPA expert system experience, our extensive knowledge of both active and passive IUSS systems, and our tracking and data fusion efforts as part of a number of tactical ASW programs.

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Topic#: 93-072
Office: NAVSEA
Contract #: N00024-93-C-4071
PI: Dr Larry L Burton

ID#: 93N00-203

Title: Multiwarfare Tactical Decision Aid

Abstract: Abstract available from the NAVY SBIR office. Contact Vinnie Schaper at (703) 696-8528.

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Topic#: 93-074
Office: NAVSEA
Contract #: N00024-93-C-4201
PI: Mr Kenneth Garber

ID#: 93N00-220

Title: Automated Acoustic Search Planning

Abstract: As the inventory of U.S. ASW platforms continues to decrease the task confronted is increasingly difficult. More capable submarines are employed by potential adversaries located in difficult acoustic environments. U.S. ASW platforms

employ suites of sophisticated sensors to handle this growing problem and tracking foreign submarines successfully requires proper planning of sensor utilization and platform tactics. The U.S. Navy needs advanced development in the area of sonar suite search plan optimization that accounts for integrated ASW techniques and can combine platform sensor capabilities. ORINCON is uniquely qualified to develop this system as a result of work currently being conducted for DARPA Advanced Undersea Warfare Decision Support System 4D5S3 and the extensive work conducted in Multihypothesis Tracking 1NHT1 ORINCON Resource tracking system will perform acoustic performance diagnostics and provide optimization guidance. MHT will be used to test the performance of the proposed tactics against simulated targets that may be encountered. This innovative method of testing a search plan against potential adversaries using MHT combined with an expert system to aid in optimizing acoustic sensor performance will provide the search planning capability required.

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Topic#: 92-127 ID#: 92PMT-111
Office: NAVAIR
Contract #: N00019-93-C-0210
PI: DR. S. LAWRENCE MARPLE, J
Title: SAR/ISAR Real-time Image Processing for Air ASW Platforms
Abstract: Three signal processing approaches are proposed here to better exploit the SAR/ISAR signal differences between sea surface noise clutter/speckle and periscope/other small manmade target signatures that have been used in previous algorithms. A special high-resolution, two-dimensional (2-D) spectral analysis approach for creating the SAR/ISAR image, rather than using the traditional 2-D fast Fourier Transform (FFT), is demonstrated to significantly reduce clutter while sharpening the resolution of target signatures. After the radar image is formed, two other signal processing techniques can be used to enhance detection of small targets in the presence of image clutter. Polycorrelation techniques (specifically, the biocoherence) are shown to yield uniquely distinctive signatures between target-in-clutter regions and clutter-only regions of SAR imagery. Time-versus-frequency representation (TFR) signal processing techniques can better exploit the Doppler signature difference between targets and clutter, as demonstrated with helicopter radar data in this proposal.

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Topic#: 92-150 ID#: 92N0A-165
Office: NAVAIR
Contract #: N62269-94-C-0505
PI: MR. DONALD K. OWEN
Title: Air ASW Acoustic Clarification
Abstract: The ASW threat in the current, post-cold-war environment is the slow-moving, low-target strength, quiet diesel submarine. The shallow water environments they typically operate in make the task of detection even more difficult. These conditions will require the use of an active sonar with a classifier architecture that can operate robustly in a variety of harsh environments. ORINCON proposes to develop both classification feature algorithms and feature vector classifier architectures. Features that are useful in both monostatic and multistatic scenarios will be developed. Classical feature vector classifiers as well as neural network classifiers will be examined. We have specific experience using neural networks to classify active returns recorded with the BSY-1 system and the Low Frequency Active (LFA) system. Automatic classification systems of this type provide 360-degree classification coverage, assistance to inexperienced operators, and the ability to "dig" targets out of clutter and reverberation. ORINCON proposes to identify techniques for active classification and define promising active classification algorithms. We will identify existing recorded data collected during Fleet operations for algorithm testing. A general method to prepare simulated recordings of active returns in a realistic background is also presented and a plan to solidify it is proposed.

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Topic#: 93-003 ID#: 93N37-044
Office: NAWCMUGU
Contract #: N68936-93-C-0408
PI: Steven Morton
Title: Advanced Systems and Technologies for Future Naval Warfare
Abstract: Flexible, powerful, compact, image processing and pattern recognition systems with high input and output bandwidths, and large memory capacity are required to solve many vital DoD and commercial applications in real-time. Adequate devices for building these systems are not available. We have conceived a four-dimensional solution to these image processing and

pattern recognition problems. Our basic building block is three-dimensional, and these building blocks are arrayed angularly, using a fourth dimension/degree of freedom. Flexible systems storing 100 million weights and performing 100 billion connections per second can be built compactly and economically. Unlike very high performance, but special purpose, digital signal processing chips, our architecture is fully programmable. Unlike very high performance analog neural network chips that have very limited memory capacity, our architecture can store and access vast quantities of information quickly. Unlike neural networks that require external image segmentation, our architecture can perform both segmentation and recognition. In addition, we provide very high input/output bandwidth. In Phase I we will show the feasibility of building our devices and system. In Phase II we will build the system and implement a real-time image processing application upon it.

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Topic#: 93-003
Office: ONR2
Contract #: N00014-94-C-0005
PI: MICHELE HINNRICHS

ID#: 93N40-184

Title: Advanced Technology of EO/IR Target Detection and Identification

Abstract: This proposal is for a new and innovative approach to multispectral sensing that addresses several areas of need: 1. Noncooperative target recognition; 2. Ship self-defense; 3. Sensor technology for counterstealth-aircraft; 4. Missiles; 5. Global surveillance. In this proposal we will describe a means of measuring the fine spectral signature of targets with in the field of view of an imaging sensor. This technique works from the ultraviolet to the millimeter spectral region. It is most applicable in the infrared spectral band for measuring the spectrum of missile and aircraft plums. However, it is also applicable for other purposes such as measuring biological and gas warfare. It can be used in missile seekers, missile warning systems, (both tactical and strategic), as a means of identifying noncooperative targets and also can be used for identifying friend or foe. Pacific Advanced Technology has invented a technique for performing multicolor imaging using staring arrays. This technique not only enables a sensor to measure multicolor, it provides the capability to measure the fine spectral signatures of targets with a resolution of less than 0.01 um in the mid infrared spectral region. Under contract to the Air Force Space Division, Pacific Advanced Technology evaluated and demonstrated the applicability of the "Image Multi-Spectral Sensing", (IMSS), concept for application in space surveillance and early warning systems.

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Topic#: 93-070
Office: NAVSEA
Contract #: N00024-93-C-4053
PI: Michele Hinnrichs

ID#: 93N00-193

Title: Under-ice Remote Detection System Using Optical Heterodyne System

Abstract: Abstract available from the NAVY SBIR office. Contact Vinnie Schaper at (703) 696-8528.

PACIFIC-SIERRA RESEARCH CORP.
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Topic#: 92-188
Office: NAWCWPTM
Contract #: N00123-93-C-0336
PI: C.J. Swigert

ID#: 92N44-001

Title: HWIL Dichroic Target Screen

Abstract: The problem is to design and develop a multi-spectral screen for HWIL laboratories which is reflective in the infrared (IR) and transmissive in the microwave region. This SBIR proposal describes four new design approaches developed at Pacific-Sierra Research Corporation for such a dichroic screen. The first technique uses a stationary, dielectric screen with a conic surface and small IR reflective squares on an RF transmissive dielectric screen to reflect the IR and transmit the RF wave through the dielectric. The second technique uses an RF transmissive dielectric screen with a quarter wave IR coating on the flat screen to reflect the IR and transmit the RF wave through the dielectric. The third technique uses a screen composed of phyllosilicate minerals that are transmissive in the RF and reflective in the IR. The fourth technique uses an agile, IR fiber-optic, RF dielectric bundle to relay an IR source image to a dielectric IR collimator which projects a collimated IR image to the missile. The RF propagates through the dielectric fiber bundle and IR dielectric collimator. The technical objectives listed for Phase I are structured to provide a detailed technical design and measurements that can be used to fabricate, test, and deliver a multispectral target screen in Phase II.

(bc)

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Phone: (415) 857-9655
Topic#: 93-004 ID#: 93N40-104
Office: ONR2
Contract #: N00014-93-C-0214
PI: MS. PATRICIA WIENER
Title: Technology for Affordability
Abstract: Page Automated Telecommunications Systems, Inc. has been developing affordable fiber optic techniques for perception action decision based systems. In the process we have discovered that we can produce fiber optic arrays, highly dense arrays for backplanes, ribbons, optoelectronic circuit/interconnect modules as well as embedded sensors. We will in this project verify present fabrication methods, its limits and automation requirements which will further reduce costs. We will define cost parameters for the manufacture of highly dense optical backplanes and interconnect modules both passive and active interconnect circuit modules. We will define assembly practices and determine capital equipment modifications to ensure cost effective, high performance products both for government and industry.

PCB PIEZOTRONICS, INC.
3425 WALDEN AVENUE
DEPEW, NY 14043
Phone: (716) 684-0001
Topic#: 93-081 ID#: 93081-11
Office: NSWCDDWO
Contract #: N60921-93-C-A337
PI: Richard W LALLY
Title: Low Cost Miniature G-Hardened Quartz Inertial Navigation Sensor
Abstract: Combining the stability of quartz and the process micromachining, it may be possible to develop cost effective inertial navigation sensors (INS). Linear position can be determined from passive or active vibrating beam type accelerometers while rotation can be determined from resonating tuning fork type gyros. Technical problems relating to noise sources, instabilities and feasibility are to be investigated. Unique mechanical configurations, crystal orientations and micro-electronic designs will be conceived, modeled and tested when possible. The feasibility of this technology for the INS will be assessed in Phase I and a recommendation provided for research and development in Phase II. Based on a large commercial potential in automobile navigation, aerospace navigation and six degree-of-freedom sensing of structural vibration; it is possible that the INS may be produced through micromachining batch processing methods at a significant cost savings to current manufacturing methods.

PDI CORP.
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Phone: (410) 224-2130
Topic#: 93-105 ID#: 93105-14
Office: NSWCDDWO
Contract #: N60921-93-C-A345
PI: Jeffrey E Greenblatt
Title: MIL-ATD-2036 Training/Authoring Expert Assistant
Abstract: Recent changes in DoD acquisition policy have led to the promulgation of MIL-STD-2O36 as the governing standard for shipboard surface and submarine electronic systems. In addition to defining a standard environmental requirements baseline MIL-STD-2O36 establishes a preference for the use of commercial off the shelf (COTS) equipment where such equipment meets system requirements. FDI proposes to develop an integrated expert-based multimedia system which will train acquisition personnel in the use of MIL-STD-2O36 as well as assist them in generating equipment-specific specifications, SOWs and CDRL items. The system will be principally composed of COTS software products linked together to present a seamless expert authoring/training tool for the user. The expert system will assist in both training and in developing specification and SOW inserts. A number of inferencing schemes will be investigated for this application. Hypertext and hypergraphics will be included to enhance the effectiveness of the tutoring and specification development. Completion of Phases I and II will result in both a system for MIL-STD-2O36 as well as the software system and methods for development of expert tutoring/authoring systems for other MIL standards.

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Topic#: 91-356 ID#: 91N13-077
Office: NAWCFTEG
Contract #: N00612-93-C-0229
PI: E. J. Lecourt, Jr.
Title: Instrumentation System to Measure Ship Motion/Airwake
Abstract: The air disturbance created by a ship's deck and superstructure known as airwake constrains aircraft-ship interaction

to varying size safe operating envelopes. Airwake phenomena has been studied and analyzed using wind tunnel models and computer simulation but present day practice still requires ship-aircraft dynamic interface (DI) tests. The technical objective of Phase I is to design a practical instrumentation system which will provide comprehensive quantitative and qualitative data for ship motion measurements and airwakes surveys used to complement DI testing. Task 1 of the project will establish the system requirements through meetings and research. A survey of applicable motion, air flow, and ancillary sensors is performed in Task 2. Task 3 is a survey of data acquisition systems and supporting equipment. Task 4 develops a software specification and performs a survey of available software. The design developed in Task 5 culminates hardware and software specifications, design drawings, and test and operations plans to be used in the Phase II development and testing.

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Phone: (516) 420-0052
Topic#: 93-064 ID#: 93N00-101
Office: NAVSEA
Contract #: N60921-93-C-0120
PI: Frederick M Ganz
Title: Sensor Tactical Decision Aid (STDA)
Abstract: A Sensor Tactical Decision Aid (STDA) is proposed that would be implemented on an SGI workstation to provide real-time performance prediction for the on-board sensors of radar and IR. The workstation will employ bases on a world-wide basis, that provide for high quality deterministic scene generation relative to the sensor platform and local weather and environmental conditions, as inputs to enable accurate predictions of sensor performance against a variety of target threats. The STDA will be structured on the Practical Scene Generation Model (PSGM) workstation architecture which provides for the necessary radar and IR sensor models, target models, and environmental phenomenology models. Sensor performance prediction on an end-to-end basis will provide the integrated terrain masking to accurately project instantaneous sensor performance capabilities and limits to the user. A real-time demonstration will be conducted as part of the Phase I activity.

PHOTONIC SYSTEMS, INC.
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MELBOURNE, FL 32901
Phone: (407) 984-8181
Topic#: 93-093 ID#: 93093-03
Office: NSWCDDWO
Contract #: N60921-93-C-0114
PI: James A CARTER
Title: Flexible Detection and Post-processing Module for Optical Processing Systems
Abstract: The practical limit of optical processor technology ultimately relates to the detection and subsequent electronic interpretation process. Optical source and modulation components are capable of much higher throughput and dynamic range than the detector and postprocessing electronics. Detectors and readout electronics typically must be optimized to specific processor technology to make it useful in system application or critical mission. Many emerging optical processor architectures use two dimensions to encode and process data and thus require high-resolution, two-dimensional detector devices. As a leader in optical processing, Photonic Systems Inc. (PSI) has recognized that two dimensional detectors with highly flexible readout control and postprocessing capabilities are essential for delivering processing gain and data throughput commensurate with the requirements of new architectures. PSI has developed and implemented a very flexible control and readout detection assembly coupled with a very high throughput Digital Signal Processing (DSP) package that is based on the Texas Instruments' TMS320C30 processor. All readout and post-processing algorithms are programmable on the fly through the Intel PC Industry Standard Architecture (ISA) peripheral bus. We propose to start with our working detector and postprocessing subsystem and design a compact and rugged module that implements its functionality in an approved form.

PHOTONICS RESEARCH, INC.
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Phone: (303) 541-9292
Topic#: 93-091 ID#: 93091-04
Office: NSWCDDWO
Contract #: N60921-93-C-0143
PI: Greg R OLBRIGHT
Title: Microlaser Diode Array Based Optical SAR Pattern Recognition Module
Abstract: Conventional SAR systems use film as their input/output display medium, which makes these processors large, unreliable and slow with respect to the Navy's need for a real-time, compact SAR pattern recognitions system. We propose to fulfill this need by inserting arrays of individually and electrically addressable vertical cavity surface emitting lasers (VCSELs) into a spatia-temporal adaptive optical processing module (OPM) that operates directly on the SAR echo returns, bypassing the

SAR image generation. Generating the SAR image is not necessary, and it is this process that prevents real-time pattern recognition on SAR data. The implementation of the proposed OPM will straightforwardly simplify pattern recognition of SAR data, and dramatically improve the performance as compared to alternative input light sources based on film or spatial light modulators. For the OPM mentioned above, higher speed, more versatility and device tolerance, as well as very compact optical system design is a direct result of the VCSEL microlaser arrays, a recent advancement in optical device technology. VCSELs are fundamentally much better suited for this application than the more circular, low-divergence beams, and they can be fabricated in arbitrary one-dimensional and two-dimensional patterns. The utility of this technology, and the OPM approach which is based on VCSELs is likely to range far beyond what we can presently imagine.

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Topic#: 93-006
Office: MARCOR
Contract #: N60921-93-C-0147
PI: Lev Sadovnik

ID#: 93N07-100

Title: Miniature Laser Discrimination Device Using Holographic Bandpass Filters

Abstract: In order to fully utilize the discrimination capability of IR up-converting phosphors, Physical Optics Corporation (POC) proposes to design and fabricate a new laser discrimination device (LDD). The key elements of the proposed device are two holographic bandpass filters tuned to luminescent spectra simulated by wavelength = 1.06 micrometers and wavelength = 10.6 micrometers radiation, respectively. Such an effective separation also permits an increase in the device's discrimination capability in the presence of strong background radiation. The most efficient phosphors will be selected to form a phosphorous compound film (PCF) to be used in the proposed LDD. The device will be extremely compact, lightweight and inexpensive. Its elements require low risk technology which makes it feasible to demonstrate a breadboard prototype device at the end of the Phase I program.

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Topic#: 93-085
Office: NSWCDDWO
Contract #: N60921-93-C-0090
PI: Dr Shudong WU

ID#: 93085-05

Title: A Compact Reliable Real-time Optical Correlator with Extremely High Computation Parallelism

Abstract: Physical Optics Corporation proposes the development of a new, highly parallel optical correlator (HPOC) capable of achieving time correlations between input sonar signals and up to 10 thousand simultaneous reference signals. The HPOC design does not rely on exotic coherent optical processing techniques or bulky lens imaging systems. It uses only state-of-the-art fiber-optic components. The HPOC concept uses a spinning drum on which up to 1024 distinct gray level encoded reference signals are placed. A light beam emitted by an LED and modulated by the incoming sonar signal is incident upon the drum and picked up by a fiber faceplate which conducts the light signals to a 1024 x 1024 CCD array. To eliminate the correlation DC background and increase the system's dynamic range, the HPOC will incorporate positive and negative CCD detection channels. With the HPOC, ten million parallel correlations can be performed. The unique, extremely high parallelism of computation, which even today's most powerful digital computers do not have, would allow simultaneous correlations with a large number of reference signatures. The HPOC is expected to solve the difficult data analysis problem of detecting and identifying underwater moving targets in the presence of extraneous noise.

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Topic#: 93-091
Office: NSWCDDWO
Contract #: N60921-93-C-0150
PI: FREDDIE LIN PHD

ID#: 93091-03

Title: A Real-time Smart Optical SAR Signal Processor

Abstract: Physical Optics Corporation (POC) proposes an innovative optical SAR signal processor for automated target-recognition applications. The processor is based on a two-step optical technique: A coarse-search step and a fine-search step. The coarse-search optical processor can compare the input pattern with the key features of an entire template data bank in one pass of light transmission and provide most likely addresses to the data bank for accessing possible matching patterns. These possible matching patterns will then be fed into the fine-search optical processor for a thorough comparison. The

advantage of this two-step processing is its intelligence--the system does not have to exhaustively search the entire data bank. POC further proposes a unique technological development in each step of the SAR N6 interconnectability which represents a technology beyond the state of the art in coarse-search processing. A distributed-array processing technique will be explored in the fine-search processor for increased throughput and dynamic range.

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Phone: (310) 320-3088
Topic#: 92-108 ID#: 92N01-013
Office: ONR
Contract #: N00014-93-C-0021
PI: Dr. Freddie Lin
Title: An Optically-assisted 3-D Cellular Array Machine
Abstract: In order to increase the data processing/communication abilities of the next generation real-time image processing systems, Physical Optics Corporation (POC) proposes to design a VLSI chip or chip set which will incorporate both electronic and photonic processing/communication hardware elements in one system. By using new techniques, a 3-D, Optically assisted cellular array "machine" for real-time image processing operations could be achieved and would out perform conventional, strictly electronic image processing systems. In addition to the benefit of scaleable expansion, photonic interconnect technology will allow a compact, 3-D system packaging solution without introducing the problems of heat dissipation and crosstalk that are encountered in conventional 3-D electronic signal processing hardware. Phase I work will include the designs for both electronic processing elements and photonic interface units which constitute the basic building blocks of the proposed 3-D, optically assisted cellular array machine. In addition, the architectural design of a real-time image processing system will also be implemented. A number of algorithms will be simulated in this conceptual system in order to demonstrate the performance of the proposed optically assisted cellular array machine.

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Phone: (310) 530-1416
Topic#: 93-121 ID#: 93N33-814
Office: NCCOSC
Contract #: N66001-93-C-7006
PI: TIN AYE, PH.D.
Title: High Resolution Wideband Tunable Fabry-Perot Optical Filter with Holographies
Abstract: High resolution tunable optical filters are critical for the Navy's free-space laser satellite communication systems for submarines. POC has developed a new Fabry-Perot (FP) technology based on holographic phase compensation of interferometrically formed FP mirrors. POC proposes to extend the tunable holographic Fabry-Perot technology to a double cavity monolithic polymer and liquid crystal overlay structure, which can be coated on any substrate regardless of profile (flat or curved). The device will be electronically tunable through the use of low-voltage liquid crystals, and will provide high resolution (1 Angstrom) filtering over the entire blue-green (450-550 nm) spectral region. Phase I objectives include: the design of the double cavity holographic Fabry-Perot filter; demonstrating the HFP LC polymer/sol-gel spacer coating; and fabricating a proof-of-concept filter. Performance goals are: size = 1-2 in. sq.; Finesse = 30-50, Pass Bandwidth = 1-4 Angstrom; Tuning Range = 50-100 nm; Speed = 50 ms-1sec. The Phase II effort will be to extend and optimize this device technology for the production of high quality prototype filters with maximum bandpass of 1 Angstrom, and tunable over a spectral range from 450 to 550 nm.

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TORRANCE, CA 90501
Phone: (310) 320-3088
Topic#: 92-142 ID#: 92N0A-074
Office: NAWCAWAR
Contract #: N62269-93-C-0248
PI: DR. ROBERT LIEBERMAN
Title: Fiber Optic Laser Ultrasound Structural Health Monitor
Abstract: The fiber optic laser ultrasound structural healthmonitor is a lightweight, retrofittable, solid state nondestructive inspection (NDI) system to detect fatigue cracks, corrosion, disbonding, and delamination in critical components of both old and new aircraft. The structural health monitor would find application in the prevention of multi-site damage (MSD) by detecting precursor defects. The system offers dramatically reduced inspection times, and in fact makes it possible to perform "real-time" inflight evaluations of key structural components. Based on a novel variation of trusted ultrasonic inspection techniques, the fiber optic laser ultrasound method offers much more versatility, a much lower cost, and ease of retrofitting to existing systems.

This is achieved by using readily available optoelectronic components to generate and detect ultrasound signals through a specially manufactured array of optical fiber sensors. The versatility and literal flexibility of the proposed fiber optic sensor system assures that this technique will be suitable for use in the most troublesome structural areas, including wing and tail joints, doors, windows, rivetted panels, and ailerons. Furthermore, the nonconducting nature of optical fibers gives the entire system RFI immunity as well as the RF "transparency" that would allow it to be installed on radomes and even antennas.

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Topic#: 92-169
Office: NSWCDDWO
Contract #: N60921-93-C-0112
PI: Jay HIRSH

ID#: 92N2D-041

Title: Real-time Adaptive Optical Processor Based on Novel Temporally Evolving Reference Algorithms

Abstract: Recent significant advances in components, architectures, and design philosophy have at last made optical automatic target recognition (ATR) competitive with or even superior to its electronic alternative. Obviously the specific scene that is encountered (noise, obscuration, decoys, camouflage, etc.) is beyond anticipation. Thus the required system must be adaptive and tolerant, yet highly accurate. POC proposes to develop an optical correlator system incorporating novel algorithms for processing target image information. The system will be designed to recognize and track targets, then perform aim point selection in real time. The principal novelty of our approach is the development of a temporally evolving reference filter algorithm to adaptively extract target features in the presence of clutter, noise, or obstructions. Successful development of this system would greatly increase both offensive and defensive military capabilities. To determine the feasibility of POC's approach, the Phase I program will go from theory to a limited demonstration of the concept. Successful completion of Phase I will prepare us to design and demonstrate a deliverable prototype system in Phase II.

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Topic#: 93-088
Office: NSWCDDWO
Contract #: N60921-93-C-0102
PI: George E CALEDONIA

ID#: 93088-04

Title: Oxygen Atom Source for Low Orbit Simulation

Abstract: We propose to provide a custom design of a laboratory facility for low Earth orbit material testing which incorporates a fast oxygen atom source capable of operation over the velocity range of -5 to 11 km/s with flux greater than 5 x 10(15) cm-2 s-1 over a beam diameter exceeding 10 cm. The beam properties will be characterized by a suite of innovative diagnostics with preliminary characterization being performed in Phase I. The source will expand upon technology previously developed in constructing an 8km/s oxygen atom source. This technique utilizes laser breakdown in pure oxygen to create a pulse of ions which subsequently recombine during hypersonic expansion to produce a nearly mono-energetic beam of neutral oxygen atoms.

PHYSICAL SCIENCES, INC.
20 NEW ENGLAND BUSINESS CENTER
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Topic#: 93-131
Office: NCEL
Contract #: N47408-93-C-7320
PI: KARL W. HOLTZCLAW

ID#: 93N4C-043

Title: A Real-time Airborne Lead Monitor for Use in Firing Ranges

Abstract: Physical Sciences Inc. (PSI) describes a program that will design, build, and test a simple, compact, and reliable monitor for airborne lead with specific application to indoor firing ranges. This instrument will provide the unique capability of real-time monitoring of lead levels on the range. It will be small and portable and therefore will provide local lead concentrations at various locations within the firing range. Our instrument will eliminate the need for extractive sampling techniques and the subsequent off-line analysis at an analytical laboratory. The instrument uses a spark to ionize a very small volume of air within the firing range. A plasma is thus created in the spark zone and species in the plasma emit light at their characteristic colors or wavelengths. The intensity of the emission from any species can be used to determine its concentration. The spark will be generated using a simple power supply and a pair of electrodes. This will make the instrument compact and turnkey in operation. PSI has used a variant of this technique to detect lead in airborne aerosols at ppm levels. In this Phase I effort, we will design construct, test, and calibrate a preprototype instrument that will be further refined and field tested in Phase II.

PHYSITRON, INC.
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Phone: (205) 534-4844
Topic#: 93-034 ID#: 93N47-198
Office: SPAWAR
Contract #: N00039-94-C-0043
PI: DR. MIKE HICKEY
Title: Data Fusion and Visualization System
Abstract: The volume of meteorological data that is available to fleet users has increased to the point where data fusion and visualization tools must be developed in order to analyze this data in an efficient and timely fashion. These tools should provide a simple, user-friendly interface with flexibility in viewing and analyzing the data, and should allow for ease of modification through modular, object-oriented programming. Physitron proposes to develop the tools required by the Navy for the fusing and visualization of multi-sensor data by drawing from our similar experience with the development of data fusion and visualization tools for NASA. These previous developments have allowed us to display single-step or time-sequenced data of various types, including images, surfaces, trajectories, vector plots, or n-dimensional data sets of vector and scalar parameters. We will examine and identify Navy requirements and all facets of data fusion, including a particular requirement that the various data sets be coregistered in time and position. In a parallel effort, we will also examine existing visualization hardware and software, modify existing code or develop new software where appropriate, and verify the fusion/visualization software with test data. The software will incorporate data-browse and on-line help facilities, the latter intended for personnel training.

PIASECKI AIRCRAFT CORP.
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ESSINGTON, PA 19029
Phone: (215) 521-5700
Topic#: 92-129 ID#: 92PMT-161
Office: NAVAIR
Contract #: N60921-93-C-0133
PI: FREDERICK W. PIASECKI
Title: Vertical Takeoff and Landing Unmanned Aerial Vehicle for Maritime and Close Combat Applications
Abstract: The unique criteria applicable to UAV shipboard operations will be identified and a specification established, including deck tie-down, launch and retrieval and hangaring/handling procedures. A baseline design to these criteria, with weight and balance and performance estimates, will be developed. Evaluation of the characteristics of weight, size, power, operational safety and operational control/handling qualities will be made. The command system will make maximum use of existing procedures and consoles where desirable. Effects of shipboard radar EMI will be a primary consideration in the design of the UAV automatic flight control system. A launching and retrieval system will be sized to match the vehicle's characteristics including weight, power required, stabilization system and deck handling from hangar to take-off/retrieval position. Separate or ship's compressed air or steam will be investigated for auxiliary takeoff thrust for vertical launching. A plan for Phase II demonstration of a full-scale flight vehicle will be developed and included in the final report of the Phase I flight vehicle design activity.

PLANNING SYSTEMS, INC.
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Phone: (703) 734-3424
Topic#: 93-038 ID#: 93N47-133
Office: SPAWAR
Contract #: N00039-93-C-0195
PI: JAMES F. FORREN
Title: Coherent Processing for Lofargrams
Abstract: This SBIR is directed to the application of image enhancement techniques to coherent two dimensional transformation of the acoustic time series to enhance low-level, stable signal components from diesel-electric submarines and suppress interference. The transformation are invertible and the final product will be an enhanced time series, relatively free from artifacts, that can be processed and displayed on current fleet classification processors, e.g., Multi-Flexible Analysis and Display System (MFLADS). The ability to display the results on current displays in familiar context permits an operator to achieve, without the requirement for training on new concepts or display types, an enhanced capability against a difficult target. The foregoing, if achieved, will be of significant cost savings to the Navy.

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Phone: (703) 734-3471
Topic#: 93-071 ID#: N93-071-2
Office: NAVSEA
Contract #: N00024-93-C-4204
PI: Beverly Bradley

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Title: Tactical Oceanography Support of Mining and Mine Countermeasures Operations
Abstract: The effects of the environment on mine warfare are more severe than on other warfare areas. Mine warfare and mine countermeasures operations are normally conducted in shallow water near shore areas where oceanographic conditions can vary widely on both temporal and spatial scales. Therefore in order to realize the full capabilities of available assets the Navy must develop and employ operational tactics that exploit local oceanographic and environmental conditions. The work proposed here will address a means to exploit tactically significant oceanographic information. Under this proposed effort we will identify the MIW systems and emerging technologies that are most likely to be employed operationally and those oceanographic parameters that impact their performance, determine the data sources and resolutions needed to make tactically useful predictions for each sensor, design useful displays for tactically significant MIW information and demonstrate the proposed structure using two prototype tactical decision aids for mine hunting and mine sweeping. Emphasis will be placed on quantifying and presenting complex environmental information to MIW tactical planners.

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Topic#: 93-015 ID#: 93N07-080
Office: MARCOR
Contract #: N00164-93-C-0156
PI: Chuni Ghosh
Title: Real-time Pattern Selective Image Fusion
Abstract: We propose to develop an image fusion system to fuse images from an intensified TV and a thermal imaging system into a single image by using a pattern selective approach. Pattern selective approach is different from pixel averaging approach in its ability to retain the contrast of the important elements in the scene as obtained by the imaging systems. The system will be able to look into the shadows, and see subtle thermal variations in the scene, see low light emissions and reflections, while retaining individual detail from each sensor. During the Phase I of the program, the recording of scenes from the cameras will be obtained from the customer after which they will be digitized and aligned to each other. Different fusion algorithms will be tried to find the best algorithm for the image combination. Based on the results, a high level design will be done for the system. Based on the design the system will be built and delivered during Phase II of the program.

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Phone: (609) 275-0070
Topic#: 93-115 ID#: 93N0A-016
Office: NAWCWAR
Contract #: N62269-94-C-0512
PI: CHUNI GHOSH
Title: Satellite Imagery Transmission Technology Development
Abstract: Efficient transmission in limited satellite bandwidth of imagery from near real-time reconnaissance is key to satisfying requirements for timely information. Standard compression may introduce degradations which significantly reduce the usefulness of imagery and communications errors may further degrade utility. Innovative methods for representing and processing imagery prior to transmission via satellite and for reconstructing the imagery at the receiving site are needed to satisfy user requirements. Princeton Electronic Systems (PES) with support from the David Sarnoff Research Center, will investigate advanced technologies for Navy satellite applications. System performance studies, supported by image quality simulations utilizing existing software models, will be performed. High level requirements, comparison of performance, and recommendations for further research and development (Phase II) will be produced. The Sarnoff-developed wavelet compression will be the foundation for the study. Companion technologies, e.g., reliable imagery transport protocols, progressive transmission, and variable rate compression will also be evaluated. The team of PES and Sarnoff have outstanding capabilities to address this problem. Both Sarnoff and PES have experience in military systems. Sarnoff has been extremely successful in developing compression technologies for commercial application. This team will leverage prior experience and complementary expertise to provide high performance, cost effective solutions.

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Phone: (609) 275-0070
Topic#: 92-162 ID#: 92PMT-284
Office: NAWCFTEG
Contract #: N00421-93-C-0106
PI: CHUNI L. GHOSH
Title: Study of Display Controls Technology for E-2C Cockpit

Abstract: The present E-2C cockpit does not support the display of tactical information from the combat information center. The use of flat panel displays in the E-2C cockpit will make it possible for pilot and copilot to observe tactical information in a form similar to that presented to the Naval Flight Officer operators in the CIC compartment. The addition of reconfigurable displays will lead to a reduction of scan time during certain flight situations. There are a number of problems like high illumination level, severe space constraints, difficulty of accessing the controls, etc. During the Phase I study we will study the civilian and military controls technology to find the best controls technology to solve the problems of the E-2C cockpit. Three alternative approaches will be presented to solve the problems of the cockpit controls and of image and data visualization. The present controls and the display technologies as well as future technologies that will be available in the next decade will be thoroughly studied for the purpose of the recommendations.

QUADRANT ENGINEERING, INC.
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Topic#: 92-110
Office: ONR
Contract #: N00014-93-C-0042
PI: James B. Mead, PhD

ID#: 92N01-032

Title: 4-Dimensional Remote Sensing of the Marine Boundary Layer with a Digital Beamforming Radar Wind Profiler

Abstract: This proposal describes a proposed four-dimensional turbulence profiling radar for shipboard use. This radar, termed the Turbulent Eddy Profiler (TEP), is a unique system that continuously monitors the intensity of atmospheric turbulence over approximately three thousand volume cells and updates these measurements several times a minute. Using a technique called digital beamforming the TEP system simultaneously monitors all pixels within the field of view of the radar, making TEP a true four-dimensional remote sensing tool. The proposal details our objective of developing a shipboard TEP system, designed specifically for Marine Boundary Layer (MBL) research. During Phase I, Quadrant Engineering will interact with scientists and engineers participating in the MBL Accelerated Research Initiative (ARI), supported by ONR, to design a system to meet the scientific needs of the program.

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Topic#: 93-090
Office: NSWCDDWO
Contract #: N60921-93-C-0098
PI: Xiang Y YANG

ID#: 93090-07

Title: Novel Optical Wavelet Correlator for Cluttered Target Identification

Abstract: We propose to develop a novel optical wavelet correlator for automatic recognition of cluttered targets. Instead of computing the correlation between the target and the reference patterns, the optical wavelet correlator computes the correlation between the wavelet transform coefficients of the target and reference patterns. It incorporates the efficient feature detection and noise suppression capabilities of wavelet transformation and the inherent high speed and two-dimensional nature of optics. The wavelet matched filter (WMF) is synthesized with the Fourier spectra of the reference pattern and the selected wavelets. This WMF replaces the conventional matched filter (CMF) in the optical wavelet correlator. When an input signal enters the wavelet correlator, the feature extraction and target identification operations are performed in a single step to produce the correlation between the WTs of the input scene and the reference pattern. By suitably choosing the wavelet functions and their dilation factors, the proposed wavelet correlator is capable of effectively recognizing targets in the presence of clutter and noise.

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Topic#: 92-145
Office: NAWCAWAR
Contract #: N62269-93-C-0238
PI: KENNETH E. WILLIS

ID#: 92N0A-084

Title: Innovative Design for Aircraft Canopy Fracturing System

Abstract: This proposal describes an electrical system for fracturing aircraft canopies so a new escape system can rapidly and safely pass the seat through the canopy. No explosives are used in the system. Instead, electrical energy is converted to small pockets of high pressure plasma which will generate pressure sufficient to initiate cracks which will weaken the canopy. Within a few microseconds, the canopy would be sufficiently weakened to allow the penetrator mounted on the seat to go through with minimum imparted loads to the seat occupant, and assure the debris is small and not harmful to the occupant.

QUANTUM MAGNETICS, INC.
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SAN DIEGO, CA 92121
Phone: (619) 481-4015
Topic#: 93-003 ID#: 93N33-854
Office: ONR2
Contract #: N00014-93-C-0272
PI: DR. W.F. AVRIN
Title: Orientation-Independent Optically Pumped Magnetometers
Abstract: Optically pumped magnetometers (OPMs) have long been used by the Navy for detecting mines, submarines, and other buried or concealed ordnance. One of the main problems with OPMs is that their readings depend on their orientation with respect to the earth's magnetic field. When the magnetometer is mounted on a moving platform, this so-called heading error significantly reduces the sensitivity of the magnetic measurements. In certain orientations, OPMs fail to operate altogether, and these so-called dead zones restrict the practical utility of the magnetometer. We propose to develop an OPM with no dead zones and greatly reduced heading errors. The new instrument will have a sensitivity approaching that of superconducting SQUID magnetometers, but will require no cryogenic technology. These advances will be achieved in part through a unique, proprietary variation of the basic optical pumping experiment. During Phase I, we will demonstrate this orientation-independent measurement process, and design a full-scale prototype that will be demonstrated during Phase II.

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Phone: (206) 872-9500
Topic#: 93-100 ID#: 93100-13
Office: NSWCDDWO
Contract #: N60921-93-C-0124
PI: James L DOYLE
Title: Rapid Detection of Biocorrosion
Abstract: Microbiologically influenced corrosion (MIC) has been shown to be a leading cause of internal corrosion and failures in marine tubing and piping systems. A technique is proposed to identify and characterize MIC-affected tubing and piping through the use of advanced and cost-effective NDE methods. The concept is based on a noncontact, laser-based sensor assembly that employs data fusion of laser-based profilometry and fluorescence spectroscopy data obtained by a single probe. The resulting inspection system will be able to scan the length of a tube or pipe rapidly and accurately and generate a detailed topographic map of the internal surface. Superimposed on this image will be a color map that identifies the presence of MIC. The results will be displayed in a number of computer-graphic formats that will allow operators to both qualitatively and quantitatively assess the level and severity of wall loss due to pitting and determine the presence and extent of MIC-affected surfaces. The system will significantly advance the state of the art of NDE and will operate cost-effectively on both tubing and piping.

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Phone: (206) 872-9500
Topic#: 92-109 ID#: 92N01-021
Office: ONR
Contract #: N00014-93-C-0029
PI: Dr. Jack J. Kolle
Title: Low-cost Photogrammetry Platform
Abstract: The proposed study will evaluate the feasibility of adapting medium format metric camera systems for aerial photogrammetry from an unmanned aerial vehicle (UAV) platform. The new generation of UAVs have the capacity to carry medium format (up to 5 cm x 7 cm) metric cameras suitable for precision photogrammetry. These platforms also offer autonomous operations and simplified take-off and landing options that minimize pilot skill requirements. This development will reduce the cost of photogrammetric monitoring of large structures in remote regions. We plan to apply the system to the study of sea ice deformation. A UAV would allow cost-effective, repetitive imaging of rafting, ridging and lead formation associated with floe scale interactions of polar sea ice. Photogrammetric techniques will allow quantitative measurements of horizontal displacements associated with these deformations. Stereophotogrammetry offers the potential to map the sea ice topography. The proposed work will include an evaluation of development requirements to provide the vibration isolation, tilt stabilization, environmental controls, and motion compensation required for aerial photogrammetry and stereophotogrammetry. Evaluations of flight planning, image processing requirements, and Arctic logistics will also be carried out.

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FALLS CHURCH, VA 22043
Phone: (619) 692-4400
Topic#: 93-023 ID#: 93N47-151
Office: SPAWAR
Contract #: N00039-93-C-0211
PI: DAVID MCDANIEL
Title: New Electronic Warfare (EW) Identification (ID) Techniques
Abstract: This proposal describes the significance of the combat identification problem, how EW plays a role, the state of current EW ID, followed by five technical objectives for this effort which would lead to improved EW ID: (1) technique development, (2) technical analysis of the techniq (3) technique performance analysis, (4) technique shipboard integration plans, and (5) identification of techniques for further improvement. The technique proposed for development and technical performance analysis is an innovative application of inferential technology to real-time tactical EW and intelligence databases. The innovations of the techniques are described. Integration with existing shipboard EW experiments is described. Some preliminary identification of techniques based upon more thorough signal exploitation is provided.

R&B ENTERPRISES
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Phone: (215) 825-1960
Topic#: 93-052 ID#: 93N00-018
Office: NAVSEA
Contract #: N00024-93-C-4222
PI: Robert D Goldblum
Title: Electromagnetic Interference Qualification of Submarine Components by Extension
Abstract: Virtually all electrical and electronic equipments installed on board submarines must meet the Electromagnetic Interference (EMI) requirements of MIL-STD-461. These requirements encompass conducted and radiated emissions from the equipment as well as conducted and radiated susceptibility of the equipment to external stimuli. Currently the only approved means of qualifying equipment to these requirements is by test. MIL-STD-461 makes no provision for qualification by similarity. The use of this standard is mandatory in military procurements of electrical equipment, and represents a significant cost in the procurement process. The problem is that the outcome of expensive tests required by MIL-STD-461 have become predictable in many cases of electric motor procurement. If the outcome of tests is predictable with high confidence, then clearly the tests should be eliminated and money saved. Imposing test requirements on equipment destined for installation aboard submarines without allowing exemption for "like" equipment, particularly motors used as stand alone devices or those used in support of hull and machinery equipments, significantly increases the overall cost of the submarine.

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Topic#: 93-019 ID#: 93N47-014
Office: SPAWAR
Contract #: N00039-93-C-0164
PI: JAY PATEL
Title: Tactical Data Transfer Protocol Accelerator
Abstract: The Safenet Lightweight Suite Accelerator (SLA) is a module designed as a real time protocol accelerator for the Navy Safenet standard for Lightweight option. This protocol is designed to provide an efficient method for data transfer between the Safenet medium and the Safenet User. To maximize the benefit of the built-in real-time performance of XTP, the module has to be designed such that it can process incoming as well as outgoing data at or better than the rate of transmission on the media thereby avoiding any impact on the throughput of the station. This can only be achieved with hardware designed for protocol processing that is tightly coupled with embedded processors. The advantaged of the XTP protocol can only be exploited beneficially if mechanisms are provided to process incoming packets at the rate of the media. If this is not achieved, the packets will have to be buffered thereby reducing the throughput of data to the user. The outgoing data has to be processed in parallel with all other simultaneous activities of the station. The SLA module proposed for this effort is designed to address this specific real-time processing requirement.

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Phone: (617) 237-9331
Topic#: 92-125 ID#: 92N10-004
Office: NAWCTRN
Contract #: N68335-93-C-0212
PI: Richard D. Webb
Title: Improved Diffusion Barrier For Silicon Carbide Fiber/Titanium Matrix Composites

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Abstract: Textron SCS-6 silicon carbide fibers presently include an exterior PG (pyrolytic graphite) coating. A primary purpose of this coating is to form a titanium carbide layer in situ during the fabrication of titanium matrix composites. The TiC layer acts as a diffusion barrier, impeding movement of C, Ti, and Si atoms, thereby protecting the integrity of the load bearing SiC fibers. An improved diffusion barrier is needed to reduce the extent and complexity of the reaction zone created during processing, and to expand the operating regime for these composites to higher temperatures and/or longer times. There are several compounds in which C, Wi, and Ti have lower diffusion coefficients as compared to TiC, most notably the carbides of tantalum, zirconium, and hafnium. We will apply thin films of one or more of these compounds onto silicon carbide fibers and investigate the reaction zones created when these coated fibers are processed at elevated temperatures in the presence of titanium. Since diffusion occurs predominantly along grain boundaries in the temperature range of interest, we will also engineer the width, length, and content of the grain boundaries to partially block these "short circuit" paths. Anticipated gains include an order of magnitude decrease in the size of the reaction zone and a dramatic reduction in residual stress at the fiber-matrix interface.

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Topic#: 93-110
Office: NUWC
Contract #: N66604-94-C-0488
PI: Daniel Fanger

ID#: 93110-04

Title: Alternate Periscope Antenna Radome Development

Abstract: Reinforced composite materials suitable for use in submarine radomes will be investigated, which will provide improved structural characteristics compared to current NORYL radomes. RF transmission performance of these cyanate-ester based materials is anticipated to be superior to that of traditional reinforced epoxy-based materials due to lower inherent loss properties. The proposed program will involve fabrication and testing of sample panels of the materials to determine structural and electrical properties. RF performance will be modelled over a 2-40 GHz bandwidth and compared with the performance of NORYL and traditional epoxy materials. This will facilitate the most realistic comparison of performance between NORYL and cyanate-ester and, if successful, lay the ground-work for timely availability of an alternate radome material more suitable for submarine applications.

RADIATION MONITORING DEVICES, INC.
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Topic#: 93-003
Office: NAWCMUGU
Contract #: N68936-93-C-0321
PI: Gerald Entine

ID#: 93N37-045

Title: Advanced Systems and Technologies for Future Naval Warfare

Abstract: Advances in semiconductor technology have resulted in vast new technological capabilities and have affected every aspect of modern life. One such application where advances in semiconductor materials can have a significant impact on space exploration is UV detectors. The ideal UV detector would be a solid state device with high responsivity to UV light and negligible responsivity to visible light. It would make possible major improvements in space instrumentation and solar observations. This proposal is to develop a new solic' state visible-blind UV detector. This detector based on a new wide bandgap ternary semiconductor boron nitride phosphide BNxP1x has the potential to display selective UV absorption as well as good long term stability.

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Topic#: 93-099
Office: NSWCDDWO
Contract #: N60921-93-C-0132
PI: Douglas K SMITHMAN

ID#: 93099-01

Title: Instrument for In Situ Measurements of Special Hull Treatments

Abstract: An approach is proposed for the direct determination of a viscoelastic polymer's complex shear and compressional moduli using a dynamic durometer. The approach is an extension of the theory and instrumentation developed by NSWC. The proposed method involves measuring the impedance associated with driving different radius indentors into the material, as a function of frequency. With multiple data points for the impedance as a function of indentor radius (at a given frequency), nonlinear simultaneous equations are solved to obtain all four constants of interest directly from the complete impedance relation

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for a radiating sphere in a viscoelastic medium. This approach will be demonstrated in Phase I. In addition, data acquisition time gating will be examined as a means of overcoming finite sample thickness issues. This will be supported by analytical theory development for radiation impedance in finite thickness materials. Because the proposed multi-indentor polymer characterization scheme uses the complete sphere radiation theory, it not only provides all of the complex moduli data, but should improve accuracy over the present approach which relies on modeling the system with a single spring rate. This method will also be valid for frequencies beyond 1000 Hz.

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Topic#: 93-008 ID#: 93N07-160
Office: MARCOR
Contract #: M67854-94-C-3008
PI: Harry May

Title: Extension of Channelized Receiver Architecture to HF/VHF/UHF Tactical Receive-Only Radio

Abstract: Radix Technologies is pleased to submit this Phase I SBIR proposal for the conceptual exploration, definition, and technical proposal of a small, light weight, low power manpack HF/VHF/UHF Receive Only Radio system. This system is referred to as the Tactical Receive-Only Radio or TROR. The TROR is designed for reconnaissance applications where rapid signal acquisition and set-on are required. The Phase II engineering design model of the TROR will provide flexible ESM receiver capabilities for fixed frequency, frequency agile, and cellular intercept over the .8 to 500 MHz frequency range in an 11" x 11" x 4.5", 25 pound unit. The TROR definition and development capitalizes on the emergence of digital technologies in battlefield communications. The radio is based on a set of recent technical advances including: a new digitizing RF architecture and residue number system (RNS), application specific integrated circuit (ASIC) digital channelizer chip set; and proven technology including: RF receiver design, polyphase filter based detection, qualification, and estimation processing, and real-time programmable Digital Signal Processor (DSP) signal tracking and demodulation code; which are integrated to provide sophisticated ESM and audio receiver capabilities.

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Topic#: 93-005 ID#: 93N40-227
Office: ONR2
Contract #: N00014-93-C-2202
PI: ROBERT E. CONKLIN

Title: Improved Materials for Navy Electronics

Abstract: In recent years, the United States has lost its technological advantage in many areas in which it pioneered research and development, due to poor make-or-buy decisions by business, or because of a reluctance to make long term business investments. This loss of technological advantage has had a negative impact on the Navy and the other services, since it has sometimes left the U.S. suppliers with a second-rate capability to accomplish technology insertion and manufacture new systems (resulting in higher cost), or has impacted the system's performance and reliability because of marginal fabrication techniques. This proposal defines methods of identifying those areas of particular interest to the Navy in which the US is not a technology leader (such as bonded wafer SOI technology), and define the programs and the resources needed for these programs to close the technology gap. Following coordination of the final technology selection with the Navy, a Phase II program which establishes a demonstration model of the technology will be considered.

RESEARCH DEVELOPMENT CORP.
11835 COOPERS COURT
RESTON, VA 22091
Phone: (703) 391-0156

Topic#: 92-158 ID#: 92PMT-252
Office: NAVAIR
Contract #: N00019-93-C-0173
PI: KEVIN WENZEL

Title: "Virtual" Air Intercept Control (AIC) Architectures for Training Air Intercept Control Procedures

Abstract: The Radar Intercept Operator (RIO) on fighter jets requires initial and ongoing training in all aspects of air intercept control procedures. Current training methods require the presence of an instructor in both initial and ongoing training of perishable skills. This increases the cost and decreases the practicality of training as the RIO must be present at a training facility to receive training, thereby taking time away from the job. The proposed work would augment the activities of the human trainer by using artificial intelligence (AI), intelligent tutoring system (ITS) and virtual reality (VR) techniques to develop automated, self-contained, and portable training devices for maintaining perishable skills. This would enable the RIO to receive

training at his convenience with minimal disruption to his duties. Phase I will be devoted to a task analysis of RIO training requirements and to development of a proof-of-concept system. Phase II will be devoted to developing a full-scale training system.

RESEARCH OPPORTUNITIES, INC.
2200 AMAPOLA COURT, SUITE 101
TORRANCE, CA 90501
Phone: (310) 533-5149
Topic#: 92-135 ID#: 92N40-226
Office: NAWCAIND
Contract #: N00016-94-C-0031
PI: William De La Torre
Title: Recent Advances in Composites for Electronic Packaging
Abstract: High thermal conductivity, thermal expansion (CTE) control, and maximum specific stiffness make composite materials important candidates for improvements in electronic packaging. Components that can be impacted include thermal planes, chip carriers, core constraint for printed wiring board (PWB), card holders, and the outer construction (boxes). High thermal conductivity graphite fibers (negative CTE) will be evaluated for PWB constraining cores in organic matrix and for thermal plane in aluminum matrix. SIC/AL will be evaluated for card holder and chip carrier. Comparison will be made with more recent composite concepts including glass matrix composites and particulate diamond substituting for SIC. The Phase I study will show through analysis and experimentation, composite properties that are expected for each application. The potential for composite utilization will be assessed both for individual components and multiple composite components in a single electronic package. Potential impact on system capability, reliability and weight/volume savings will be assessed. Of particular interest is a module with all components tailored to chip CTE. The Phase II program will be oriented to composite data base design, assembly of selected components for performance demonstration, performance assessment, identification of Navy system utilization, and system impact analysis.

RGS ASSOC., INC.
CRYSTAL PARK TWO, SUITE 104, 2121 CRYSTAL DRIVE
ARLINGTON, VA 22202
Phone: (703) 769-5852
Topic#: 93-044 ID#: 93N1C-004
Office: NAVSUP
Contract #: N00600-94-C-0587
PI: Dr. Richard G. Stiegliltz
Title: Industrial/Supply Information Interface Development
Abstract: The product of this Phase I SBIR project will be the conceptual design for a translator that allows Navy industrial activities and FISCs to communicate with each other effectively in the new supply environment dictated by recent DMRDs. A Feasibility Report will be prepared to evaluate the translator's ability to: (1) support existing transactions between NSCs and industrial activities: (2) automate new transactions necessitated by the FISC concept; and (3) freely share material management information among FISCs and their industrial activities. The report will outline an approach and schedule for Phase II. During Phase II, the conceptual design will be refined, a prototype translator will be developed using expert system techniques, and the effectiveness of the prototype will be assessed at a pilot installation. The translator concept, when refined and prototyped in Phase II, will improve service to the Navy's industrial activities, help achieve full implementation of the FISC initiative, and preserve current ADP interface capabilities.

RTWARE, INC.
714 NINTH ST., SUITE 206
DURHAM, NC 27705
Phone: (919) 286-3114
Topic#: 92-112 ID#: 92N01-066
Office: ONR
Contract #: N00014-93-C-0055
PI: Richard Clarke
Title: Module Interconnection Framework for Software Producibility
Abstract: We propose research into the design of a Real-Time Distributed Module Interconnection Framework (RTD-MIF) system for use in the development of distributed, real-time computer software. Real-time capabilities will include abnormal event processing, RT/FT events and on-line system monitoring and control. The resulting system will have the ability to compose, integrate and monitor the performance of software modules in a variety of domains, particularly real-time distributed applications. The research will also formalize the mathematical semantics of the system, using partial-ordering constructs (directed acyclic graphs) and temporal logic semantics. We will utilize an existing distributed real-time spreadsheet package (ControlCalc from RTware, Inc.) designed specifically for process control and monitoring. The Polylith (Purtilo, 1991) system will be used for interfacing software modules. The RTD-MIF will use MIF capabilities to generalize and extend its existing

ability to manage and analyze real-time date, events and distributed processes in diverse environments. Deliverables: 1) Detailed design document for extending Polylith into an RTD-MIF. 2) Formal mathematical semantics of an RTD-MIF. 3) Prototype implementation of Polylith-based RTD-MIF. 4) Design and implement a subset of a running RTD-MIF application based on a distributed, real-time spreadsheet.

SAM TECHNOLOGY, INC.
51 FEDERAL STREET, SUITE 402
SAN FRANCISCO, CA 94107
Phone: (415) 227-4900
Topic#: 93-188 ID#: 93N50-032
Office: NPRDC
Contract #: N66001-94-C-7012
PI: Alan Gevins
Title: Biopsychometric Signal Acquisition and Processing System
Abstract: To meet the U.S. Navy requirement for a rugged and highly portable physiological data acquisition and processing platform for use in operational environments, we propose to integrate and enhance existing hardware and software technology we have been developing over the past five years. Our Biopsychometric Signal Acquisition and Processing System (BSAPS) will utilize state-of-the-art data acquisition hardware and will provide PC-based software control over recording characteristics. The system will provide up to 32 channels for collecting EEG and other physiological signals and an additional 16 channels for collecting stimulus and behavioral event data from training simulators or other devices, as well as high-level physiological signals such as respiration. A fast application electrode positioning system, analog preamplification with telemetry of the head, and user-programmable DSP filtering and analysis capabilities will be included in the design. The BSAPS will consist of a hat with active electrodes and telemetry, a paper-back book-sized amplifier/filter/digitizer box, and a lap-top PC with DSP processor and large, ruggedized hard disk. The platform will allow for real-time EEG artifact detection and removal to minimize signal contaminants prior to data analysis. The result of this development would be a small, low-cost, flexible, user-friendly, physiological data acquisition and processing system for use in naturalistic work environments.

SATCON TECHNOLOGY CORP.
12 EMILY ST.
CAMBRIDGE, MA 02139
Phone: (617) 661-0540
Topic#: 91-332 ID#: 91N14-499
Office: NAWCFTEG
Contract #: N00612-93-C-0204
PI: Dr. James R. Downer
Title: Higher Harmonic Control and Actuation System for the Navy H-60 Helicopters
Abstract: Future Army rotorcraft/air-vehicle systems will require advances in survivability, operability and supportability. SatCon Technology Corporation proposes to design, fabricate, and demonstrate an integrated swashplate hydraulic actuation system for control of helicopter vibrations which will allow improvements in all three these areas. This system will improve operability by improving maneuverability, agility, and speed; improve supportability by increasing reliability; and improve survivability by decreasing noise signature. In conventional helicopters, control of the rotor is achieved by the use of a swashplate. For a number of rotor control problems, however, the existing hydraulically actuated swashplate is sub-optimal. Due to the limited frequency response of the swashplate's hydraulic actuators, existing swashplates have insufficient bandwidth to provide active control of higher harmonic helicopter rotor vibrations. However, the actuator bandwidth problem can be alleviated if the existing hydraulic actuators are replaced with a modern state-of-the-art hydraulic system. This approach requires a minimum modification of the existing hardware while achieving a significant reduction in the vibration of the fuselage. Phase I will consist of proof-of-concept, initial design, and detailed planning for phase II. Phase II will consist of design, fabrication, and testing of the prototype hardware.

SATCON TECHNOLOGY CORP.
12 EMILY ST.
CAMBRIDGE, MA 02139
Phone: (617) 661-0540
Topic#: 91-359 ID#: 91N34-087
Office: NAWCMUGU
Contract #: N68936-93-C-0090
PI: Vijay Gondhalekar
Title: Inertial Energy Storage and Roll Control Module
Abstract: The Navy has expressed an interest in developing a combined power and roll control module to improve the utilization of the volume within a missile envelope. Combined power and attitude control modules have been proposed before for orbiting spacecraft with emphasis on high specific energies (kJ/lb). The application of this technology to missiles demands emphasis on achieving a high energy density (kJ/in3) in conjunction with a relatively high torquing capability. However, the power

requirements are incompatible with the torque requirement if a simple motor/generator, reaction wheel approach is adopted. The proposal here outlines a program for attacking this challenging problem and presents a viable solution for achieving the desired goals. The component technologies for a successful design do exist. In fact SatCon Technology Corporation is fabricating a 65.4 kJ/lb carbon fibre flywheel unit storing 8.0 nJ of energy and delivering attitude control torques for large spacecraft. Integrating these technologies into a volume constrained package requires an in depth knowledge of flywheel energy storage/retrieval, power conditioning and attitude control techniques. Phase I program will conduct a technology assessment, design a module and evaluate expected performance. Phase II program will build, test and deliver a prototype model.

SCHWARTZ ELECTRO-OPTICS, INC.
3404 N. ORANGE BLOSSOM TRAIL
ORLANDO, FL 32804
Phone: (407) 298-1802
Topic#: 92-107 ID#: 92N01-007
Office: ONR
Contract #: N00014-93-C-0053
PI: Dr. Madhu Acharekar
Title: Nonlinear Dynamical Control of Laser Arrays
Abstract: The subject of Chaos has been investigated since the turn of the century, it wasn't until the recent advances in Chaos that the importance and scope of the field was realized. It was believed that random Chaotic variations were too complicated to describe mathematically and statistical descriptions were the only means of understanding these dynamic systems. Now it is known that these chaotic systems are not just random fluctuations but are totally deterministic. More importantly they can be controlled by studying the nature of the Chaos and applying small perturbations to the systems parameters. SEO with the help of Dr. Bandy's group at Oklahoma State University, propose to use the recent techniques of stabilizing nonlinear dynamic systems on a diode pumped external cavity resonator. Experimental and computer modeling of the laser external resonant cavity will be conducted with different stabilizing parameters studied.

SCIENCE & ENGINEERING INTERNATIONAL
11705 DINWIDDIE DR.
ROCKVILLE, MD 20852
Phone: (301) 984-6167
Topic#: 93-012 ID#: 93N07-140
Office: MARCOR
Contract #: N60921-93-C-A359
PI: Dr. A. Kochman
Title: Nanocomposite Chromium Plating for Interior Surfaces of Gun Barrels
Abstract: Science & Engineering International Corporation (SEIC) is proposing to develop a metal plating technology based on nanocomposite chromium for gun barrels and other interior surfaces of military hardware. Use of nanocomposite chromium plating will greatly improve wear, erosion, and corrosion resistance of interior surfaces of gun barrel that are exposed to propellant combustion and other adverse effects of interior ballistics. The proposed technique applied to a number of different surfaces, has been demonstrated to produce coatings that are more than two times harder, have two times better wear resistance and have significantly better adhesion than standard hard chromium plating techniques. It was also demonstrated that the new method does not increase substantially the cost of the plating process. The proposed technology is base on properties of unique material: nanosize diamond powder that is formed by cubic diamond particles. This material has become available only recently. The addition of nanosize diamond to electrolyte allows for the significant decrease in the grain size of the electroplated chromium coating a vast improvement in the quality of the coated layers.

SCIENCE & ENGINEERING SERVICES, INC.
4040 BLACKBURN LANE, SUITE 105
BURTONSVILLE, MD 20866
Phone: (301) 989-1896
Topic#: 93-063 ID#: 93N00-098
Office: NAVSEA
Contract #: N60921-93-C-0121
PI: Hyo Sanw Lee
Title: A Differential-absorption Lidar System for Assessing Radar Propagation Conditions
Abstract: This proposal pertains to the development of a near ocean environment sensor for Navy application. The sensor is based on the differential absorption lidar DIAL technique using SESI, a single mode frequency agile solid state ring laser system. Prediction of radar ducting and the propagation environment requires near real-time profiling of an atmospheric refractive structure. We propose to develop a DIAL system to measure parameters found to most influence the refractive structure. The likely important parameters are humidity and temperature. The DIAL technique measures humidity using laser radiation in the water vapor, 720 nm band absorption and temperature in the 760 nm region oxygen A band absorption. By absorption strength and agile tuning of single mode laser frequency we can assume the atmospheric profiles with high accuracy water vapor and

temperature level and range up to a few tens of km. Unlike Raman lidar this sensor will allow both day and night operation due to its strong return signal. By combining advances in DIAL technology and SESI's new single mode tunable alexandrite laser system, a new capability in DIAL meteorological measurements will be demonstrated with the prototype design of an operational sensor.

SCS TELECOM, INC.
107 HAVEN AVENUE
PORT WASHINGTON, NY 11050
Phone: (516) 883-0760
Topic#: 93-085 ID#: 93085-03
Office: NSWCDDWO
Contract #: N60921-93-C-0093
PI: Gary LOMP
Title: High Speed Multichannel Optical Correlator for Sonar Signal Processing
Abstract: Underwater target detection and identification is a difficult data analysis problem. The inherent parallelism of optical signal processing lends itself well to the problem of sonar signal processing. A high speed multichannel optical correlator is proposed. This system employs preprocessing signal conditioning and an incoherent optical time-integration scheme which provides for long integration times and a large correlation range. The system is capable of performing 1000 parallel correlation of 1000 points per correlogram in parallel.

SEAGULL TECHNOLOGY, INC.
1310 HOLLENBECK AVENUE, SUITE F
SUNNYVALE, CA 94087
Phone: (408) 732-9620
Topic#: 92-173 ID#: 92N0A-107
Office: NAWCAWAR
Contract #: N62269-93-C-0251
PI: DR. RICHARD BORTINS
Title: Design and Verification of Active Control for Fighters
Abstract: Mission requirements calling for higher performance aircraft have increased the challenges faced by designers. Conventional passive approaches to improving performance as measured by one set of metrics often degrade performance as measured by other metrics. These are the fundamental performance trades that confront aircraft designers. A need exists for a rapid, efficient, and reliable methodology for multivariable FCS evaluation at an early stage in the development process in order to reduce risk during flight simulation and flight testing. During this Phase I SBIR effort Seagull Technology will (1) design a multivariable control law for the F/A-18A that improves performance during maneuvers and (2) construct a rigorous proof of concept procedure. Three objectives will be accomplished during this work: (1) problem formulation, (2) FCS control design for the F/A-18A, and (3) proof of concept test formulation. The problem formulation will include uncertainty and variation in the aircraft dynamics, and a matrix of maneuvers and agility and maneuverability metrics. The FCS design will use a multivariable design technique. The proof of concept test formulation will provide a blueprint for rigorous and reliable evaluation of multivariable controllers.

SECURE COMPUTING CORP.
1210 WEST COUNTY ROAD E, SUITE 100
ARDEN HILLS, MN 55112
Phone: (612) 482-7427
Topic#: 93-022 ID#: 93N47-187
Office: SPAWAR
Contract #: N00039-93-C-0181
PI: TODD FINE
Title: Using Composibility to Improve Security Analysis Techniques
Abstract: This proposal describes an approach for applying existing composibility techniques to analyze complex, multilevel secure (MLS) systems. Although there has been significant progress in developing composibility techniques, there is little experience with using these techniques. Thus, the set of problems to which the techniques are applicable and the amount of effort required to apply the techniques are unclear. The proposed project will examine the applicability of these techniques to computer security problems such as analyzing 1) distributed security enforcement, 2) assured pipelines for trusted subsystems, and 3) covert channels in distributed systems. For each of these potential problem areas, it is necessary to investigate the value of composibility both for synthesis and refinement. Instances in which composibility simplifies synthesis provide the basis for a library of reusable secure components. Instances in which composibility simplifies refinement suggests the use of modular decomposition to simplify security analysis. Based on deficiencies identified from this investigation, we will develop approaches for addressing the deficiencies. In summary, the goals of the proposed project are to 1) determine the problem areas to which composibility techniques are applicable and 2) address deficiencies in the prior work.

SENTEL CORP.
1735 JEFFERSON DAVIS HIGHWAY, SUITE 407
ARLINGTON, VA 22202
Phone: (703) 413-1100
Topic#: 93-024 ID#: 93N47-170
Office: SPAWAR
Contract #: N00039-93-C-0184
PI: WILLIAM L. SCHUMMER
Title: Inter-service Voice Communications Model
Abstract: The overall objective of this effort is to develop a voice communications model for application in interactive simulation systems that will address joint force operations. The model will address all aspects of the communications process including technical phenomenon related to transmitters, receivers, antennas, propagation path, crypto operation, circuit loading, electromagnetic interference, and jamming, and relate the total system performance to the joint operational decision making process. The specific objective of this Phase I effort is to define the model concept such that how each of the above mentioned aspects will be modeled and the identification of the models and architecture necessary to integrate and implement them are addressed. SENTEL's approach to defining the model concept and providing a detailed model description is based on our straight forward three step process: 1. Develop specific requirements for this Inter-service Voice Communication Model. 2. Research the existence of communications model components and interfaces between simulators and voice communications models that can be used directly or can be adapted to this model. 3. Using all available information and our extensive knowledge of communication systems we will develop the design for a multilayer, object-oriented communications model including the architecture and modules required to meet the specific agreed upon requirements identified in step 1.

SFA, INC.
1401 MCCORMICK DRIVE
LANDOVER, MD 20785
Phone: (301) 621-8938
Topic#: 93-073 ID#: 93N00-209
Office: NAVSEA
Contract #: N00024-93-C-4211
PI: Howard Burkom
Title: Optimization of Sonar Search Patterns
Abstract: The tactical officer faces the complex problem of devising an optimal track to satisfy a mission. As a flexible expandable solution to this problem, an expert tactical system that utilizes fuzzy logic and is written in an object-oriented environment is proposed as a tactical design tool. The process of formulating tactics will be modeled as a fuzzy inference engine to avoid the shortcomings of conventional expert systems. An object-oriented type hierarchy is presented and discussed including objects representing the fuzzy inference engine, the various real-world entities and the relevant TDA methods. This tactical design tool will be written according to the GOTS software standards. The integration will be done so that the expert system can itself call external TDAs and other utilities or invoke its own internal optimization functions. The operator will use the system either to build, modify an expert system or to make a consultation. At each stage he will be able to inspect the decisions and rationale of the fuzzy inference engine and to override any part of the decision process. Once a candidate track is formed the expert system will present it along with operator-specified for immediate evaluation.

SHADOW RESEARCH, INC.
898 COACHWAY DRIVE
ANNAPOLIS, MD 21401
Phone: (410) 849-3933
Topic#: 93-004 ID#: 93N33-749
Office: ONR2
Contract #: N00164-93-C-0093
PI: GARY L. FITZHUGH
Title: Generic SEM (GSEM)
Abstract: The Generic SEM (GSEM) effort is focused on exploring an engineering methodology to permit the smooth transition of aging electronic technology to modern technology in such a way that the utility of the targeted hardware end product (form, fit and function) is transparent to the technology invoked.

SHERWIN, INC.
5530 BORWICK AVENUE
SOUTH GATE, CA 90280
Phone: (310) 861-6324
Topic#: 92-122 ID#: 92PMT-077
Office: NAVAIR
Contract #: N00019-93-C-0119
PI: RONALD G. SHERWIN
Title: "Alternative Dyes and Water Treatment Procedures in Inspection Penetrant Methods"
Abstract: Significant environmental issues face inspection penetrant users and manufacturers, including minimizing the release of petroleum or solvent-based wastes into waste water, and waste water treatment. The contractor proposes to develop

alternative water-based liquid dye penetrant formulations using chemiluminescent and naturally luminescent materials. The contractor proposes also to document procedures for recycling penetrants from waste water and for reducing the need to dump penetrants from large systems.

SIGNATRON A C
1L0 HARTWELL AVE
LEXINGTON, MA 02173
Phone: (617) 861-1500

Topic#: 93-079
Office: NAVSEA
Contract #: N66604-94-C-0178
PI: Dr Steen Parl

ID#: 93N00-277

Title: High Frequency (HF) Skywave Recognition Using Small Baseline Antenna Arrays

Abstract: This proposal investigates a novel technique for determining whether an HF signal is arriving via ground wave propagation and is therefore emanating from within the tactical area or whether the wave is propagating via sky wave and is therefore emanating from the strategic area of interest. The technique makes use of an electrically spinning loop antenna combined with a signal processor to differentiate vertically polarized ground waves arriving over sea water from elliptically polarized sky waves. The technique exploits differences between the characteristics of skywave propagation and waves propagating via ground wave over a good ground.

SIGPRO SYSTEMS, INC.
1121 BALDWIN STREET
SALINAS, CA 93906
Phone:

Topic#: 91-067
Office: NAVAIR
Contract #: N00019-92-C-0162
PI: LONNIE WILSON

ID#: 91N14-395

Title: Advanced ESM Techniques

Abstract: Advanced ESM signal processors are required to solve critical radar emitter ID problems, which are complicated by complex linear chirp frequency codes, nonlinear frequency codes and phase coded radar waveforms. High density radar emitter environments are further compounded by modern radar WARM waveforms. New radar emitter ID algorithms will be developed, evaluated and demonstrated to handle these modern radar waveform problems, and retain the fundamental or existing ALR-76 system capability of handling simple radar emitter identifications. SigPro Systems will use new ESM signatures or parameters, which have demonstrated key properties; such as, unique to an emitter, robust with S/N ratio variations and other parameter variations and stable over time. These new ESM signatures will be signal processed using, a modified version of, SigPro's powerful feature extraction algorithm. These feature sets will be processed with an advanced identification Processor for ESM emitter ID.

SOFTECH, INC.
3100 PRESIDENTAL DRIVE
FAIRBORN, OH 45324
Phone: (315) 456-2484

Topic#: 93-021
Office: SPAWAR
Contract #: N00039-93-C-0185
PI: MICHAEL J. MOORE

ID#: 93N47-137

Title: Critical-time/Real-time Database Management

Abstract: This research will explore: (1) Real-Time Data Base Management System (RT-DBMS) high-level query language, and (2) the primitive level language interface to RT-DBMS "engines." We will focus on interface features rather than implementation issues. The goal is to provide RT-DBMS technology for mission-critical applications with hard and soft time constraints and embedded system spatial constraints. Phase I objectives: (1) identify sources of RT-DBMS application requirements; (2) identify sources of information on hardware technology to estimate architectural and performance characteristics within which an RT-DBMS must function; (3) gather data from identified sources; and (4) elaborate a research plan for identifying real-time query language (RTQL) requirements, as well as a low-level RT-DBMS engine interface language. SofTech will perform this work in conjunction with the Naval initiative for the DBMS Interface Standard Working Group (DISWG). The research will support DISWG needs and promote language standards. In Phase II, we will perform research to extract an RT-DBMS language and engine interface requirements, develop these requirements into language and interface specifications, and verify these developments by demonstrating their use for selected applications. Phase III will translate RT-DBMS queries into the engine interface language, preserving the temporal and spatial constraints expressed in the queries.

SOFTWARE PRODUCTIVITY SOLUTIONS, INC.
122 N 4TH AVENUE
INDIALANTIC, FL 32903
Phone: (407) 984-3370
Topic#: 93-101 ID#: 93101-03
Office: NSWCDDWO
Contract #: N60921-93-C-0153
PI: Dr Andres RUDMIK
Title: Unified Methodology and Toolset
Abstract: The Navy develops some of the largest, most complex information processing systems in the word. To facilitate system analysis and development, CASE tools are often used. However, a significant limitation of current CASE tool methods is the capturing of just a few perspectives of a system under development while ignoring other relevant information. Each method supported by the tools also tends to be very different and incomplete, covering only one specific view of the system. The Unified Methodology and Toolset (UMT), an innovative solution to this problem, combines the many different views of a system into a single, consistent information model. The UMT captures different system perspectives by combining a set of methods into a single methodological framework. The framework categorizes the methods to determine the kinds of information collected or omitted. Comprising the framework are a small number of generalized representations modelling the system under development. By storing the information in a centralized database, information omitted by one method is obtained through other methods. Each piece of information is stored only once within the framework, thus maintaining consistency between methods. Phase I will document the requirements and design of the UMT, demonstrate feasibility, and prototype risk areas.

SOFTWARE TECHNOLOGY & SYSTEMS
3600 MARKET STREET
PHILADELPHIA, PA 19104
Phone: (714) 476-3606
Topic#: 93-095 ID#: 93095-05
Office: NSWCDDWO
Contract #: N60921-93-C-A339
PI: Sanjai KOHLI
Title: Miniature G-Hardened Fast Acquisition GPS Inertial Navigator Sensor
Abstract: In this proposal a program is described to develop a low cost Guidance and Navigation unit for artillery shells. The Phase I effort will include the identification of key cost and risk drivers, simulations will be performed to determine the component accuracies.

SONALYSTS, INC.
215 PARKWAY NORTH, PO BOX 280
WATERFORD, CT 06385
Phone: (203) 442-4355
Topic#: 93-072 ID#: 93N00-202
Office: NAVSEA
Contract #: N00024-93-C-4046
PI: Robert D Smith Jr
Title: Multi-warfare Tactical Decision Aid
Abstract: An embeddable rule-based expert system will be developed to support decision making for multiple emergent U.S. Naval warfare missions. This expert system module will contain individual components tailored to decision support for each of the following warfare areas: shallow water, quiet-target, ASW Special forces deployment retrieval, and ATLAN strike warfare. Decision making within the context of these warfare areas will be based on interpretation of the warfare scene and evaluation of the impact of changes in the scene components. Scene components include such items as oceanographic and meteorological environmental conditions relationships of tactical platforms logistics and battle damage. The critical components decision drivers will vary from mission to mission. For example, coastal sea state will likely be a primary driver for a special forces mission and a secondary driver for an ASW mission. The essence of the expert system rule base will be the translation of changes in decision drivers to tactical recommendations. The ONI for the module will support highly interactive modification of scene components and input parameters in both automated and manual fashion. This will be mandatory considering the rapidly changing nature of scene components.

SOUTHWEST MICROSYSTEMS
1432 MANDEVILLE PLACE
ESCONDIDO, CA 92029
Phone: (619) 741-8056
Topic#: 93-065 ID#: 93N00-124
Office: NAVSEA
Contract #: N60921-93-C-A354
PI: Kenneth M Johnson
Title: Frequency Synthesizer
Abstract: Abstract available from the NAVY SBIR office. Contact Vinnie Schaper at (703) 696-8528.

SPACE APPLICATIONS CORP.
6632 S. 191ST PLACE, SUITE E-103
KENT, WA 98032
Phone: (206) 656-0140

Topic#: 93-041 ID#: 93N47-025
Office: SPAWAR
Contract #: N00039-94-C-0027
PI: JOHN S. CAROTHERS

Title: Passive Acoustic Signal Classification Using Unconventional Techniques

Abstract: Advances in passive acoustic systems exacerbate the problem of signal classification in a high contact-density environment. Increased contact loading forces the operator to classify contacts more rapidly, reducing his effectiveness. New methods that assist feature extraction, provide automated detection and classification, and offer potential for new and unique classification clues are required to maintain the Navy's technological edge against an increasingly quiet threat. Phase I will explore classification methods utilizing unconventional signal processing techniques. These techniques, in conjunction with visually-based image processing techniques, will form an integrated detection and feature extraction process that promises improved detection and extraction of low-SNR features (such as transients) contained within beam-formed , time-frequency data. We seek to understand the key signature features revealed by this analysis approach, with a focus towards automating the process. Phase I will evaluate the feature extraction and classification capabilities of the unconventional techniques, which include wavelet transforms, higher-order spectral analysis, time-frequency distributions, and image processing, on simulated acoustic data. We will also research the applicability of advanced GUI methods to user displays and controls. Phase II will implement a Combined Acoustic Signature Analysis Station for validation of the most promising techniques against real measured data.

SPACE APPLICATIONS CORP.
6632 S. 191ST PL, SUITE E-103
KENT, WA 98032
Phone: (206) 656-0140

Topic#: 92-150 ID#: 92N0A-167
Office: NAVAIR
Contract #: N62269-94-C-0515
PI: JOHN S. CAROTHERS

Title: Acoustic Signal Classification Using Unconventional Techniques

Abstract: Advances in active acoustic systems exacerbate the problem of signal classification in a high contact-density environment. Increased contact loading forces the operator to classify contacts more rapidly, reducing his effectiveness. The key to early classification is an understanding of target response in terms of vibrational mode and localization of dominant contributors. Phase I will develop this understanding of target response and permit synthesis of classification methods utilizing unconventional signal processing techniques. These techniques, in conjunction with visually-based image processing techniques, will form an integrated detection and feature extraction process that promises improved detection and extraction of low-SNR features (such as modal response) contained within beam-formed, time-frequency data. We seek to understand the key signature features revealed by this analysis approach, with a focus toward automation of the process. Phase I will evaluate the feature extraction and classification capabilities of the unconventional techniques, which include wavelet transforms, higher-order spectral analysis, time-frequency distributions, and image processing, on simulated acoustic data. We will also research the applicability of advanced GUI methods to user displays and controls. Phase II will implement a Combined Acoustic Signature Analysis Station for validation of the most promising techniques against real measured data.

SPECTRA GROUP LIMITED, INC.
1722 INDIAN WOOD CIRCLE, SUITE H
MAUMEE, OH 43537
Phone: (419) 891-9767

Topic#: 93-045 ID#: 93N1C-018
Office: NAVSUP
Contract #: N00600-93-C-3094
PI: Joseph W. Klingler, PhD

Title: Desktop Engineering/Manufacturing Systems

Abstract: The immediate Spectra Group Ltd (SGL) contribution responding to N93-045 is the capacity to produce rapid prototypes directly from CT scans using stereolithography. SGL has been printing medical models derived from CT scans for more than a year and has access to industrial CT scan devices (section 3.4.e.), the resolution obtainable in the best of which is 100 microns in all dimensions. The goal of the work proposed is to develop a device which will produce a functional part of known dimension from scan data obtained either from a combined scan file obtained from laser scanners and from computer tomography (CT). The objectives are to evaluate and make operational laser scan/stereolithography interfaces and develop protocols for scanning surfaces, mapping surfaces, and printing the ouput; to convert the output from laser scan/computer tomography into an assembled CAD file for editing and outputting in an intelligent digital format; to evaluate the accuracy and precision of the technique; to compare the accuracy of CT scan/stereolithography solid images with those whose surface data

are obtained from laser scans; to begin, in consultation with Professor D. C. Neckers' research group at Bowling Green State University, the development of chemistries by means of which this data can be converted to stereolithographic parts which can be fired to ceramics for direct application or for use in molds, or directly to metals such as aluminum; to lay out a desk top manufacturing device being the size of a simple office copy machine.

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DAYTON, OH 45459
Phone: (513) 436-4454
Topic#: 92-180 ID#: 92N13-008
Office: NAWCFTEG
Contract #: N00421-93-C-0100
PI: Paul D. Zidek
Title: Anechoic Chamber Radiated Environment (ACRE)
Abstract: Spectra Research Inc. (S*R) proposes to configure off-the-shelf specialized antennas for installation in the wall of an anechoic chamber to provide a quick look test capability where fine direction of arrival (DOA) is not required. Several technical approaches to the antenna installation will be evaluated to determine the best technique to use before actual installation. S*R will subcontract to Georgia Tech Research Institute to apply their expertise in RF radiated environments to select the best approach and support the design of the billboard array alternative. The team will develop a preliminary design for movable billboard arrays than can be used to rapidly change DOA during the test of electronic systems. The arrays will be fabricated, installed and tested during a phase II effort.

SPIRE CORP.
PATRIOTS PARK
BEDFORD, MA 01730
Phone: (617) 275-6000
Topic#: 91-094 ID#: 91N34-102
Office: NRL
Contract #: N00014-93-C-2078
PI: Patricia A. Sekula-Moise
Title: Advanced Monolithic GaAs CHBT Technology Development
Abstract: The proposed project is aimed at utilizing the GaAs complementary heterojunction bipolar transistor (CHBT) technology to synthesize and demonstrate two circuits in great demand: a monolithic CHBT push-pull lower amplifier and a monolithic CHBT operational amplifier. Spire has already succeeded in developing the growth of simple monolithic CHBT structures by Metalorganic Chemical Vapor Deposition (MOCDV), and has demonstrated reliable operation in IIL ring oscillator circuits. The proposed program reaches for much more difficult circuits which are of greater interest and importance to the power electronics community. The success of the CHBT technology is based on Spire's ability to employ selective-MOCVD (with SiN CVD deposition) to attain both npn and pnp structures on one wafer in a planar topography which facilitates easy circuit formation. By working with the Research Triangle Institute, Spire complements its epitaxial wafer growth and processing capability with their circuit design, fabrication, and testing expertise. This combination of technical talents has proven highly successful in a preceding CHBT effort that resulted in operational GaAs CHBT IIL circuits.

STANLEY ASSOC., INC.
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ALEXANDRIA, VA 22314
Phone: (703) 684-1125
Topic#: 93-053 ID#: 93N00-020
Office: NAVSEA
Contract #: N00024-93-C-4232
PI: Robert Cutsforth
Title: Fault Tolerant Processor (FTP) Life Cycle Maintenance
Abstract: The ability to provide life cycle maintenance support for the Fault Tolerant Processor (FTP) of the SEAWOLF Ship Control System (SCS) is vital to ensure continued reliable operation and demands integration of state-of-the-art test equipment and software diagnostics. The extent of this support is restricted in scope by fiscal realities. While the FTP uses several of the most advanced electronics modules in the U.S. Navy's inventory, thus placing additional emphasis on the automatic test equipment requirements, the planned procurement of only two SEAWOLF platforms has further complicated the development of an Integrated Logistics Support plan that will support cost effective FTP module troubleshooting and repair. To fully address this problem, cost trade-off studies must be performed that evaluate the upgrade and use of existing U.S. Navy resources to meet the FTP troubleshooting and repair requirements. This effort will likely result in significant cost savings in troubleshooting and repair programs across all submarine ship control and combat control system programs.

STRAINOPTIC TECHNOLOGIES, INC.
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Topic#: 93-111 ID#: 93111-17
Office: NUWC
Contract #: N66604-94-C-0327
PI: Dr Dale Jiao

Title: A Novel Ultrasonic B-Scan Technique For One-sided Inspection Of Thick Composites With Complex Surface Shapes

Abstract: A high power low frequency, frequency bandwidth control ultrasonic sector B-scan system with specially designed sector scan transducers is proposed for the internal or under water one-sided inspection of thick (at least 3") composite components with complex surface shapes. This technique is based on the following considerations for ultrasonic NDT of thick composite components: high attenuation, low signal-to-noise ration (s/n), and anisotropy. Low frequency and high power along with specially designed transducers can increase the penetration capability of the ultrasonic waves. An effective computer program, split spectrum processing (SSP), will also be applied to this technique to increase s/n. The sector B-scan in different directions provides information about fiber orientation as well as defects. Transducers with a special soft front plate to match the complex shape surfaces of the composite components will be designed. The sensitivity and resolution of this system will be further examined. It is anticipated that the defects of dimension of 10 mm or less be detected.

STRUCTURAL INTEGRITY ASSOC.
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SAN, CA 95118
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Topic#: 93-100 ID#: 93100-03
Office: NSWCDDWO
Contract #: N60921-93-C-0100
PI: George J LICINA

Title: An Innovative method for on-line monitoring of biocorrosion in seawater

Abstract: Biofilms that form on metallic surfaces can exert a significant influence on corrosion of shipboard seawater piping and heat exchangers. Early detection of biofilm formation permits the system operator to implement mitigation measures when they are most effective. A novel electrochemical sensor has been developed for on-line monitoring of biological activity and biocorrosion. The two-electrode probe utilizes a stack of identical stainless steel electrodes that are polarized relative to one another for a short time each day. This probe has demonstrated its effectiveness in detecting biofilm formation in fresh water environments. Biofilm activity is signalled by an increase in the current required to achieve the pre-set polarization potential and by the appearance of a low-level current between the electrodes, even when the applied potential is removed. This probe configuration also permits biofilm detection by monitoring changes in the ohmic resistance along probe surfaces. The proposed concept has been shown to be effective in signalling the formation of biofilm, the precursor to microbiologically influenced corrosion, in scale-forming and scale-dissolving fresh water environments. During Phase I, the feasibility of adapting this approach for detecting biofilm formation and microbiologically influenced corrosion in seawater will be demonstrated.

SUMMIT RESEARCH CORP. (SRC)
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Topic#: 93-036 ID#: 93N47-001
Office: SPAWAR
Contract #: N00039-93-C-0189
PI: Robert S. Myre

Title: Machine Assisted Anti-Submarine Warfare (ASW) Passive Acoustic Classification System

Abstract: The U.S. Navy's complex passive acoustic surveillance and ASW systems depend significantly on an acoustic operator/analyst's ability to quickly recognize potential targets of interest, analyze the parameters and characteristics of the acoustic data presented to the operator, evaluate the meaning of the parametric data and classify the target. With the advent of numerous friendly and threat and neutral forces operating in the world, the task of consistently classifying numerous acoustic targets has become extremely difficult. Acoustic Intelligence data on hundreds of target types is impossible to memorize or quickly reference. Operators need a passive acoustic data classification tactical decision aid which can help them reference important parametric data and assist in accurate and timely classification of the targets. This proposed effort will research and develop a design for a Passive Acoustic Classification (Computer) System with a robust acoustic parameters data base and algorithms to query the data base, score the results of data base matches using math algorithms, and interact with the operator/analyst in reaching timely and accurate target classification.

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Phone: (804) 460-6205
Topic#: 93-074 ID#: 93N00-223
Office: NAVSEA
Contract #: N00024-93-C-4200
PI: Roy Newton
Title: Surface Ship and Submarine Automated Acoustic Search Planning
Abstract: Recent developments make it impossible for an individual to assimilate all of the knowledge needed to optimize an ASW sonar suite line-up. Prominent amongst these development areas are proliferation of operating modes, increased environmental information from APP products and in situ measurements. Emphasis on littoral warfare including third-world diesels which has enormously increased the Acoustic Intelligence (ACINT) operational library. Urgently required is a tactical decision aid (TDA) to assist the tactical action Officer how best to employ his sonar suite. Summit Research Corporation (SRC) will develop the needed sonar suite TDA methodology in prototype form with initial focus on the Surface Forces. SRC is deeply involved in development of On Board Mode Selection (OBMS) for the Air ASH community and playing a strong role in Submarine Fleet Mission Program Library (SFMPL). SRC's objective will be to take the best of what exists and sensibly improve it with application to Surface Forces. The structured design of the resulting TOA will allow module changes to accommodate platform unique suites or tactical employment options to make the process adaptable to any suite on any platform.

SUNOL SCIENCES CORP.
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Phone: (510) 828-4940
Topic#: 93-111 ID#: 93111-19
Office: NUWC
Contract #: N66604-94-C-0326
PI: Ronald G Peterson
Title: Nondestructive Inspection Technique For Composite Material Components
Abstract: Digiray reverse geometry x-ray scanning technology is evaluated for in situ inspection of composite components. Applicability of current Digiray machines is established directly by tests. Feasibility of extending Digiray technology for the full range of materials and thicknesses of interest, and for submersed inspections, is established by engineering studies. Technical approaches and design concepts for a submersible inspection tool will be submitted for development in the Phase II program. Composite specimens of interest are inspected by existing Digiray machines. Detection and resolution capabilities, in terms of specimen thickness, feature size and feature type, are established by quantitative data analysis. Analytical methods are correlated and calibrated using test data. Calibrated analytical methods are used in engineering studies to determine design modifications required to extend applicability over the full range of materials and thicknesses of interest, and to establish feasible technical approaches to these modifications. Computations will determine x-ray energies required to inspect the full range of materials and thicknesses of interest. Engineering studies will establish the technical approach and feasibility of attaining required x-ray voltages. All data, technical approaches, and engineering results will be submitted in a final technical report.

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Phone: (614) 594-2221
Topic#: 93-009 ID#: 93N07-120
Office: MARCOR
Contract #: DAAK70-93-C-0054
PI: Gong Chen
Title: Electric Free-piston Stirling Refrigerator for Combat Medical Units
Abstract: Sunpower, Inc., proposes to demonstrate an electrically-driven free-piston Stirling refrigerator for Combat Medical Units. This silent, energy-efficient, highly reliable refrigerator will provide required cooler and freezer compartment temperatures without using a traditional compressor or CFCs. The machine's linear motor and its associated control electronics are capable of utilizing electric power supplied by military vehicles, electrical generators, or domestic or foreign utilities. Phase I will demonstrate the electric free-piston Stirling refrigerator design approach by integrating an available highly developed electrically driven free-piston Stirling cooler with an appropriate heat absorbing exchanger and an insulated compartment. The thermal performance of this refrigerator, including temperatures produced, energy efficiency, cooling capacity and capacity modulation, will be tested under Combat Medical Unit conditions. Phase I results will be the basis for the construction and testing of additional engineering development models in Phase II.

SUPERIOR PROGRAMMING SERVICES
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Topic#: 93-021 ID#: 93N47-055
Office: SPAWAR
Contract #: N00039-93-C-0165
PI: RAY C. TROUT
Title: Critical-time & Real-time Database Management
Abstract: The Critical-time/Real-time Database Management System is a Tandem Memory (Smart-Memory) which shares two memory functions. The memory functions are a Real-time Data Memory (RDM) with separate I/O and a similar memory for storing of Distributed Data words (DDM) or parameters. Associated with each memory function is a data processor with a cache memory and a knowledge base for the memory. The processors provide the system control, verify input and output data, identifies and classifies the data words and controls the transfer of data between the RDM and the DDM on separate input and output ports. The Knowledge Base (KB) function will aid the processors in data identity and classification plus other system functions. The System will be modular which will allow the system to grow or retract to meet operating requirements and system loading. A data archiving function will be included for storage of data that is not memory resident. Parallel Distributed Processing allows real-time access to current input data words.

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Topic#: 93-113 ID#: 93113-04
Office: NUWC
Contract #: N66604-94-C-0130
PI: James R Moden PE
Title: An Electrolyte Reformation Technique for Significant Weight & Volume Savings in the Aluminum-Silver Oxide Battery System
Abstract: An electrolyte reformation technique for use in the aluminum-silver oxide battery system is proposed. Successful implementation of this technique will reduce the weight of the energy section of a high power aluminum-silver oxide battery by more than 100 pounds. The technique is based on the fact that while sodium aluminate is soluble in hot aqueous solutions of sodium hydroxide, lithium aluminate is not. Therefore, the addition of lithium hydroxide to a sodium hydroxide solution, containing dissolved sodium aluminate, will cause a reaction in which lithium aluminate forms as a precipitate with the reformation of sodium hydroxide. The weight savings are the result of not throwing over board contaminated electrolyte but instead reclaiming the electrolyte using the proposed electrolyte reformation technique. Carrying the majority of the electrolyte in the lower molecular weight form, lithium hydroxide, provides additional weight reduction. Sixty four laboratory experiments will establish the operating parameters of the technique. A 1/16 scale electrolyte circulation and reformation test apparatus operating at 10 gallons per minute will be designed, fabricated and tested to demonstrate the efficacy of the technique. The intended site is Undersea Warfare Center, Newport, RI.

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Phone: (408) 434-0110
Topic#: 92-113 ID#: 92N01-072
Office: ONR
Contract #: N00014-93-C-0101
PI: Dr. John Platt
Title: Object Recognition Chip (ORC)
Abstract: Synaptics has demonstrated that it is possible to design and produce a commercial integrated circuit capable of imaging and recognizing a single-font character set. This device-called the I1000-includes an area imager (silicon retina), two single-layer analog neural networks and digital control. It appears possible to extend the I1000 architecture to create a single chip capable of recognizing simple objects. This device-called ORC-will have electrically programmable parameters so that it can be tailored to the recognition of user-defined objects. The parameters are learned off-line in a computer system simulating the ORC neural networks, but receiving actual images produced by the ORC silicon retina. The ORC will recognize objects despite some variation in scale, orientation, and shape of the objects. The basic objective of this research effort is to define the specific architecture of the ORC and assess its technological feasibility. The ultimate objective is to be able to produce a cost-effective general-purpose object recognizer for commercial and military applications.

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Topic#: 93-055 ID#: 93N00-034
Office: NAVSEA
Contract #: N00024-93-C-4061
PI: James D Miessler
Title: Light Weight Syntactic Foam
Abstract: A proposal is made to explore the feasibility of manufacturing a syntactic foam with a density of less than 20 lb/ft primarily for application to Navy submarines. The Phase I effort would survey the current state-of-the-art regarding materials and processes as well as proposing the development and use of new strength-enhanced materials. One proprietary and one patented process are discussed that would be of benefit in achieving the program goal.

SYSTEM DYNAMICS INTERNATIONAL, INC.
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Phone: (904) 371-8035
Topic#: 92-132 ID#: 92PMT-179
Office: NAVAIR
Contract #: N00019-93-C-0198
PI: WILLIAM R. GRAHAM
Title: Multisensor Integration for High Altitude Bombing
Abstract: The U.S. Navy has identified a need to accurately attack ground targets with weapons delivered from advanced high-altitude aircraft. The high altitude bombing concept affords enhanced aircraft survivability since weapons can be released beyond the range of ground-based enemy air defenses even when operating near the target area. However, to ensure accurate guidance to the target area and ultimately a high probability-of-kill, such weapons are expected to be equipped with an inertial measurement unit (IMU), a GPS receiver, and possibly a narrow field-of-view seeker. Consequently, in order to realize a high-performance, cost effective system, it is anticipated that state-of-the-art sensor configurations and innovative IMU transfer alignment algorithms will be required to optimize the high-altitude bombing concept. The focus of this proposed research is to: (1) identify candidate state-of-the-art sensors for high-altitude aircraft/weapon systems, (2) postulate and evaluate innovative aircraft/weapon sensor configurations, and (3) conduct tradeoff analyses to characterize the feasibility of the candidate configurations. Detailed mathematical models will be formulated to characterize the error behavior of each sensor, and representative aircraft and weapon flight trajectories will be generated. Candidate configurations consisting of alternative aircraft/weapon sensors, aircraft-to-weapon transfer alignment procedures, and weapon mid-course guidance aiding schemes (e.g., GPS-aiding) will be postulated. The candidate configurations will be embedded into a computer simulation which will be employed to generate weapon system alignment error, navigation error, and seeker pointing error time-histories. Based on these projected errors, performance/risk/cost tradeoff analyses will be conducted for each candidate configuration. The most promising configurations will be selected for in-depth analyses to be conducted under the subsequent Phase II effort.

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Phone: (402) 293-1559
Topic#: 92-154 ID#: 92PMT-242
Office: NAVAIR
Contract #: N60921-93-C-A343
PI: JOHN H. MORDESON
Title: Terrain Contour Matching (TERCOM) Map Placement
Abstract: Determining sites to build new TERCOM maps has proven to be a very complicated and time consuming task, as evidenced in both SIOP cruise missile planning and Operation Desert Storm. The cruise missile planner, with some difficulty, can determine needed candidate TERCOM sites, but all too often, because of insufficient terrain roughness, the Defense Mapping Agency (DMA) is unable to create a TERCOM at this location. According to DMA, as many as 90% of the TERCOM requests they receive are infeasible or repeat infeasible requests. As a result, the planner is left with unsatisfied TERCOM needs, and DMA's time is wasted. SCT has been developing an interactive graphics program for the Air Force which integrates our operationally proven cruise missile routing algorithms with DMA-endorsed TERCOM site validation criteria. This program provides a window based user interface with graphical plots, optimal path computations, data management of past and present TERCOM requests, TERCOM site validation tests, request form production, and message handling between DMA and the STRATCOM. This technology can be adapted to meet the Navy's specific TERCOM planning needs at a low cost with minimal or no risk. This nuclear planning tool will result in TERCOM requests being sent to DMA which are not only feasible, but which truly satisfy the cruise missile routing needs.

SYSTEMS CONTROL TECHNOLOGY, INC.
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Phone: (415) 494-2233
Topic#: 91-355 ID#: 91N10-069
Office: NAWCFTEG
Contract #: N00612-93-C-0230
PI: Mark R. Anderson
Title: Portable Aircraft Flight Test Instrumentation System
Abstract: To test an aircraft in its operational environment, minimal changes must be made to either the aircraft or its environment. Areas in which such non-intrusive testing methods are needed include the study of the ship/rotorcraft aerodynamic interface, remote site flight testing, and gathering simulation validation data from routine flight tests. To meet these needs, a portable instrumentation package (PINS) will be designed in the Phase I effort. Specific technical objectives of the program are: to develop system requirements based on the data accuracy, resolution, and sampling rates needed far flying qualities and performance testing, to develop and evaluate options for access to the signals required from existing production and non-production sensors, and to perform an initial design study of the portable instrumentation system. The specific innovation in the PINS design lies in the use of inertial navigation system (INS) data, in the design of an easily installable air data system, and in the use of a specialized microprocessor controller which will control the entire data recording process. The microprocessor will further allow for other features such as on-line health monitoring, automatic data quality checking and a simplified user interface.

SYSTEMS TECHNOLOGY, INC.
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Topic#: 92-164 ID#: 92PMT-291
Office: NAWCFTEG
Contract #: N00421-93-C-0108
PI: WALTER A. JOHNSON
Title: Use of Heads-up Displays in the E-2C Cockpit
Abstract: The technical objective of the Phase I effort described herein is to determine whether a "virtual" improvement in the E-2C aircraft flying qualities in the carrier environment can be achieved by having the pilot use a heads-up display (HUD). In order to accomplish this objective, existing military and civilian HUD technology will be surveyed to determine what might be available for use in the existing E-2C cockpit without major airframe interruptions. At least three candidate systems will be selected for presentation, with their particular rationales, in report format. The Phase I work plan will assay the merits of a heads-up display (HUD) for the E-2C in terms of six key display characteristics: (1) identification of critical mission phase(s) and tasks, (2) the elements of the display, (3) the display content, (4) the display format, (5) the symbology, and (6) cost/feasibility assessment of most promising HUD systems. This technical approach employs closed-loop analysis of the pilot's tasks associated with a specific vehicle operational profile or mission phase. The resulting multiloop feedback (and feedforward) structures reveal, in detail, not only the content, format, and dynamic properties of essential pilot information requirements but also appropriate piloting control techniques, which can be helpful in training as well as in predicting flying qualities.

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Topic#: 92-173 ID#: 92N0A-110
Office: NAWCAWAR
Contract #: N62269-94-C-0201
PI: THOMAS T. MYERS
Title: Active Control of Fighter Maneuvers
Abstract: An original approach to application of active control in fighter maneuvering is proposed. This will involve a problem-driven design process tailored to exploit new developments in robust multivariable control theory to serve the needs of real world flight control design. This process emphasizes the formulation of application-specific design requirements as the key to practical implementation of new multivariable synthesis methodologies. Requirements formulation include the development of new multivariable lower order equivalent systems (MLOES) models for representation of basic requirements and their interface with various multivariable synthesis procedures. These will be used in a process involving directed optimization in which the overall flight control system will be developed as a related suite of multi-loop designs distinguished and integrated by functional modality.

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Topic#: 93-005 ID#: 93N4C-014
Office: ONR2
Contract #: N66001-93-C-7013
PI: JAMES H. BECHTEL
Title: New Optoelectronic Technologies
Abstract: TACAN Corporation proposes an innovative technology that will have a significant impact on promoting the optoelectronics industry in the United States. This technology is based on the development of wavelength-stable semiconductor diode lasers. With the proposed technology the wavelengths of these diode lasers are precisely determined and controlled by a temperature-stable Bragg reflector that provides strong wavelength-selective reflection. Unlike standard Distributed Bragg Reflection (DBR) lasers, our approach uses a Bragg reflector that is made of a different material than the gain portion of the laser and separated from the gain region. Moreover, our Bragg reflectors are formed from glasses which are chosen for their superior temperature stability. Thus the laser emission wavelength is locked to a predetermined value. With this approach optimized and well-developed diode lasers may be combined with optimized Bragg reflectors. There are numerous applications of this technology. For example, in the communications arena our approach can provide hundreds of non-interfering wavelengths for dense wavelength division multiplexing. The development of this technology will give U.S. industry a lead in semiconductor laser technology that is now dominated by Japan.

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Topic#: 92-124 ID#: 92N10-016
Office: NAWCTRN
Contract #: N68335-93-C-0213
PI: Tibor R. Tallian
Title: Establishment of New Rolling Contact Bearing Life Calculation Method.
Abstract: Improved rolling contact bearing spalling fatigue life prediction model will be formulated in the following steps: survey recent published models; compare their input parameter set and structure; extract a consensus set of influential input parameters; create model structure; prepare computerized method for numerical life prediction using this model. Model architecture studies recently completed by this proposer representing a model approach encompassing most consensus input parameters will be used as one, but not the only, point of departure. Observational bearing fatigue life data collected from Industry and other institutions, will be processed into a database for use in model validation. Statistical methods for life model validation will be designed and used to test the predictive power of the proposed model against collected observational data. The model will be refined based on validation results and documented for use in a follow-up Phase II effort.

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Topic#: 93-004 ID#: 93N40-103
Office: ONR2
Contract #: N00014-93-C-0206
PI: MASSIMO SIVILOTTI, PH.D.
Title: Affordable Integrated Circuit Manufacturing Using Shared-mask Gate Arrays
Abstract: We propose to design and develop a system of manufacturing integrated circuits in small and medium volume using shared masks. Current gate array manufacture dedicates high cost masks to each chip design. For high volumes, this cost is acceptable because it is amortized over a large number of chips. For typical small DoD volumes, the tooling costs make the chips' unit cost 10 to 100 times the high volume unit cost. Our method shares common mask and fabrication costs among 10 to 100 different designs, thus dramatically reducing the cost of each design. Shared mask technology has been successfully used for years by the DARPA-funded MOSIS service, but shared mask technology has never been applied to produce low cost gate arrays in low volumes. Our Phase I effort will include the design, fabrication and testing of sample gate arrays, and the investigation of two advanced concepts. The first idea leads to increased flexibility of the size of gate arrays and therefore reduces the start-up costs of the shared-mask gate array manufacturing process. The second idea targets the lowering of costs for medium volume fabrication runs. Phase II will include a full-scale multiproject gate array fabrication run and transition to a Phase III commercial service providing the Navy and commercial customers with low-volume gate arrays at less than 1/10th their current cost.

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Phone: (818) 792-3000
Topic#: 92-108
Office: ONR
Contract #: N00014-93-C-0028
PI: Andrew Moore
ID#: 92N01-008
Title: Real-time Image Enhancement with Resistive Grids
Abstract: The dynamic range of modern image sensors can exceed the range of a video monitor by an order of magnitude or more. This means that fast and intelligent range compression and image enhancement must be interposed between the sensor and display for effective surveillance and target tracking. Digital hardware can enhance an image in real time, but the common method for range compression on digital hardware, linear filtering, can severely distort the image. We propose to research and develop integrated analog image processors with nearest-neighbor interconnect architectures that carry out nonlinear filtering for range compression and image enhancement at video rates. The nonlinear filtering intelligently compresses the range without distortion. Digital processors, which consume orders of magnitude of more power than this kind of processor, are not capable of applying a similarly effective and distortion-free algorithm in real-time. Our Phase I effort will include the design, fabrication and test of circuits to improve the state of the art of such processors, and will include the demonstration and evaluation of an existing low-resolution analog video image processor. Our approach will utilize commercial CMOS/bulk integrated circuit technology; products arising from this R&D can be fabricated reliably and economically by a number of vendors.

TECHNICAL SOLUTIONS, INC.
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Topic#: 93-004
Office: ONR2
Contract #: N00014-93-C-0230
PI: DR. ALTON L. GILBERT
ID#: 93N33-733
Title: Agile Manufacturing - A Next Generation Controller Paradigm and Demonstration
Abstract: The objective of agile manufacturing is to increase competitiveness of the U.S. manufacturing base, while addressing DoD priorities, with a combined goal of improving US global competitiveness and national security. To achieve this objective, significant changes in technology and infrastructure must occur. This proposal addresses a significant component of these required changes, a Next Generation Controller (NGC). Its development, by design, will provide for integration into the open architecture environment of the work cell and the factory floor, and in addition provide for the integration of its internal components into open architecture systems. The technological advances proposed within draw upon lessons learned from previous NGC programs such as MOSAIC, and also from Army initiatives in distributed intelligent controls for Army programs such as intelligent minefields and advanced field artillery systems, and DoD programs in robotic system simulation and control. A demonstration of the NGC concepts is proposed, through the integration of a vision-based sensor and data base manager with a water-jet milling machine provided by Pratt & Whitney.

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Topic#: 93-123
Office: NSWCCARD
Contract #: N00167-94-C-0013
PI: William E Bennett
ID#: 93123-13
Title: Active Control for Ship Silencing
Abstract: Advanced technology for adaptive structures is being developed which enable advancements in distributed control and sensing for application to active suppression of ship noise in Naval operations. Advanced control systems for wide band cancellation of ship borne noise as well as reduction of reflected acoustic energy from echo ranging are considered for evaluation. Advanced methods in modern control theory will be applied to evaluate alternative control architectures, discriminate performance potential of candidate control algorithms, and to guide the development of a new class of adaptive algorithms for wide band noise suppression. Predictive evaluation of noise suppression performance based on radiated acoustic energy will be performed in concert with the control system analysis.

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Topic#: 93-075
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Contract #: N00024-94-C-4064
PI: O M Tuck
ID#: 93N00-225

Title: Standard Low Cost Display Console TAS Proposal 93-1113
Abstract: Commercial off-the-shelf (COTS) computing and display equipment has demonstrated its suitability for use in a variety of shipboard applications providing powerful and low-cost solutions to problems in command control communications and intelligence (CCCI). The publication of MIL-STD-2036 marks the U.S. Navy's acceptance of the suitability of COTS equipment for shipboard use. This task will determine shipboard subsystem requirements and develop a procurement specification for a low-cost general-purpose display console conforming to MIL-STD-2036 and suitable ror use in a variety of submarine display and control applications. This console will be compatible with the requirements of the Next Generation Computer Resources (NGCR) program and will be based on an open systems architecture that will allow the easy insertion of technological improvements. Specifically the console will be based on the Futurebus interconnect standards and will incorporate an operating system conforming to the appropriate requirements of the FOSIX operating system interface standard. The console will adhere to the SAFENET-II fiber optic networking standard and will incorporate the X-Windows graphics system for interchange of text and graphics data.

TECHNOLOGY ASSESSMENT & TRANSFER, INC.
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ANNAPOLIS, MD 21401
Phone: (301) 261-8373
Topic#: 93-126
Office: NCEL
Contract #: N47408-93-C-7315
PI: WALTER ZIMBECK
ID#: 93N4C-129
Title: A Safe, Low Cost & Rapid Catalytic Decontamination Technique for PCP-Treated Wood
Abstract: The Naval Weapons Station Seal Beach, California, is the custodian of what is believed to be the free world's supply of napalm. Beginning late in FY93, the Navy expects to accomplish the removal and disposal of the napalm and the aluminum canisters. When this task is completed, all that will remain are the 35,000 PCP treated wood crates in various states of disrepair. This amounts to approximately six million pounds of waste that must be disposed of properly. Because of current State regulations and pending regulatory changes at the Federal level, careful consideration must be given to disposal of PCP-treated wood products. TA&T, Inc. proposes to demonstrate in Phase I, a safe, low cost and rapid chemical catalyst technique for decontamination of PCP-treated wood. The technique is called Base Catalyzed Decomposition and has already been demonstrated to decontaminate PCP contaminated soil, as well as PCB contaminated wood. Based on these demonstrations, the extension of this technique to decontamination of PCP-treated wood has a high probability of success.

TECHNOLOGY SERVICE CORP.
962 WAYNE AVE.
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Phone: (301) 565-2970
Topic#: 93-064
Office: NAVSEA
Contract #: N60921-93-C-0125
PI: Stan Silberman
ID#: 93N00-108
Title: Sensor Tactical Decision Aid
Abstract: Abstract available from the NAVY SBIR office. Contact Vinnie Schaper at (703) 696-8528.

TECHNOLOGY SERVICE CORP.
6515 MAIN STREET
TRUMBULL, CT 06611
Phone: (203) 268-1249
Topic#: 92-172
Office: NAWCWAR
Contract #: N62269-94-C-0507
PI: LINDA HAWKINS
ID#: 92N0A-171
Title: Feasibility of Aircraft Target Identification in an ECM Environment
Abstract: Radar-based, aircraft target identification techniques have the potential to allow the U.S. Navy's long-range missiles to safely engage hostile aircraft, beyond visual range (BVR). To fully realize this potential, the identification techniques, which typically exploit the radar image or modulation characteristics of aircraft targets, must be able to function reliably in an ECM environment. To progress toward achieving a BVR capability, this Phase I effort will survey both operational and developmental noncooperative target identification (NCTI) techniques and assess their vulnerability to a variety of obscuration and deception countermeasures. The high-resolution and/or dual-polarization processing typically employed by modern NCTI techniques will be studied to determine its potential for extracting information about the ECM. ECMs to the processing algorithms will be sought to exploit what can be learned about the presence and nature of the countermeasure. An assessment will be made of the level of improvement that can be provided by adaptively modifying the NCTI algorithms in the presence of ECM. Finally, a plan will be provided for implementing the NCTI algorithms and demonstrating their performance in an operational radar system.

This study will systematically assess the technical feasibility of employing radar-based NCTI techniques in an ECM environment, and provide a plan for the quantitative evaluation of the most promising techniques in Phase II.

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Topic#: 92-124 ID#: 92N10-019
Office: NAWCTRN
Contract #: N68335-93-C-0111
PI: Tedric A. Harris

Title: Establishment of a New Rolling Contact Bearing Life Calculation Method

Abstract: Rolling bearings for aircraft gas turbines and power drives are designed to meet endurance requirements basically determined according to the standard fatigue life calculation method. This method is based on Lundberg-Palmgren fatigue life theory as modified by reliability, material and lubrication factors. As aircraft load and speed requirements increase, this method results in bearings of increasing size, significantly adding to the size and weight of the gas turbines and power drives. Newly developed life prediction methods recognize the existence of a fatigue limit stress. If the stresses a bearing experiences during operation do not exceed the limit stress, the bearing can achieve infinite life. Bearings designed using these new methods will have smaller diameters, weigh less and cost less. This Phase I project will investigate these new methods and analytically evaluate the utility of each by comparing fatigue lives so predicted with actual fatigue life data accumulated by aircraft engine and power drive manufacturers. To conduct the evaluation, computer programs BBEAN2 and CYBEAN2 will be used for bearing performance analysis. Assuming reasonably successful comparison of actual and analytical data, a Phase II project will further develop a practicable method using the fatigue limit stress for aircraft bearing design.

TFR TECHNOLOGIES, INC.
701 SE SALMON
REDMOND, OR 97756
Phone: (503) 923-0804

Topic#: 93-062 ID#: 93N00-090
Office: NAVSEA
Contract #: N60921-93-C-A352
PI: Kenneth Lakin

Title: Miniature Tunable Filters

Abstract: Many modern radar and communications concepts employ microwave transmitter receivers TyR modulem. It is desirable to use a TyR module with a large bandwidth in order to encompass many applications and therefore reduce costs. However using broadband modulem without filter selectivity results in receiver susceptibility to spurious and unwanted signals. In addition, some form of selectivity allows higher transmit power amplifier efficiencies. This program will address the general tunable filter requirements in the context of a novel transmission line concept that allows tunability or programmability of filters and other components. The concept will allow miniaturization of filters by significantly decreasing the characteristic phase velocity of transmission lines through the use of circuit concepts and materials processing. In addition, the Phase I program will review the thin film resonator technology and its application to lower frequency ranges, 1-10 GHz, where the ultra-miniature high performance devices would be switched to have the flexibility of tunable filters.

THE FEDERATED SOFTWARE GROUP, INC.
342 W. MADISON
KIRKWOOD, MO 63122
Phone: (618) 628-4215

Topic#: 93-018 ID#: 93N47-202
Office: SPAWAR
Contract #: N00039-93-C-0180
PI: DOUGLAS NELSON

Title: Security and Functional Requirements for Multilevel Secure Distributed Operating Environments

Abstract: The lack of Multilevel Secure (MLS) computer systems within the Department of Defense (DoD) is recognized as a significant shortcoming. Past efforts to build secure computing environments have resulted in a multiplicity of single-level systems, operating on a system high mode, with each system handling a single level of classified information. This results, in addition to difficulties and inefficiencies in intercommunication, in significant data redundancy, over-classification, time delays, and the added expense of maintenance and operational costs associated with redundant equipment. There have been several recent efforts to develop workable distributed computing environments. None of these have made serious inroads into addressing multilevel security. Part of the lack of progress is attributable to our lack of understanding of the impact of security as applied to a true distributed computing environment. The objective of this effort is to identify and analyze the functional capabilities required by a distributed computing environment capable of supporting heterogeneous processors performing real-time operations. The security threats to a distributed system will also be identified and analyzed. In addition, several existing

distributed operating environments will be analyzed as possible candidates for designing a trusted distributed computing environment. Finally, some initial requirements for the design of a trusted distributed operating system will be developed.

TIMEPLUS, INC.
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Phone: (404) 422-7542
Topic#: 92-163 ID#: 92PMT-287
Office: NAWCFTEG
Contract #: N00421-93-C-0107
PI: ROBERT M. CHAMBERLAIN
Title: Flat Panel Display Technology for the E-2C Cockpit
Abstract: The E-2C cockpit is currently equipped with analog instrumentation that is rapidly becoming unsupportable. Retrofit of the E-2C with flat panel, multi-function displays will resolve the supportability problem and will provide new mission support capability for the pilot and copilot. This new capability has the potential of dramatically improving the mission effectiveness of the E-2C. This research project will identify the constraints and operating environment and survey existing and planned cockpit display technologies. TimePlus will determine E-2C cockpit retrofit requirements and trade off display technologies against the constraints operating environment, requirements and schedule to recommend 3 technology approaches for the retrofit program. The Phase II study plan tasks will generate a display subsystem specification for the E-2C retrofit, analyze the potential for a Navy-standard multifunction cockpit display, and develop an advanced crew concept for executing command and control mission in the E-2C with enhanced pilot and copilot functions.

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Phone: (404) 422-7542
Topic#: 92-179 ID#: 92N10-088
Office: NAWCTRN
Contract #: N68335-93-C-0110
PI: Bernie Miron
Title: Adaptable 1553 Bus Controller and Operator Station Improvements for Aircraft Engine Testing
Abstract: The standard 1553 Bus Controller and related engine test facility improvements will give NAPC a standard controller interface for testing engines equipped with FADECS. This effort will make hardware and software improvements to the operator station to add real-time data display, consistent operator test control, record/playback functions and rapid configuration change capabilities. The application of advanced domain modeling and QFD techniques will improve the requirements analysis process. This will result in a balanced analysis of the total system to ensure system changes result in improvements to key problems.

TOYON RESEARCH CORP.
75 AERO CAMINO, SUITE A
GOLETA, CA 93117
Phone: (805) 968-6787
Topic#: 93-029 ID#: 93N47-071
Office: SPAWAR
Contract #: N00039-93-C-0192
PI: DR. THOMAS L. LARRY
Title: Broadband Submarine Communications Mast Antenna
Abstract: A design study is proposed for mast mounted antenna systems to be used on submarine platforms as part of the COPERNICUS System communication link. Several types of multielement antenna structures and matching network topologies will be investigated. Optimization analyses will be performed for each combination of structure and network topology. This will result in a set of 'optimum' designs. A tradeoff analysis will then be performed to determine the design or designs that best satisfy the requirements for the Copernicus System. Optimization will be accomplished using ANTELOPE - a unique set of software tools which Toyon has developed to optimization electromagnetic EM system design concepts. The antenna systems will make use of optical technologies. This includes fiber optic links, optical modulator devices which directly sense the incoming EM fields, and optically controllable circuit elements.

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Phone: (805) 968-6787
Topic#: 93-030 ID#: 93N47-065
Office: SPAWAR
Contract #: N00039-93-C-0198
PI: DR. THOMAS L. LARRY
Title: Submarine RF Communications Antenna
Abstract: A design study is proposed for antenna systems mounted on buoys which will be towed by submerged submarines and

part of the COPERNICUS System communication link. Several types of multielement antenna structures and matching network topologies will be investigated. Optimization analyses will be performed for each combination of structure and network topology. This will result in a set of 'optimum' designs. A tradeoff analysis will then be performed to determine the design or designs that best satisfy the requirements of the Copernicus System. Optimization will be accomplished using ANTELOPE - a unique set of software tools which Toyon has developed to optimize electromagnetic EM system design concepts. The antenna systems will make use of optical technologies. This includes fiber optic links, optical modulator devices which directly sense the incoming EM fields, and optically controllable circuit elements.

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Topic#: 93-083 ID#: 93083-01
Office: NSWCDDWO
Contract #: N60921-93-C-0123
PI: Robert D CHAPMAN

Title: Energetic Phosphazene Polymers

Abstract: Ongoing DoD requirements for improved ordnance systems require novel chemical structures that can provide unique properties. A class of compounds that potentially offers unusual chemical and physical properties is the cyclic and linear polyphosphazenes. This class has received little attention, compared to conventional organic structures, toward determining its scope of reactions. Such an extension of usable chemical structures in explosives and propellant systems would especially allow performance improvements in advanced binders. The most important objective of the Phase I program is to demonstrate the feasibility of preparing tailorable phosphazene polymers containing energetic substituents. Prior methodology toward this goal has been very limited in scope but will be extended and developed here. An innovative anionic polymerization of phosphoranimines to prepare new linear polyphosphazenes incorporating energetic substituents. Phosphazene structured with energetic alkoxy groups would be of particular interest. Isolation of several model compounds with high energy content and their thermal stability characterization will demonstrate the feasibility of such incorporation.

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Topic#: 93-094 ID#: 93N2D-500
Office: NSWCDDWO
Contract #: N60921-93-C-0117
PI: Robert D. Chapman

Title: Process Development for a New Oxidizer for Navy Missile Propellants

Abstract: This process development for nitrogen pentoxide is directed toward improvements in ammonium dinitramide (ADN) production. ADN is " a new candidate propellant oxidizer... for low signature propellants." Thus improvements in a production process for acid-free nitrogen pentoxide, required in the current best process for ADN production, would be especially beneficial for ultimate practical production of this new oxidizer. The most important objective of the Phase I program is to demonstrate improved practicality in the preparation of acid-free nitrogen pentoxide or useful solution of it in an appropriate inert solvent. This will be achieved through a feasibility study of innovative process improvements using several different separation technologies applied to the nitrogen pentoxide-nitric acid system. Innovative separation experiments will employ technologies based on extraction, membrane diffusion, and phase separation methods.

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Topic#: 93-129 ID#: 93N4C-067
Office: NCEL
Contract #: N47408-93-C-7318
PI: KENNETH B. KIDD

Title: Bacterial Enhancement of Hyperaccumulators for Remediation of Lead Contaminated Sites

Abstract: The remediation of soil and water contaminated with lead and other toxic metals presents a serious challenge to known cleanup methods. Ex situ remediation of some metal contaminated sites has been demonstrated on a small scale using specially adapted microbes, but removal of the contaminated soil and slow turnover rates downgrades this method. Hyperaccumulator plants show great potential, but only a very few, rare species have been identified as hyperaccumulators. Bacteria will be adapted to high lead concentrations through soil-extract culture methods. These adapted bacteria will increase the transport of lead from soil to plants. These adapted bacteria have the potential to generate hyperaccumulation of lead in common crop plants, such as Grasses, Legumes, and Brassica. These crop plants, because of the advantages of wide geographic distribution, fast

growth, multiple cuttings, commercially available seed, genetic variability, and known agronomics, could significantly enhance hyperaccumulation as a site remediation technique. TPL will evaluate the contaminated lead sites, hyperaccumulators and remediation techniques to choose potential candidates. Bacterial and chemical enhancement methods for bacteria adaptation will be studied. A final greenhouse test of lead accumulation using the candidate plants with the enhancement techniques will be performed. Dr. K. Blake Kidd has been active in innovative reuse and reformulation technologies that exploit biological systems. Collaborating from NMSU are Drs. McCaslin and Lindemann, specialist in Agronomy and Soil Microbiology, respectively.

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Topic#: 92-131
Office: NAVAIR
Contract #: N00019-93-C-0118
PI: H. M. STOLLER

ID#: 92PMT-174

Title: An Investigation of Semiconductor Technology for a 20mm RADHAZ Safe Primer

Abstract: The M52 primer used in 20 MM ammunition presents a radiation hazard in the intense electromagnetic environment encountered aboard Navy ships. Shields or attenuators are not feasible for small components such as the M52. Semiconductor technology for RF-resistant primer device applications is a promising innovation. An investigation will be conducted into relevant semiconductor technologies. Two design concepts, labeled semiconductor initiator (SCI) and semiconductor bridge (SCB), will be the probable focus of the investigation. Antenna coupling analysis, in-line RF resistance testing of primer devices, nondestructive testing, and temperature sensitivity will be employed as evaluation criteria. Ability to meet Navy specifications will be established. A Phase II development plan will be formulated. TPL is developing semiconductor primer devices for DoD applications. This proposed effort will be supported by consultants active in the development of semiconductor initiation technology. Experimental facilities exist to support the proposed program.

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Topic#: 92-176
Office: NAWCTRN
Contract #: N68335-93-C-0120
PI: Dr. Richard W. Brotzman,

ID#: 92N10-023

Title: A Hydrophobic Ceramic Composite Air Filter

Abstract: A filter is required to remove airborne contaminants from the intake air in small displacement diesel engines. The filtration system must be simple, lightweight, and produce negligible pressure drops across the air intake. The filter will be fabricated by sol-gel techniques using a patent pending ambient pressure drying procedure that offers net-shape, low-cost fabrication with precise control of membrane pore structure. Combined with ceramic fiber reinforcement, the sol-gel process enables the fabrication of tough, low cost, high performance filters. Cylindrical filters will be chemically aged, dried, and infiltrated to control membrane pore size and pore size distribution. A hydrophobic layer will be covalently bound to the surface of the filter to prevent airborne contaminants from wetting and fouling the filter. Characterization will include thermal stability, mechanical properties, pore size and pore size distribution, filtration efficiency, in-line pressure drop, and wetting. TPL, supported by the research studies of the Center for Micro-Engineered Ceramics at the University of New Mexico, represents state-of-the-art expertise in ceramics, composites, sol-gel processing, and filter technology.

TRIANGLE RESEARCH & DEVELOPMENT CO.
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Topic#: 91-322
Office: NAVAIR
Contract #: N00019-92-C-0084
PI: Richard A. McKinney

ID#: 91N14-481

Title: Water Survival Training System for the V-22 Osprey

Abstract: The purpose of this Phase I program will be to assess the water survival training requirements for crew and passengers of the V-22 Osprey. This will be accomplished by comparing the current training procedures for both helicopters and fixed-wing passenger carrying aircraft. Recommendations will then be made regarding methods of addressing the V-22 water survival training system requirements. In addition, new training equipment and water survival equipment requirements will be identified.

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Topic#: 92-152 ID#: 92PMT-238
Office: NAVAIR
Contract #: N00019-93-C-0144
PI: RICHARD A. MCKINNEY

Title: Development and Testing of Helicopter Crew Seat/Cushion to Increase Survivability

Abstract: This Phase I program would examine the feasibility of developing aircraft seat cushions that can help crews of the AH-1W to survive crashes. The effort will focus on adapting novel hydraulic air cushioning structures (HACS) to absorb the impact energy of a crash. These HACS structures, which are elastomeric compounds with controlled air-flow passages, when incorporated within the seat or cushion, could absorb tremendous amounts of impact energy during a crash. Combined with current stroking seat technology, the cushions could significantly reduce the average rate of 14.5 G and the maximum G currently experienced in helicopter seat drop tests conducted by Simula. With these shock absorbing qualities, the cushions have the potential to render certain kinds of crashes more survivable. The cushions would not be highly expensive and could be easily designed to be retrofitted to existing aircraft. In addition, later Phase II studies could investigate the incorporation of fire retardant materials to aid in the survival of post-crash fires.

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Phone: (703) 273-1012

Topic#: 93-101 ID#: 93101-10
Office: NSWCDDWO
Contract #: N60921-93-C-0135
PI: Nicholas E KARANGELEN

Title: Multidomain System Design View Integration Methods and Tools

Abstract: The complexity and sheer magnitude of modern computer systems including advanced combat systems, sensors and weapons require a disciplined structured approach for their development. The principal objective of the system development process is to establish a design which satisfies the system requirements and constraints while optimizing the key trade-offs and issues associated with system functionality, behavior, and implementation. This Phase I SBIR project will leverage ongoing research to refine a multi-domain system design capture and analysis methodology based upon five views of the system and will develop an advanced tool prototype supporting this methodology. The tool will allow the user to rapidly capture the system design across the five design views using an interactive graphic user interface and provide automated support for consistency checking and for defining the mappings or relationships between views. Interfaces to existing tools such as Teamwork by Cadre and others will be supported through adherence to the CASE Data Interchange Format (CDIF) for import and export of captured design data. The tool will also support automated conversion or generation of executable simulations from the captured design.

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Topic#: 93-004 ID#: 93N40-149
Office: ONR2
Contract #: N00014-93-C-0201
PI: JOSEPH STANCO

Title: A Novel Approach for Agile Manufacturing of Metal Matrix Composites for Naval Systems

Abstract: A novel approach to agile manufacturing for production of metal matrix composites (MMC) is proposed. The composites are precision cast by pressurized infiltration casting. Thin-walled ceramic molds are used to contain and infiltrate complex-shaped preforms. A powerful, user-friendly 3D graphics software package is used to interactively create mold designs from the solid model of MMC component to be cast. The software can also analyze the casting process in transient 3D to simulate mold filling. A rapid prototyping method directly creates ceramic molds from the CAD-generated solid model, eliminating intervening steps and part-specific tooling. This increased flexibility allows for rapid design changes, dramatically reducing the cost and lead time involved in casting MMC's. Computer integrated manufacturing incorporating rapid prototyping will establish pressure infiltration casting as a new paradigm for affordable and timely manufacturing of near-net shape metal matrix composites and components. The proposed effort will demonstrate enabling technology by fabricating near-net shape Gr/Al heatsinks for Naval avionics applications.

U.S. COMPOSITES CORP.
105 JORDAN ROAD
NY, NY 12180

Topic#: 91-085 ID#: 91N4F-004
Office: NSWCIH
Contract #: N00174-93-C-0093

Phone: (518) 283-8700 PI: George A. Earle III
Title: Missile Lug/Composite Material Integration
Abstract: Abstract available from the NAVY SBIR Office. Contact Vinnie Schaper at (703) 696-8528.

ULTRAMET
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Phone: (818) 899-0236
Topic#: 92-125 ID#: 92N10-008
Office: NAWCTRN
Contract #: N68335-93-C-0083
PI: Arthur J. Fortini, Ph.D.
Title: Interfacial Coatings for SiC Fiber-reinforced Titanium Matrix Composites
Abstract: Continuous silicon carbide (SiC) fiber-reinforced ordered titanium intermetallic alloy (Ti3Al) matrix composites are enabling materials for next-generation turbojet compressor and hypervelocity vehicle airframe applications. They possess unique combinations of several attractive properties such as high specific strength, high specific stiffness, and excellent fatigue and creep resistance. However, several key issues challenge the fabrication and application of these composites, led by their complex interfacial Phenomena. In this Phase I Program, Ultramet Proposes to deposit single-layer, graded, and duplex interlayers of refractory metals and/or ceramics by chemical vapor deposition (CVD) to eliminate interfacial reactions, eliminate the weak carbon layer on commercially available SiC fibers, and ease thermal stress at the fiber/matrix interface. Ultramet will collaborate with other experts to coat fibers, fabricate and characterize the composites, and screen the material systems Proposed for the interlayers.

UTILITY DEVELOPMENT CORP.
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Phone: (999) 999-9990
Topic#: 93-055 ID#: 93N00-038
Office: NAVSEA
Contract #: N00024-93-C-4189
PI: Harry S Katz
Title: Light Weight High Performance Syntactic Foam
Abstract: During this Phase I program, we will develop a syntactic foam or similar material with less than 20 pounds per cubic foot density and greater than 200 ksi compressive modulus, which can be used to provide positive buoyancy to submarines by filling void spaces. Our objective will be achieved by combining low density microsphere fillers and short fiber reinforcements within a high-strength polymer matrix. These syntactic foams will be tested for density, compressive modulus and strength, and water absorption. Tests will also be conducted after thermal cycling, controlled humidity exposure, and accelerated aging. At the end of Phase I, we will provide a detailed Phase II plan, schedule and cost estimate.

VECTOR MICROWAVE RESEARCH CORP.
1150 S WASHINGTON STREET, SUITE 300
ALEXANDRIA, VA 22314
Phone: (703) 683-3399
Topic#: 92-168 ID#: 92N2D-029
Office: NSWCDDWO
Contract #: N60921-93-C-A344
PI: Ronald T CRABB
Title: ECM Payloads for UAVS
Abstract: The spatial separation offered by UAVs (Unmanned Air Vehicles) negates many advantages of advanced monopulse radar and IR seeker designs. UAVs provide unusual EW payload design freedoms - EW protection of naval surface ships is emphasized. Unique ship considerations include relatively large RCS, limited speed and maneuverability, short warning times, long counter-targeting engagement durations, unusual IR characteristics, multiple ships to be defended, and widely variable engagement geometries. Vector will define an effective, practical, and affordable EW payload that counters both targeting and homing (radar and IR) functions - advanced threat technology dictates requirements and system design. Vector Microwave Research has previously identified and tested an RF ECM technique set for UAV applications - a set to be expanded based on a reassessment of the advanced threat. Vector will add IRCM approaches which accommodate unique UAV constraints. Comprehensive digital modeling will evaluate effectiveness of the additional techniques. Information exchanges with UAV platform developers and the UAV JPO will better define information, mechanical, thermal, and electrical interfaces between EW payload and candidate UAV platforms (counter-rotating rotors and tilt rotor designs). System definition includes concept of operations (Command, Control, and Coordination with the AN/SLQ-32(V)/54), interface requirements (payload-UAV-ships via UAV datalinks), and tactics.

VERSATRON CORP.
103 WEST NORTH STREET
HEALDSBURG, CA 95448
Phone: (707) 433-3000
Topic#: 93-096 ID#: 93096-02
Office: NSWCDDWO
Contract #: N60921-93-C-A348
PI: John SPEICHER
Title: Low Cost Control System Components for Gun Launched Projectiles
Abstract: Technologies developed under this SBIR will result in modular control section components to meet the requirements of a range of gun launched projectiles. Critical to the success of this effort is the consideration of each element's impact on other parts of the system relative to the shock hardening. Alternative approaches to the motor, gearing, and drive electronics, will be evaluated for their own merits as well as the impact on other components. The design we propose will meet the G load requirements by control of load paths, load distribution, and elimination of susceptible components. Versatron's proven experience in control system simulation and design will assure that the system proposed for Phase II will meet all of it's performance goals. We have teamed with International Dynamics Corporation (IDC) for expertise in shock hardening. The Phase I effort will emphasize design trade studies in the areas of cost, size, shock hardening attributes, motor size and type, electronics architecture, and the method of gear reduction. The result will be a detail design approach that integrates available technology to meet the technical requirements. The selected design will be analyzed in sufficient detail to allow low risk detail design, fabrication, and testing in Phase II.

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Phone: (619) 438-8099
Topic#: 93-008 ID#: 93N07-112
Office: MARCOR
Contract #: M67854-94-C-0017
PI: Thomas E. Carter
Title: Receive-only Radio Equipment
Abstract: The goal of this proposed multiphase SBIR program is to enhance the Marine Corps tactical receive capability by providing a small, light weight, low power and low cost device with built in step, scan, and search capabilities to acquire and process all standard military communications signals ranging in frequency from HF to UHF. An integrated capability, such as the one proposed, provides significant advantages over existing tactical radios. Application of advanced communications techniques, new electronic technology and state-of-the-art mechanical design can yield a small light-weight device which is more easily integrated into the battlefield and provides better performance. The low lost of the approach permits wide distribution which greatly enhances troop coordination and the dissemination of tactical information. The ability to search and scan over a wide frequency band provides the capability to easily monitor friendly and enemy communications and future capabilities could include decryption and dehopping of ECCM signals as well as LPI transmit for local two-way communication. ViaSat proposes to modify an existing hand-held radio to provide the required capabilities. Phase I will define requirements, select a candidate radio to provide high level designs for a demonstration. Phase II will produce a proof-of-concept demonstration closely matching the form, fit, and function of a full scale development in Phase III.

VISTA RESEARCH, INC.
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Phone: (415) 966-1171
Topic#: 93-063 ID#: 93N00-096
Office: NAVSEA
Contract #: N60921-93-C-0138
PI: Alan A Burns
Title: Near Ocean Environment Sensor
Abstract: Vista Research Inc. proposes to analyze the utility of an innovative system that uses variations in GPS signal strength as satellites rise and set to deduce the primary features of the refractivity profile and its variations around the horizon. The important features to be extracted are the mean refractivity gradient the presence and matures of ducts and irregular structures. The proposed system would exploit the precise knowledge of satellite position to detect shifts in the temporal signal fading patterns. Shifts can be interpreted in terms of the horizon refractivity gradient. In addition evaporative ducts are revealed by specific gross distortions of the first interference lobe. Smaller structure is manifested by fading and signal variations within the lobes, especially the first one. Statistical descriptions of the finer-scale signal variations may be usefully interpreted in terms of statistical parameters regarding the atmospheric structure at the horizon. The constellation of GPS satellites will soon reach the planned 24 satellites. As the GPS satellites are in several offset 12-h orbital planes one will rise or set every 15 min and cover four quadrants each hour on average. This will usually provide adequate coverage and updates. A decisive advantage of this approach is that it is completely passive and so does not require any radiation from a vessel.

WADDAN SYSTEMS
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Phone: (805) 257-4172
Topic#: 93-081 ID#: 93081-07
Office: NSWCDDWO
Contract #: N60921-93-C-A336
PI: Mahendra SINGH
Title: Gun Launchable Inertial Navigation System GLINIS
Abstract: Development of an Inertial Measurement Unit (IMU) for a low cost miniature gun launchable Inertial Navigation System (INS) to be packaged within a 60 mm projectile is proposed. The IMU sensor cluster design proposed is based upon the inertial silicon sensors produced by Waddan Systems. A pair of the silicon accelerometers are mounted together with their input axes coincident. Each is excited by an equal but opposite velocity normal to the input axes. This velocity has no effect on the acceleration sensed if the pair is put in a pure linear acceleration field, because each senses the same acceleration component. But when it is subjected to an angular rate normal to both the input axis and the velocity vector, the coriolis acceleration experienced by each is equal but opposite. Thus, by taking the sum and difference of the outputs of the devices one can measure both the linear acceleration and the angular rate. A minimum of three such pairs in a sensor cluster would yield a three axis IMU. The objective of the Phase I effort is to design an IMU which is analytically as well as technologically feasible for the 60 mm projectile application.

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Topic#: 93-119 ID#: 93N33-910
Office: NCCOSC
Contract #: N66001-93-C-7007
PI: JOHNSON J. H. WANG
Title: Multi-octave Passive VHF/UHF Antenna Technology
Abstract: The objective of the proposed research is to develop a small, light-weight, broad-beamwidth, multi-octave antenna which has a useable gain of over 0 dBi and which can operate without degradation of these characteristic parameters in the presence of a 3.3 watt per meter-square power density. By using the newly invented spiral-mode microstrip antenna (patent pending), of which Wang-Tripp Corporation holds the exclusive license, as a baseline approach, a passive antenna prototype covering the entire 30-500 MHz range with the required power-handling capability will be designed, fabricated, and tested. To reduce the size and increase the bandwidth of this antenna, mode-switching and a feed network integrated into the antenna structure will be used.

WATER & AIR RESEARCH, INC.
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Topic#: 93-130 ID#: 93N4C-075
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Contract #: N47408-93-C-7360
PI: JAMES ZHANG
Title: Subsurface Landfill Barrier: Hydrodynamical Enhanced Barrier System (HEBS) for Landfill Sites Remediation
Abstract: An eight month study is proposed on the fundamentals of a new system of subsurface barrier called Hydrodynamic Enhanced Barrier System (HEBS). The mechanism of HEBS is that it can, via oscillatory motion of working fluids or steady state circulating flow, remove contaminants from groundwater accumulated in a subsurface collector at rates exceeding that of pure molecular dispersion by several order of magnitude. This rapid removal of contaminants in groundwater creates a hydrodynamical barrier. Such a hydrodynamical barrier, superimposed on existing slurry wall, effectively prevents hazardous substances from dispersing into surrounding groundwater and/or surface water systems. When operating in oscillating flow mode, the contaminants can be removed from groundwater without pumping the groundwater out, which is especially important for those hazardous-waste landfill sites where the water table is shallow and treatment off-site is difficult or limited. The present study is proposed with the aim to better understand the temporal and spatial behavior of contaminant diffusion and the formation of the hydrodynamical barrier with the Enhanced Mass Pump (EMP) which is the key component in the HEBS.

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Topic#: 92-114 ID#: 92N01-092
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Contract #: N00014-93-C-0035
PI: Dr. Mohammed Ettouney
Title: Acoustic Radiation and Scattering from Submerged Structures Using Pressure Mode Similarity Surfaces

Abstract: The uncertainty in the magnitude and spatial distribution of concentrated masses internally attached to a shell submerged in an acoustic media is considered. The governing probabilistic equations are derived, and the supporting computer code is developed. The method will result in the statistical properties of important output measures, such as the structural velocities as well as the far field pressures. Among those properties are the expected values and variances. The method is shown to be computationally efficient. It is general enough to account for submerged complex structures as well as a large number of random variables, such as concentrated masses and/or uncertain internal boundary conditions (impedances). The flexibility of the method makes its extension to more demanding and complicated systems straightforward. Using such a probabilistic methodology makes it possible to correlate test results and analyze results in a systematic way, to better understand the analysis results, to identify important sources of noise in the system, and finally to have an optimal design of structures which are submerged in an acoustic fluid.

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Topic#: 93-003
Office: ONR2
Contract #: N00014-93-C-0276
PI: BAL K. JINDAL

ID#: 93N40-194

Title: Advanced Sensor Technology for Future Naval Warfare: A Two-color Infrared Sensor System

Abstract: Here we propose the development of a "Two-Color" Integrated Infrared Sensor that will have military applications in the areas of surveillance, target detection, acquisition and tracking, non-cooperative target recognition, missile guidance, thermal imaging, navigational aids, night vision, and sensor technology for counterstealth-aircraft, etc. It will have the unique capability of providing "Discriminatory Signature", which is the ability to discriminate between two types of targets or objects such as airplanes, for example distinguish a U.S. Airplane from a non-U.S. airplane. Xacton has already demonstrated a major breakthrough in the Infrared Sensor Technology by producing very high quality wafers and Detectors of Mercury Cadmium Telluride over a range of wavelengths. In this program, we will demonstrate an Integrated Two-Color Sensor, with one Sensor operating in the 3-5 micron range and the other in the 8-12 micron range.

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Topic#: 93-168
Office: ONR2
Contract #: N00014-93-C-0025
PI: Edwin D. Nesburg

ID#: 93N40-512

Title: Multimedia Technology Insertion Into Open Systems Architecture

Abstract: Advances in image digitization and compression techniques have fueled significant improvements in multimedia technology (MMT) for simulation and modeling, presentation, and training. Compact Disc-Interactive (CD-I) is an emerging technology which combines the power of real-time, multitasking computer functions and the high density storage capabilities of compact disc necessary for multimedia. With CD-I systems the user interacts with complex programs, manipulating sequences of audio, video, graphics, animation and motion video. Through the preparation of an engineering report and demonstration, this project will illustrate the feasibility of using CD-I as a platform for integrating multimedia in an open systems architecture philosophy. The investigation will take approximately four months.

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