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The Department of Defense

DoD DEPARTMENTS/AGENCIES:



Department of the Army



Department of the Navy



Department of the Air Force



Defense Advanced Research Projects Agency



Defense Nuclear Agency



Strategic Defense Initiative Organization

DEFENSE SMALL BUSINESS INNOVATION RESEARCH PROGRAM (SBIR)

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VOLUME III AIR FORCE ABSTRACTS OF PHASE I AWARDS 1991

NATIONAL SBIR CONFERENCES

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FY 1991 SBIR SOLICITATION
PHASE I AWARD ABSTRACTS
AIR FORCE PROJECTS
VOLUME III

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PREFACE

This report presents the technical abstracts of the Phase I proposals that resulted in contract awards from the Fiscal Year 1991 Solicitations of the Department of Defense (DoD) Small Business Innovation Research (SBIR) Program. The Army, Navy, Air Force, Defense Advanced Research Projects Agency (DARPA), Defense Nuclear Agency (DNA), and Strategic Defense Initiative Organization (SDIO) are the DoD components of the SBIR Program. Two solicitations inviting small business firms to submit proposals under this program were published in FY91. All six DoD components participated in Program Solicitation 91.1 (Closing Date: 11 January 1991), and Army, Navy, and DARPA participated in Program Solicitation 91.2 (Closing Date: 1 July 1991). The selection of proposals for funding was made from proposals received by the Military Services and Agencies.

FY 1991 SBIR PROGRAM

	<u>Number of Topics</u>		<u>Proposals Received</u>		<u>Phase I Awards</u>	
	<u>91.1</u>	<u>91.2</u>	<u>91.1</u>	<u>91.2</u>	<u>91.1</u>	<u>91.2</u>
Army	30	225	806	2033	60	219
Navy	290	77	2683	843	221	85
Air Force	202	-	2340	-	232	-
DARPA	83	160	838	1227	123	158
DNA	20	-	208	-	21	-
SDIO	15	-	632	-	128	-
Total	640	462	7507	4103	785	462
Grand Total		1102		11610		1247

Of the 1247 Phase I awards, 159 awards went to minority-owned businesses and 105 awards were to woman-owned businesses. Overall, 10.7 percent of the FY91 SBIR proposals were selected for funding.

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 DARPA, DNA and SDIO 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.

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 funded by setting aside 1.25 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, Defense Advanced Research Projects Agency (DARPA), Defense Nuclear Agency (DNA), and Strategic Defense Initiative Organization (SDIO).

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 from non-Federal sources 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 scientific/technical quality of the research proposal and its relevance to the topic description, with special emphasis on its innovation and originality.
- Qualifications of the principal investigator, other key staff, and consultants, if any, and the adequacy of available or obtainable instrumentation and facilities.
- Anticipated benefits of the research to the total DoD research and development effort.
- Adequacy of the Phase I proposed effort to show progress toward demonstrating the feasibility of the concept.

Public Law 99-443, the "Small Business Innovation Act of 1986" was signed by the President on October 6, 1986. This law re-authorized Public Law 97-219 (signed July 22, 1982) to extend the "Sunset Clause" to 1993; to continue 1.25 percent taxation of the extramural research and development budget; and excludes from taxation those amounts of the DoD research and development budget obligated solely for operational systems development.

AIR FORCE ABSTRACTS OF SBIR PHASE I AWARDS

ABARIS
125 CATRON DRIVE
RENO, NV 89512
Phone: (702) 348-6566

Topic#: 91-123
Office: WL/ML
Contract #: F33615-91C-5634
PI: William L. Murphy

ID#: 91WML-423

Title: Materials and Processes for Aerospace RTM

Abstract: The U.S. Air Force has an interest in high rate, low cost, production processes for aircraft parts. ABARIS proposes a combined analysis and testing project to explore modifying present Resin Transfer Molding (RTM) techniques to evaluate the feasibility of their use in the production of high performance, aerospace, composite materials. Epoxy resins shall be utilized in combination with graphite reinforcements in the form of thick (1/4 to 1/2 inches) high density preforms to fabricate laminates for test and evaluation. The development of low-cost fabrication processes for high-performance composites is of paramount importance in the economical use of composites in aerospace structures. Phase I tasks are to build two tools, from test panels of different thicknesses, and conduct structural tests, to explore the resulting performance. The objective is to develop and demonstrate injection processes to resin transfer molding of thick, high density, carbon fibers, filament wound preforms. Phase II objectives will be to scale up and optimize the resin injection process to achieve lower costs consistent with aerospace quality and to generate sufficient data to allow materials and process specifications to be written.

ADAPTIVE SENSORS, INC.
216 PICO BLVD, SUITE #8
SANTA MONICA, CA 90405
Phone: (213) 396-5997

Topic#: 91-087
Office: WL/AA
Contract #:
PI: DR HAROLD M. FINN

ID#: 91WAA-051

Title: X-BAND, AIR-TO-AIR RADAR SIDELobe CLUTTER MITIGATION THROUGH ADAPTIVE PROCESSING

Abstract: An adaptive array signal processor capable of adaptively nulling multiple sidelobe jammers and sidelobe distributed and discrete ground clutter returns competing with the target return, in AI-low observable target detecting medium-PRF radars is the subject of a design study. The ASI-developed airborne radar adaptive array simulation test bed (implemented in a PC-286 computer) is proposed to be used during the Phase I program for evaluation a number of candidate adaptive array signal processors by 'flying' the airborne radar incorporating each processor in the modeled jamming and ground clutter environment. The candidate configurations include space-time adaptive processors (STAP) effecting the sidelobe jammer nulling in a single processor; and also two-stage processors - motivated by dimensionality reduction goals-performing the multiple sidelobe jammer nulling function in a firststage sidelobe canceler configuration, and allocating the second stage for the sidelobe nulling function implemented with either a STAP or spatial-only processor adapting in Doppler filter space. The formidable design problem of avoiding the 'contaminating' sidelobe ground clutter in the first stage SLC is discussed. Performing both functions in a single STAP processor is noted to overcome this difficulty. Configurations involving both aperture and beam pace adaptation will be evaluated. Implementation considerations include the use of subbanding, and systolic arrays employing the Gramm-Schmidt orthogonalizing node.

ADAPTIVE TECHNOLOGY, INC.
309 CURTIS STREET
SYRACUSE, NY 13208
Phone: (315) 475-1121

Topic#: 91-087
Office: WL/AA
Contract #:
PI: DONALD R MIEDANER

ID#: 91WAA-089

Title: X-BAND, AIR-TO-AIR RADAR, SIDELobe CLUTTER MITIGATION THROUGH ADAPTIVE PROCESSING

Abstract: This proposal presents an approach for providing a sidelobe clutter suppression capability to the X-band, air-to-air, look-down radar operating in the Doppler ambiguous medium and low PRF modes using space/time techniques. In particular, advantage will be take of planned jammer cancellation capabilities in the form of an adaptive sidelobe cancellation (ASLC) system. The approach deals with the jammer/clutter integration problem by canceling both jamming and clutter signals at a common cancellation node. A key feature of the approach is constraining the space/time process by prefiltering the inputs, from the main and auxiliary channels, to the weight generation process, significantly enhancing clutter cancellation performance while suppressing interactions with mainlobe clutter. Another feature of the project is the use of a time-sample computer model, implemented on a high speed array processor in a Sun workstation environment, which will closely represent real hardware. Finally, the project will define a Phase II program which will develop an experimental X-band test bed for conducting laboratory and roof top test.

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ADELPHI TECHNOLOGY, INC.
285 HAMILTON AVE STE 430
PALO ALTO, CA 94301
Phone: (415) 328-7337

Topic#: 91-196 ID#: 91OSR-363
Office: APOSR
Contract #: F49620-91-C-0041
PI: MELVIN A. PIESTRUP

Title: A COHERENT X-RAY SOURCE USING TRANSITION RADIATION

Abstract: By designing transition radiators such that there is uniform foil thickness and spacing, the angle of emission can be reduced and the brightness of the x-ray source increased. Under this contract we will calculate the brightness of this source and compare it to synchrotron emitters. In addition we will investigate methods for reducing the electron beam energy required for the process to occur. Methods of narrowing the bandwidth of the source will be studied. These include antenna-array synthesis and photoabsorption edge truncation of the spectrum. The detrimental effects of electron scattering and higher mode proliferation will be also studied. The goal of this work is to establish the commercial feasibility of a compact, quasimonochromatic, collimated x-ray source using transition radiation and a moderate energy electron beam source.

ADROIT SYSTEMS, INC.
2970 PRESIDENTIAL DRIVE, SUITE 340
FAIRBORN, OH 45324
Phone: (513) 427-1220

Topic#: 91-080 ID#: 91ASD-694
Office: ASD
Contract #: F33657-91C-2148
PI: WILLIAM R. WILLIAMSON

Title: SYSTEMS ANALYSIS QUALITY METRICS

Abstract: This research will develop an extensive set of quality metrics for the evaluation of IDEF model quality, in particular, and for the evaluation of systems analysis model quality, in general. The research is the continuation of investigations already performed by the Principal Investigator, Mr. William R. Williamson, under internal company funding. The specific methodology, IDEF, was chosen for the research because of its direct applicability to Premilestone I planning. IDEF is the most widely used methodology within the DoD for concept definition and for requirements analysis and specification. The key product of this research is a set of quality metrics which goes far beyond editing considerations such as labeling, drafting and compliance with modeling rules. The metrics will evaluate model decomposition quality, precedence relationships, constraint vs flow conflicts, generic vs specific content, and model complexity. The research products will be specific and generic quality metrics, methodology formalization enhancements, identification of machine detectable quality factors, and training materials.

ADVANCED FUEL RESEARCH, INC.
PO BOX 380343
EAST HARTFORD, CT 06138
Phone: (203) 528-9806

Topic#: 91-096 ID#: 91WEL-021
Office: WL/EL
Contract #: F33615-91C-1735
PI: PHILIP W. MORRISON, JR

Title: PROCESS MONITORING AND CONTROL DURING PLASMA PROCESSING OF SEMICONDUCTORS

Abstract: Successful plasma processing and the elucidation of the unknown plasmachemistry require simultaneous knowledge of many process variables within the plasma reactor. These variables include 1) gas temperature and composition, 2) substrate temperature, and 3) film thickness, composition, and index of refraction. There are currently no techniques that can monitor more than one of these variables at a time. This proposal will apply Fourier Transform infrared (FT-IR) spectroscopy for process monitoring and control of plasma processing. FT-IR spectroscopy has the potential to monitor most of the above process variables simultaneously and in-situ. Good spatial resolution is also possible. Phase I will develop modifications of state-of-the-art FT-IR techniques and demonstrate their capabilities by establishing process control of a simple plasma reactor. A key feature of this proposal is the use of IR fiber optics to multiplex the FT-IR to many sensing points. In addition, AFR will hold technical discussions with representatives of the Microelectronics Manufacturing Science and Technology program (MMST). Phase II of this proposal will extend these new techniques to develop a rugged spectrometer for use on commercial reactors. Phase II will include a field test of the FT-IR monitor (preferably at MMST).

ADVANCED MATERIAL SYSTEMS, INC.
230 WEST HALL, SUITE 201
SLIDELL, LA 70460
Phone: (504) 649-5536

Topic#: 91-122 ID#: 91WML-022
Office: WL/ML
Contract #: F33615-91C-5630
PI: MATTHEW T. LIU

Title: Non Chromated Corrosion Inhibitors for Adhesive Bonding and Painting Processes

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Abstract: The use of toxic chemicals derived from metals such as strontium, calcium and lead as anti-corrosives in paint and adhesive bond primers for aluminum alloys is a well established technology. However, use of certain types of "Surface Active Agents" such as organo metallic complexes, quaternary chelating agents and guanidines and their derivatives for chemical anti-corrosion purposes has remained relatively unexplored. This paper discusses the feasibility of using such "Surface Active Agents" as corrosion inhibitors for use in paint and adhesive bond primers to protect aluminum and aluminum alloys. The paper also discusses the material property requirements, material selection criteria, coating system formulations and formulation processes; we will also discuss proof of concept testing, such as salt (fog) spray and humidity aging tests per standard ASTM (American Society of Testing Material) methods. Future research and development efforts as well as directions in optimizing the corrosion-inhibiting additive packages are suggested.

ADVANCED TECHNOLOGY MATERIALS, INC.
520-B DANBURY ROAD
NEW MILFORD, CT 06776
Phone: (203) 355-2681

Topic#: 91-118 ID#: 91WML-419
Office: WL/ML
Contract #: F33615-91C-5633
PI: Charles P. Beetz, Jr.

Title: Novel Process for the Bulk Growth of SiC Single Crystals

Abstract: The next generation of high power, high frequency electronic device technology will be based on wide bandgap semiconductor materials such as SiC, GaN and diamond. Of these, silicon carbide is the most promising material for near term applications, since its processing shares many common features with well-established silicon processing. Technology has been demonstrated for producing ohmic and Schottky contacts, shallow dopants are available for both p and n type materials, and p-n junctions are readily fabricated. A major deficiency that is presently limiting the acceptability of SiC as a serious material system for high temperature, high power electronic applications is the lack of a commercially available source of semiconductor grade SiC wafers. We propose a novel, commercially viable approach for the growth of bulk single crystal 6H-SiC ingots. The proposed technology development uses several innovative approaches to control the rate of sublimation of SiC from a solid source rod and to seed the crystal growth.

ADVANCED TECHNOLOGY MATERIALS, INC.
520-B DANBURY ROAD
NEW MILFORD, CT 6776
Phone: (203) 355-2681

Topic#: 91-192 ID#: 91OSR-357
Office: AFOSR
Contract #: F49620-91-C-0046
PI: PHILIP CHEN

Title: NOVEL MOLECULAR SOURCES FOR DISPERSING BORON IN CARBON-CARBON COMPOSITES

Abstract: Improving the oxidation resistance of carbon-carbon composites is key to expanding the use of this material system into higher temperature applications. While boron particles have been added to these materials to seal cracks in protective coatings, oxidation of the carbon matrix neighboring the boron particles seriously affects composite strength. This problem is exacerbated by a natural segregation of the boron particles to fiber rich areas of the composite. The Phase I program proposes the use of new carborane chemistry as a means of atomically dispersing boron throughout the matrix. Robust candidate molecules will be identified, synthesized, combined with phenolic resins for conversion into carbon test coupons for oxidation studies. Microanalytical techniques will be used to map the boron distribution in these samples for comparison to particulate derived samples. The Phase II effort will translate the results of Phase I into the manufacture of composites for cyclic oxidation studies.

AERODYNE RESEARCH, INC.
45 MANNING ROAD
BILLERICA, MA 01821
Phone: (508) 663-9500

Topic#: 91-088 ID#: 91WAA-274
Office: WL/AA
Contract #: F33615-91C-1759
PI: FRANK J. IANNARILLI, JR

Title: TARGET RECOGNITION USING SPECTRAL/SPATIAL TECHNIQUES

Abstract: The emergence of EO multispectral imaging technology motivates exploration of potential improvements in automatic target recognition (ATR) system performance using novel spectral/spatial techniques. Such concepts offer a promising combination of complementary techniques, with the spectral component reducing clutter ambiguity for spatial processing which sifts high-value targets from those of non-interest, e.g., tank from truck. The spectral/spatial algorithm concepts proposed by Aerodyne integrate and exploit model-predicted knowledge using Markov random fields to represent spatial dependencies of

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predicted target spectral attributes. Our conceived model-based spectral discrimination process, resistant to target occlusions (e.g., camouflage), produces a pre-classified scene. Ambiguities with in this processed scene are significantly reduced utilizing a dynamic process which exploits joint spectral and spatial contextual information, restoring weak and totally occluded target pixels. Finally pose and scale-invariant recognition is achieved using a model-based content-addressable memory. The resulting algorithmic structure is inherently parallel, promising computational feasibility via implementation on massively parallel neural networks. The phase I investigation will assess the extent of exploitable spectral differences between targets of interest and clutter. A survey of emerging multispectral imaging capability will be coupled with focused analysis and testing of key details of the concept algorithms to determine the feasibility of phase II algorithm implementation.

AERONAUTICAL TECHNOLOGY ASSOC.
920 LINDENCLIFF STREET
TORRANCE, CA 90502
Phone: (213) 530-4563

Topic#: 91-201 ID#: 91ASD-702
Office: ASD/NAF
Contract #:
PI: Rudolph J. Swigart

Title: DEVELOPMENT OF AN OPTICAL COMMUNICATIONS WINDOW FOR HYPERVELOCITY VEHICLES
Abstract:

ALPHATECH, INC.
50 MALL ROAD
BURLINGTON, MA 1803
Phone: (617) 273-3388

Topic#: 91-195 ID#: 91OSR-358
Office: AFOSR
Contract #: F49620-91-C-0047
PI: ROBERT TENNEY

Title: MULTI-RESOLUTION IMAGE FUSION

Abstract: Two significant trends in image processing technology offer revolutionary performance improvements for a variety of Air Force applications. One is the development of data fusion algorithms which operate directly on video data from a sensor, as opposed to conventional techniques which detect point targets and process estimates of their kinematic parameters. The second is the introduction of a whole new class of observed phenomena into wavelet transforms, which permit decomposition of observed phenomena into different physical scales. The computational leverage provided by multi-scale image processing techniques, when applied to multi-sensor image data, promises to increase the sensitivity and reliability of image processing systems in several applications. This proposal offers to evaluate the feasibility of marrying multiscale image processing techniques to multisensor image data. The product would be a software testbed which generates synthetic "ground truth" image data, extracts sensed data for sensors operating at different resolutions (e.g. corresponding to sidelooking radar and overhead infrared sensors), identifies model parameters necessary to process the data, and permits assessments of algorithm performance. Of necessity, the models used in the testbed will be notional, capturing key aspects of multiresolution sensing systems but omitting calibration to specific cases.

AMERICAN GNC CORP.
9131 MASON AVENUE
CHATSWORTH, CA 91311
Phone: (818) 407-0092

Topic#: 91-001 ID#: 91MNP-008
Office: WL/MNPB
Contract #:
PI: MR CHING-FANG LIN

Title: INTEGRATED ESTIMATION, GUIDANCE, AND CONTROL SYSTEMS DESIGN FOR BTT MISSILES

Abstract: This proposal responds to the technical needs of integrated estimation, guidance and control systems for advanced bank-to-turn (BTT) missile applications. Four technical innovations are anticipated: (1) an adaptive multimode sensor data fusion rule which optimizes acquisitions by accounting for individual sensor's characteristics and the varying environment conditions; (2) a maneuvering target tracker that blends multimode measurements and operates in a multitarget, multipath environment; (3) an advanced BTT guidance law which accommodates coupled dynamics; and (4) an integrated multimode sensor data fusion, estimation, guidance, control, and warhead fuzing system design which produces a robust synergism among various subsystems and improves target intercept capability immensely. A three phase research program is proposed for which the ultimate objective is to develop an integrated sensing, estimation, guidance and control engineering design and evaluation capabilities to support advanced BTT missile system engineering efforts. The deliverable for Phase I will be an integrated design methodology consisting of all relevant algorithms for the sensing, estimation, guidance and control of the advanced HAVE DASH II missile. In Phase II, the effectiveness of the design methodologies shall be demonstrated via a design and simulation effort on a generic

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HAVE DASH II missile model. Also in Phase II, the integration sensing, estimation, guidance and control design and evaluation capability will be developed. In Phase III, appropriate hardware together with the corresponding validated software shall be implemented so as to demonstrate the design capability.

AMHERST SYSTEMS, INC.
30 WILSON ROAD
BUFFALO, NY 14221
Phone: (716) 631-0181

Topic#: 91-081 ID#: 91ASD-743
Office: ASD
Contract #: F33657-91C-2173
PI: DR. CESAR BANDERS

Title: Advanced AI Techniques for Multiacuity ATR

Abstract: A fundamental problem in automatic target recognition (ATR) is the overwhelming amount of sensor data which must be processed. Many advanced ATR algorithms which reduce the false alarm rate cannot be executed in real time due to computational complexity. This limits overall system performance. In ATR, the features that must be resolved are localized within the field-of-view (FOV) of the sensor. Uniformly sampling within the FOV is thus inappropriate; regions with little or no relevance to the task are sampled at the same resolution as key features, occupying valuable signal bandwidth and computational resources, and increasing system latencies. A new class of machine vision systems, called foveal systems, is proposed for the automatic recognition of strategic targets. Foveal systems features imaging sensors and signal processing with graded acuity analogous to biological vision. Foveal systems operate much more efficiently because resolution is treated as a dynamically allocatable resource. The development and analysis of selected advanced foveal ATR techniques is proposed. The techniques include hierarchical knowledge representation and data structure/ multiprocessor design, advanced gaze control, and variable acuity feature extraction, including neural net based multiresolution classifiers. Overall system performance will be computed analytically and through simulations using actual imaging sensor data.

AMHERST SYSTEMS, INC.
30 WILSON ROAD
BUFFALO, NY 14221
Phone: (716) 631-0610

Topic#: 91-091 ID#: 91WAA-079
Office: WL/AA
Contract #: F33615-91C-1756
PI: EDWARD J. BIALEK

Title: RECONFIGURABLE, REAL-TIME, COHERENT RADAR SIMULATOR

Abstract: There currently exists only limited capabilities to measure the degree of performance degradation imposed on a board range of threat radar systems by friendly Electronic Warfare Countermeasure systems in a dynamic, realistic, and reconfigurable manner. The Amherst Systems Reconfigurable Radar Simulator will provide the ideal tradeoff between the dynamic, realistic, and reconfigurable simulation requirements by generating dynamic, real-world scenarios utilizing threat radar specifications and realistic returns. This simulator will emulate threat system transmit, receive, and signal processing capabilities, and will be quickly keyboard re-configured as new threat specification become available. Due to its' flexibility the Reconfigurable Radar simulator will give defense organizations the opportunity to easily test friendly indigenous, and experimental ECM equipment and techniques against coherent threat Radar systems with know, or estimated performance characteristics. The results of Phase I will be a Radar Simulator design, a software description for command and control, and a Radar Simulator development proposal. Potential payoffs are substantial in terms of improving ECM development capabilities and reducing development schedules and costs. Accomplishment of the Radar Simulator performance goals described in this proposal will represent a major technological advance in support tools for ECM system development.

ANALYSIS & COMPUTER SYSTEMS, INC.
209 BURLINGTON ROAD
BEDFORD, MA 01730
Phone: (617) 275-5800

Topic#: 91-025 ID#: 91ESD-562
Office: ESD
Contract #:
PI: JERRE B. GOODMON

Title: ANALYSIS/DESIGN OF DYNAMIC NETWORK MEMBERSHIP CONTROL SYSTEMS

Abstract: THIS PROPOSAL IDENTIFIES THE MANUAL INPUTS REQUIRED FOR THE AUTOMATIC TERMINAL INITIALIZATION (ATI) COMPUTER AID AND FORMULATES A PLAN TO REPLICATE THIS MANUAL PROCESS IN AN ARTIFICIAL-INTELLIGENCE BASED COMPUTER PROGRAM. IT WILL PROVIDE AUTONOMOUS GENERATION OF A DATA SET REQUIRED TO SUPPORT AUTOMATIC CONSTRUCTION OF A JTIDS CONNECTIVITY MATRIX. THE PROGRAM IS DESIGNED TO SUPPORT THE ENTRY OF NEW MEMBERS INTO AN

AIR FORCE ABSTRACTS OF SBIR PHASE I AWARDS

ESTABLISHED NETWORK WITH DEDICATED TIME SLOTS. IT WILL ALSO DETERMINE THE DISPOSITION OF VACATED TIME SLOTS FROM DEPARTING NET MEMBERS.

ANRO ENGINEERING, INC.
FIVE MILITIA DRIVE, SUITE 104
LEXINGTON, MA 02173
Phone: (813) 957-3080

Topic#: 91-180 ID#: 91BMO-976
Office: BMO/MYSP
Contract #:
PI: GERALD F. ROSS, PH.D.

Title: INTERCONTINENTAL BALLISTIC MISSILE (ICBM) BASING SECURITY TECHNIQUES
Abstract: IMPULSE RADAR HAS BEEN SHOWN TO BE VERY FLEXIBLE AND COST-EFFECTIVE FOR FIXED AND MOBILE SECURITY SURVEILLANCE. THE FIRST IMPULSE RADAR SECURITY SYSTEM INTRODUCED FOR MILITARY APPLICATIONS IS PORTABLE, LIGHT-WEIGHT, AND HAS A RANGE OF 300 FEET AGAINST A WALKING HUMAN TARGET. THIS CLASS OF SENSOR IS IDEAL FOR SINGLE ASSET OR LIMITED AREA PROTECTION. IT IS PROPOSED TO DEVELOP LONGER RANGE IMPULSE RADAR SYSTEMS THAT CAN EFFECTIVELY COVER LARGE STORAGE AREAS OR MULTIPLE ASSETS SUCH AS AIRCRAFT ON A RAMP. RECENT BREAKTHROUGHS IN HIGH VOLTAGE LOW-COST SOURCE TECHNIQUES HAVE MADE RANGES OF NEARLY ONE-HALF MILE AGAINST HUMAN TARGETS POSSIBLE. FURTHER IMPROVEMENTS IN RECEIVER TECHNOLOGY HAVE THE POTENTIAL TO FURTHER INCREASE THIS RANGE TO 1.6 MILES. PHASE I WILL INVESTIGATE THE TECHNICAL AND MISSION REQUIREMENTS FOR RANGE AND PERFORMANCE, PARTICULARLY IN THE AREAS OF VEGETATION PENETRATION AND CLASSIFICATION OF NUISANCE ALARMS. A BREADBOARD MODEL OF A FOUR ELEMENT TIME DELAY STEERED ARRAY CONSISTING OF 1 KV-100 PS AVALANCHE TRANSISTOR SOURCES WILL BE CONSTRUCTED AND FIELD TESTED. UNDER PHASE II A FEASIBILITY MODEL WILL BE BUILT TO TEST BOTH HARDWARE AND SOFTWARE FEATURES OF A FULLY UPGRADED STEERED TRANSMITTER ARRAY AND COHERENT PROCESSING RECEIVER. THE SUCCESSFUL DEVELOPMENT OF A LONGER RANGE IMPULSE RADAR SYSTEM WILL PROVIDE SUBSTANTIAL IMPROVEMENT IN MEETING THE REQUIREMENTS FOR FIXED AND MOBILE ICBM BASE SECURITY. THE LOW PROCUREMENT COST AND FALSE ALARM RATE, HIGH PROBABILITY OF DETECTION, AND RELIABILITY OF AN IMPULSE RADAR WHEN COMPARED TO COMPETING SENSORS ARE ESSENTIAL TO PRACTICALLY MEETING SECURITY NEEDS.

APA OPTICS, INC.
2950 NE 84TH LANE
BLAINE, MN 55434
Phone: (612) 784-4995

Topic#: 91-001 ID#: 91MNP-006
Office: WL/MNPB
Contract #:
PI: DR W. T. BOORD

Title: SOLID STATE LASER SCANNER FOR LASER ORDNANCE INITIATOR

Abstract: This proposal addresses the development of a solid state laser scanner for routing a high energy laser beam among the fiber optic energy transfer paths of a laser ordnance initiation system. A solid state laser scanner with no moving parts will enable a more compact and durable laser ordnance initiation system. APA Optics' solid state laser scanner utilizes integrated optic waveguides of AlGaAs and electro-optically activated Bragg transmission gratings. The Phase I program will address issues related to scaling the current 0.83 micron wavelength design and fabrication technology to that appropriate for 1.06 microns wavelength. The Phase I objectives will be to demonstrate low loss, electro-optic active waveguides for 1.06 microns; and to demonstrate laser damage resistant waveguides at the laser power levels required for laser ordnance initiators. In Phase II, a solid state laser scanned module will be developed for evaluation in a laser ordnance initiator test setup.

APPLIED ANALYSIS, INC.
45 MANNING ROAD
BILLERICA, MA 01821
Phone: (508) 663-6828

Topic#: 91-025 ID#: 91ESD-560
Office: ESD
Contract #:
PI: ROBERT L. HUGUENIN

Title: DETECTION AND IDENTIFICATION OF AIRCRAFT AND SHIPS USING AN AUTOMATED PROCESS

Abstract: APPLIED ANALYSIS INC. HAS DEVELOPED A NEW DATA PROCESSING TECHNOLOGY THAT WHEN USED IN CONJUNCTION WITH SENSORS CAN PROVIDE MUCH HIGHER TARGET ACQUISITION AND

AIR FORCE ABSTRACTS OF SBIR PHASE I AWARDS

IDENTIFICATION PERFORMANCE THAN CURRENT IMPLEMENTATIONS CAN ACHIEVE. IT SHOULD PROVIDE STRONGER DISCRIMINATION AGAINST CLUTTER, BASED ON ITS DEMONSTRATED STRONGER CLUTTER DISCRIMINATION CAPABILITY THAN THOSE OF PRIOR ART TECHNOLOGIES. THE DEMONSTRATED ROBUSTNESS AGAINST VARIATIONS IN BACKGROUND CONDITIONS MAY ALSO PROVE ESSENTIAL FOR HANDLING BATTLEFIELD AS WELL AS AREA SURVEILLANCE SCENARIOS.

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Topic#: 91-082 ID#: 91ASD-841
Office: ASD
Contract #: F33657-91C-2175
PI: DR ROBERT L. HUGUENIN

Title: DETECTION AND IDENTIFICATION OF TARGETS OF INTEREST USING AN AUTOMATED MULTISPECTRAL PROCESS

Abstract: Applied Analysis Inc. has developed a new data processing technology that when used in conjunction with multispectral sensors can provide much higher target acquisition and identification performance than current implementations can achieve. The characteristics and demonstrated performance of the Applied Analysis Spectral Process (AASAP) appear to be ideally suited for providing the level of object discrimination performance needed for signature extraction of targets of interest from multispectral imagery and then detecting and identifying multiple occurrences of the targets of interest. Targets of interest can range from natural phenomenology such as vegetation and geologic formations to man made phenomenology of any configuration. AASAP promises to provide higher levels of detection than other existing capabilities due to the ability to detect targets that are sub-pixel in size. It should provide stronger discrimination against clutter, based on its demonstrated stronger clutter discrimination capability than those of prior art technologies. The demonstrated robustness of AASAP against variations in background conditions may also prove essential for handling battlefields as well as area surveillance scenarios.

APPLIED MODERN TECHNOLOGIES CORP.
6232 MALAGA COURT
LONG BEACH, CA 90803
Phone: (213) 785-8896

Topic#: 91-067 ID#: 91ARM-503
Office: ARMSTR
Contract #:
PI: MR LARRY S. HORWITZ

Title: Ocular Vergence and Accommodation (OVA) Sensor for Helmet-Mounted Displays (HMD)

Abstract: Applied Modern Technologies Corporation (AMTech) has developed a method by which the eyes of person using a HMD can be tracked in angular displacement and characterized as to the visual accommodation with a single optical system (for each eye). AMTech proposes herein to build a breadboard, helmet-mounted optometer for laboratory proof-of-concept demonstration. The demonstration system will be configured using off-the-shelf components to minimize the risk due to hardware. Moire deflectometry will be used as the measurement phenomenology for both measurements. The inherent properties of this technology as developed by AMTech provides both ocular focal range and ocular angular position (i.e., vergence). The system construction is as simple as a near IR diode laser, collimator, IR beam splitter, IR/visible spectral combiner and a video camera. Though in typical moire metrology the processing of the moire pattern can be quite complex, in the OVA Sensor system even this task is minimized. This proposal describes moire deflectometry and derives the simple methodology by which the measurements are made. A 6 month schedule is proposed with intention to lead to a Phase II stage. AMTech also proposes potential technology transfer applications for the OVA Sensor.

APPLIED RESEARCH ASSOC., INC.
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ALBUQUERQUE, NM 87110
Phone: (505) 883-3636

Topic#: 91-001 ID#: 91MNP007
Office: WL/MNPB
Contract #:
PI: MR BARRY L. BINGHAM

Title: IMPACT CHARACTERIZATION FOR IMPROVED PENETRATOR PERFORMANCE AND SURVIVABILITY

Abstract: The central postulate of the proposed effort is that weapons will sense their impact conditions; i.e. trajectory angle, angle of attack (AOA), rotation velocity, and velocity in relation to the target surface. If those conditions are less than beneficial for penetrator survivability and/or performance, the weapon will adjust its orientation to prescribed conditions. Weapon designers have assumed that the optimum AOA is zero degrees and the optimum rotation is zero. These conditions may not be the most beneficial for non-normal trajectories. The objective of this Phase I effort is to determine the impact conditions (in

AIR FORCE ABSTRACTS OF SBIR PHASE I AWARDS

terms of AOA and off-axis weapon rotation velocity) for non-normal trajectories on a target surface that minimize weapon plastic deformation and/or maximize penetration performance. The levels gained in weapon performance and survivability will be determined in order to assist the Air Force in determining whether continued development in this area is worthwhile. The use of the idealized impact conditions will be applied against a modeled target to determine if those conditions reduce the actual number of weapons needed to kill a target.

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ALBUQUERQUE, NM 87110
Phone: (303) 980-8007

Topic#: 91-182 ID#: 91BMO994
Office: BMO/MYSP
Contract #:
PI: ROY J. HEYMAN

Title: AIR BLAST RESPONSE OF LOW DRAG SHAPE LAUNCHER VEHICLES

Abstract: THE PROPOSED RESEARCH ADDRESSES METHODS OF INCREASING THE BLAST HARDNESS OF MOBILE LAUNCH VEHICLES BY THE REDUCTION OF THE DRAG AND LIFT DURING THE DRAG PHASE OF BLAST LOADING. THE WORK WILL DEVELOP MOBILE LAUNCH VEHICLE SECTION PROFILES WHICH REDUCE THE DRAG AND LIFT COEFFICIENTS WITHOUT INCREASING THE DIFFRACTION PHASE BLAST LOADS. THE PROFILES WILL BE DEVELOPED BASED ON EXISTING KNOWLEDGE GLEANED FROM A LARGE DATA BASE OF SHOCK TUBE, FIELD TEST, AND WIND TUNNEL TEST DATA AS WELL AS THEORETICAL ANALYSIS. PROVEN BLAST LOADING CODES AND BLAST RESPONSE CODES WILL BE EMPLOYED TO CALCULATE THE BLAST RESPONSE OF THE DEVELOPED SECTION PROFILES THROUGH AN OVERPRESSURE RANGE EXTENDING TO 150 PSI. MOST EXISTING LAUNCH VEHICLE SHOCK TUBE AND FIELD TEST DATA WAS OBTAINED AT OVERPRESSURE LEVELS LESS THAN 100 PSI. THIS DATA WILL BE USED TO VALIDATE THE BLAST LOADING AND RESPONSE CODES. LOADS AND RESPONSES FOR THE NEWLY DEVELOPED PROFILES WILL BE CALCULATED THROUGH BOTH THE OVERPRESSURE RANGES OF THE TEST DATA AS WELL AS THE HIGH OVERPRESSURES. COMPARISONS OF THE RESULTS WITH THE EXISTING DATA BASE WILL ENSURE THE RATIONALITY OF THE RESULTS. INCREASING THE BLAST HARDNESS OF MOBILE LAUNCH VEHICLES WILL LEAD DIRECTLY TO HIGHER LAUNCH VEHICLE SURVIVAL RATES AND A DECREASE IN THE REQUIRED DEPLOYMENT AREA. FEWER VEHICLES, COUPLED WITH SMALLER DEPLOYMENT AREAS, WILL RESULT IN A SUBSTANTIALLY REDUCED SYSTEM COST. COMMERCIAL APPLICATION IS MORE REMOTE; THE RESULTS COULD LEAD TO VAN AND TRACTOR-TRAILER DESIGNS WITH LESS SIDE LOAD SENSITIVITY AND REDUCED FORWARD DRAG.

APPLIED TECHNOLOGY ENTERPRISES, LTD.
11722 INDIAN RIDGE ROAD
RESTON, VA 22091
Phone: (703) 620-1784

Topic#: 91-074 ID#: 91ASD-589
Office: ASD
Contract #:
PI: Dr. Frederick Rothwarf

Title: High Performance Iron-Based Rare Earth Permanent Magnet Materials

Abstract: This proposal addresses the problem of synthesizing and developing new permanent magnet materials for use at temperatures greater than 300 oC. The recent synthesis of a new compound, $SM_2Fe_{17}N_3-y$, with a strong uniaxial anisotropy, a large spontaneous magnetization, a potential energy product, of about 60 MGOe, and a Curie temperature, T_c , of 476 oC suggests the possibility of achieving cost-effective, high performance materials needed to satisfy the requirements of a variety of military and commercial devices. Substitution of other elements for iron can produce a T_c over 725 oC and offers the opportunity for producing magnets for use at temperatures greater than 300 oC. Some applications include traveling wave tubes, motors and generators that must operate at elevated temperatures. A brief background discussion compares the new material with other rare earth materials that have been developed in the last two decades. A program is proposed for using particular substituents to enhance both the Curie temperatures of these new nitrided $SmFe$ -based materials. Emphasis is given to developing processing procedures for consolidating the materials into fully dense permanent magnet structures that will have remanences corresponding to their saturation magnetization.

AIR FORCE ABSTRACTS OF SBIR PHASE I AWARDS

AQUIDNECK MANAGEMENT ASSOC., LTD.
28 JACOME WAY
MIDDLETOWN, RI 02840
Phone: (401) 849-8900

Topic#: 91-048 ID#: 91ROM-105
Office: ROMELAB
Contract #: F30602-91-C-0070
PI: SCOTT BATES

Title: CAD STATION RM ON-LINE SUPPORT SYSTEM

Abstract: THIS PROJECT OUTLINES A RELIABILITY AND MAINTAINABILITY KNOWLEDGE BASE AND THE HYPERTEXT INTERFACE REQUIRED TO TRANSPORT THIS DATA INTO COMPUTER-AIDED DESIGN (CAD) ENVIRONMENTS. THE PRIMARY FOCUS OF THE PROPOSAL IS THE DEVELOPMENT OF THE FOUNDATION FOR AN ENGINEERING RELIABILITY AND MAINTAINABILITY INFORMATION PRESENTATION SYSTEM TO SUPPORT ELECTRONIC CIRCUIT AND SYSTEMS DESIGN ENGINEERS IN A CAD WORKSTATION ENVIRONMENT. AQUIDNECK MANAGEMENT ASSOCIATES, LTD. WILL EXAMINE DESIGN-LEVEL RELIABILITY/MAINTAINABILITY PRESENTATION SYSTEM INTO CURRENT CAD ENVIRONMENTS. A HYPERMEDIA INFORMATION SYSTEM IS PROPOSED BECAUSE HAYPERMEDIA ENVIRONMENT PROVIDES A STRUCTURE FOR THE DIRECT LINKING OF MASSIVE AMOUNTS OF REFERENCE DOCUMENTATION SUCH AS TRADITIONAL PAPER-BASED DOCUMENTS, DRAWINGS, AND RELATIONAL DATABASES INTO A SINGLE PRESENTATION STATION. THE CONCEPT OF HYPERMEDIA IS PRESENTED AS WELL AS INTERMEDIATE, STAND-ALONE DESIGN RELIABILITY INFORMATION BASE THAT IS EASILY ACCESSIBLE, USER-FRIENDLY, AND SUPPORTIVE TO THE CAD DESIGNER. THE DEVELOPMENT OF AN INTERMEDIATE, STAND-ALONE DESIGN RELIABILITY HYPERMEDIA INFORMATION SYSTEM IS THEN DISCUSSED IN DETAIL.

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Topic#: 91-001 ID#: 91MNP008
Office: WL/MNPB
Contract #:
PI: MR OLIN K. MCDANIEL, III

Title: SLAPPER DETONATOR FLYER VELOCIMETRY BY MICROPHOTOGRAPHY WITH A MULTIFRAME KERR CELL AND CRANZ-SCHARDIN CAMERA

Abstract: Critical to all Exploding Foil Initiator or "Slapper" Systems is the bridge-barrel-flyer combination, which needs to be optimized for each application and fire set. The best way to do this is with optical diagnostics. Parameters desired are the flyer position, shape, and velocity versus time as a function of charge voltage and discharge current. Multiframe microphotography of a flyer moving down a barrel is one solution but poses several problems, one of which is the insufficient depth of field of the optics system. If most of the "infinite" diameter barrel length is removed and the flyer is viewed from the side, then its axis of movement will remain in focus, displacement versus time will be recorded, and its shape inferred. Bridge burst may also be photographed to guarantee against shorting and attain maximum performance. After a review of the principles of Kerr cells, two multiframe Kerr cell cameras will be described. Using a nitrogen laser pumped dye system as backlight, the Kerr cameras may photograph nonluminescent objects. Minus the Kerr cells, the multiframe optics and laser may be used in a Cranz-Shardin mode. A development scene is put forward with proof of principle experiments.

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Topic#: 91-051 ID#: 91CES-138
Office: AFCESA
Contract #:
PI: THOMAS R. MCKNIGHT

Title: POSITIONING SYSTEM FOR MOBILE ROBOTS

Abstract:

ATN MICROWAVE, INC.
11 EXECUTIVE PARK DRIVE
BILLERICA, MA 01821
Phone: (508) 667-4200

Topic#: 91-100 ID#: 91WEL-026
Office: WL/EL
Contract #: F33615-91C-1745
PI: CHARLES WOODIN

Title: LOW INSERTION - LOSS MILLIMETER-WAVE PROBES FOR ON WAFER, NOISE PARAMETER, MEASUREMENT ACCURACY

AIR FORCE ABSTRACTS OF SBIR PHASE I AWARDS

Abstract: The development of a low loss wafer probe is essential to improve the accuracy of on-wafer millimeter wave noise parameter and S-parameter measurements. The loss of the probe directly limits the performance of the millimeter wave tuner and post receiver, degrading system accuracy. During Phase I of the SBIR, an investigation of air dielectric, coaxial probes will be performed resulting in the design, fabrication and test of a pair of prototype probes. The results will be compared to those of low loss probes using coplanar substrate technology. Technical areas to investigate include impedance tapering, mode suppression, alignment concepts to improve contact repeatability, and prototype fabrication techniques. The definition of accurate methods for probe evaluation will also be addressed.

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Topic#: 91-099 **ID#:** 91WEL-047
Office: WL/EL
Contract #: F33615-91C-1740
PI: DR I.C. CHANG

Title: MULTIPLEXING FOR FIBER-OPTIC SENSORS

Abstract: Fiber optic sensors have been developed for a variety of industry monitoring and control applications. Fully realization of the potential capability of the fiber optic intensity sensors, however, require innovative approaches to practical implementing methods to multiplexing the intensity sensors into fiber optic data networks. A novel wavelength division multiplexing technique on a unique device, the acoustic-optic tunable filter (ACTF), is described in this proposal. Phase I effort of the proposal program includes a system analysis and experimental investigation of the proposed technique to determine the practical limits of accuracy, repeatability and multiplexing capability of the fiber optic sensors.

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Phone: (518) 877-7270

Topic#: 91-124 **ID#:** 91WML-424
Office: WL/ML
Contract #: F33615-91C-5642
PI: David M. Cross

Title: Tools for Simulation of Crystal Growth via Cellular Automata

Abstract: There are many difficulties related to the use of computer simulations for solving scientific problems. One of the greatest barriers is the requirement for specialized knowledge about both the scientific problem and the computing machinery that is brought to bear on the problem, especially when non-traditional machinery is involved. Recently, a new class of computers have evolved for scientific simulations. These computers, known as "cellular automata machines" (CAMs) are not yet widely available, but have shown extremely encouraging results for a small number of problems. Though the architecture of these machines seems to make them ideal for a large class of problems in materials simulations, the lack of wide-spread availability of these machines has made it difficult to access their utility in addressing these, and more general scientific problems. This proposal addresses the problem of making these machines accessible for materials simulations. The approach is to design easy-to-use software for a limited class of materials simulations on a commercially available CAM. The software will be designed to accommodate more general materials simulations problems and newer CAMs presently under construction.

AVOCA LABORATORIES
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ITHACA, NY 14850
Phone: (607) 255-1467

Topic#: 91-141 **ID#:** 91WXN-674
Office: WL/XN
Contract #:
PI: ROBERT A. YORK

Title: 60 GHZ IMPATT POWER AMPLIFIER

Abstract: THE OUTPUT POWER OF SEMICONDUCTOR BASED MILLIMETER-WAVE AMPLIFIERS ARE LIMITED BY THE POWER-HANDLING CAPABILITIES OF THE INDIVIDUAL DEVICES USED. TO OVERCOME THESE PROBLEMS COMBINING TECHNIQUES ARE USED TO DISTRIBUTE THE POWER LOAD. WE ARE PROPOSING A FUNDAMENTALLY NEW COMBINING APPROACH USING A QUASI-OPTICAL PLANAR 2-D ARRAY OF INTEGRATED IMPATT AMPLIFIERS. IN THE ARRAY, IMPATTS ARE INTEGRATED DIRECTLY INTO PATCH ANTENNAS. INPUT AND OUTPUT SIGNALS ARE COUPLED INTO AND OUT OF THE PATCH VIA FREE SPACE. THIS APPROACH HAS THE POTENTIAL FOR VERY HIGH EFFICIENCIES AND CAN BE SCALED TO LARGE NUMBERS OF DEVICES. AVOCA LABORATORIES IS UNIQUELY QUALIFIED TO INVESTIGATE THIS SCHEME,

AIR FORCE ABSTRACTS OF SBIR PHASE I AWARDS

HAVING TWO KEY PERSONNEL WHO HAVE DONE PIONEERING WORK IN DEMONSTRATING THESE ARRAYS. THE MAIN BENEFIT OF THIS APPROACH IS THAT THE RF IMPATT AMPLIFIERS CAN BE FABRICATED MONOLITHICALLY IN GAAS OR SILICON. THIS COULD SIGNIFICANTLY REDUCE THE COST AND WEIGHT, THEREBY ALLOWING A WIDE RANGE OF NEW COMMUNICATION AND RADAR APPLICATIONS AT MILLIMETER-WAVELENGTHS.

AVOGADRO ENERGY SYSTEMS, INC.
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STATEN ISLAND, NY 10301
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Topic#: 91-150 ID#: 91PAC-752
Office: PL/OLAC
Contract #:
PI: CHARLES POWELL

Title: EVALUATION OF THE PLASMA FOCUS AS A THRUSTER WITH NEUTRON-LEAN FUSION REACTIONS
Abstract: AN EXTENSIVE EVALUATION OF A PLASMA THRUSTER FOR SPACE PROPULSION IS PROPOSED IN THE LIGHT OF NEW RECENT DEVELOPMENTS. THE PLASMA FOCUS WITH A MATHER'S GEOMETRY IN ITS MOST ADVANCED FORM, APF, HAS FIELD DISTORTION ELEMENTS IN THE INTER-ELECTRODE GAP FOR INCREASING THE FUSION REACTION YIELD BY A FACTOR 5-10 AND HAS EXPERIMENTALLY DEMONSTRATED THE CAPABILITY OF PRODUCING A SUBSTANTIAL REACTION YIELD FROM FUSION REACTIONS OF HIGH-Z NUCLEI IN THE PLASMA PINCH. FURTHER IMPROVEMENTS AND DEVELOPMENTS OF PLASMA FOCUS RESEARCH WILL BE BENEFICIAL FOR COMMERCIAL APPLICATION OF PLASMA FOCUS MACHINES SUCH AS, AMONG OTHER APPLICATIONS, NEUTRON RADIOGRAPHY (SLOW AND FAST NEUTRONS FOR THICK OBJECTS RADIOGRAPHY), X-RAY LITHOGRAPHY, SHORT-LIFE ISOTOPE PRODUCTION FOR MEDICAL APPLICATIONS. THE PROPOSED PROJECT APPEARS TO HAVE POTENTIAL USE BY THE FEDERAL GOVERNMENT FOR ALL THE REASONS STATED ABOVE AND/OR AS PLASMA THRUSTER WITH FUSION REACTIONS.

AXIOM CORP.
1485 CHAIN BRIDGE ROAD, SUITE 105
MCLEAN, VA 22101
Phone: (703) 556-0200

Topic#: 91-082 ID#: 91ASD-569
Office: ASD
Contract #: F33657-91C-2165
PI: Cass G Panciocco

Title: Future System Concepts and Related, Innovative, Analysis Tools

Abstract: PROJECT OBJECTIVES: The primary objective of this proposed effort is to develop an analytical model for cost estimating of emerging technologies. Given the forecasted resource constraints, this cost estimating tool will assist in early evaluation of design approaches focused on solving mission goals and assisting in program start decision making. APPROACH: AXIOM will develop updated approaches while utilizing existing activities which as, cost estimating for the single stage to orbit (SSTO), program to develop this approach. This Phase I proposed effort will develop a sample model from a select emerging technology. The sample model technology chosen will be agreed upon mutually by AXIOM and the Air Force program sensor. AXIOM will develop a data collection plan model and CER development plan, then develop the actual model. The model will be tested by using an existing technology with available cost data and reviewing the results. PROJECT RESULTS: The phase I effort will deliver a tested analytical tool to assist in planning. Next AXIOM will develop a phase II plan which takes the proven concept to a full-scale life-cycle cost modeling approach.

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Topic#: 91-001 ID#: 91MNP012
Office: WL/MNPB
Contract #:
PI: DR KHOSROW BAKHTAR

Title: DEVELOPMENT OF SAFETY CRITERIA FOR EXPLOSIVE STORAGE STRUCTURES

Abstract: An innovative and cost-effective approach is presented for development of explosive safety (Quantity-Distance) criteria for shallow tunnels. The approach proposes to formulate and validate the Scaling Laws for Q-D incorporating properties of explosives, as well as the physical and mechanical characteristics of engineering systems, i.e. concrete, steel reinforcing elements, etc.; and geologic systems, i.e. soil and rock mass hosting the structures. The formulated scaling laws are then validated through a series of large-scale tests. The design of test specimens are based on scaling length, time, and force (mass) such that similitude conditions are maintained between the model and actual structure to facilitate the ease of interpolation of

AIR FORCE ABSTRACTS OF SBIR PHASE I AWARDS

the obtained results to predict prototype response. Most of the effort in Phase I is concentrated towards engineering analysis of one-g scale model, identification of pertinent parameters for formulating the scaling laws and planning the test matrix for concept validation. The proposed research investigation provides a powerful approach for developing explosive safety criteria and a unique and cost-effective approach for concept validation.

BARRETT TECHNOLOGY, INC.
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CAMBRIDGE, MA 02138
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Topic#: 91-070 ID#: 91ARM-458
Office: ARMSTR
Contract #:
PI: DR WILLIAM T. TOWNSEND

Title: Design of a High-Performance Miniature (Knuckle-sized) Joint Drive for Exoskeleton Hand Teleoperators
Abstract: The proposed project is to extend to teleoperator exoskeleton masters newly invented joint-drive transmission technology, recently patented by MIT specifically for use with high-performance robots and teleoperators. Combined with new fiber materials, these cabled transmissions/speed-reducers are key to implementing inherently stable bilateral force control while enhancing both dynamic range and bandwidth of force control. Miniaturization of these devices is needed to implement them in the smaller joints of robotic hands and exoskeleton hand masters. The proposed effort is to develop a baseline based on design concepts for miniaturization. The concepts will be evaluated through simple experiments, analysis, and discussions with other experts in the field. The most promising concept will be selected for more extensive experiments in Phase II. Phase II will result in a prototype on-degree-of-freedom master-to-slave teleoperator system implemented in full bilateral force control.

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Phone: (718) 338-3311

Topic#: 91-132 ID#: 91WFO-428
Office: WL/PO
Contract #: F33615-91C-2129
PI: Michael R. Beltran

Title: Particle Bed Nuclear Reactor Technology for Future Air Force Air-Breathing Propulsion Systems
Abstract: It is here proposed to evaluate particle bed nuclear reactor technology for use in future Air Force air-breathing propulsion systems. Since air-breathing chemical propulsion is limited in the amount of energy and thrust it can produce, and since vehicle concepts are reaching the end of that limit, it is becoming necessary to investigate other possibilities, such as nuclear propulsion systems. Nuclear fuels provide approximately one million times the energy per unit weight of chemical fuels; thus, vast increases in performance are possible for air-breathing propulsion systems. Systems which will be evaluated include: the nuclear turbojet, the nuclear turboprop, and the nuclear ramjet.

BIO-IMAGING RESEARCH, INC.
425 BARCLAY BOULEVARD
LINCOLNSHIRE, IL 60069
Phone: (708) 634-6425

Topic#: 91-155 ID#: 91PAC-791
Office: PL/OLAC
Contract #:
PI: E. ANNE SIVERS, PH.D.

Title: REAL TIME IMAGING OF ROCKET MOTORS DURING LIVE FIRE
Abstract: THE PRIMARY EFFORT OF THIS PROGRAM DEVELOPS AN INSTRUMENT THAT WILL ALLOW INTERNAL IMAGING OF ROCKET MOTORS AND NOZZLES DURING LIVE STATIC FIRES. THIS INSTRUMENT WILL PRODUCE VOXEL-BY-VOXEL X-RAY DATA SO THAT A THREE-DIMENSIONAL IMAGE OF THE ROCKET CAN BE MADE IN REAL-TIME DURING FIRING. THE PRINCIPLE OF OPERATION, FLASH LAMINOGRAPHY, COMBINES TWO IDEAS: (1) SIMULTANEOUSLY-STROBED X-RAY SOURCES TO PRODUCE SHARP PICTURES ON A BLUR SCALE CONSISTENT WITH FINE SPATIAL RESOLUTION DURING THE BURN, AND (2) TOMOSYNTHESIS, A RECONSTRUCTIVE TECHNIQUE INTERMEDIATE TO THE PRINCIPLES USED IN COMPUTED TOMOGRAPHY (CT) AND CONVENTIONAL FILM LAMINOGRAPHY. FLASH LAMINOGRAPHY (FL) IS DISTINGUISHED FROM EITHER TECHNIQUE, HOWEVER, IN THAT IT OFFERS THE POTENTIAL FOR VIEWING TOMOGRAPHIC IMAGES OF ANY PLANE OR SURFACE OF THE TEST SPECIMEN IN REAL-TIME, INCLUDING A LONGITUDINAL CROSS-SECTION CONTAINING THE ROCKET'S AXIS OF SYMMETRY. THUS, ROCKETS AND COMPONENTS CAN BE EXAMINED DURING STATIC FIRE. AS A PERIPHERAL EFFORT, THE PROPOSAL ALSO PERFORMS A PRELIMINARY INVESTIGATION OF A PURELY ELECTRONIC IMAGING TECHNIQUE THAT PROMISES EXTREMELY FAST, LOW RESOLUTION, TOMOGRAPHIC IMAGES OF LIVE, EXTRATERRESTRIAL FIRES. THE

AIR FORCE ABSTRACTS OF SBIR PHASE I AWARDS

PHASE I PROGRAM EMPHASIZES AN EXPERIMENTAL DEMONSTRATION OF PROOF-OF-PRINCIPLE OF THE PRIMARY EFFORT AND SETS THE STAGE FOR A PHASE II FEASIBILITY/CAPABILITY EXPERIMENT. THE PHASE I PROGRAM WILL ALSO DETERMINE AN EXPERIMENTAL CONFIGURATION FOR THE ALTERNATIVE, EXTRATERRESTRIAL SYSTEM. BOTH OF THESE NEAR REAL-TIME TECHNIQUES COULD BE APPLIED TO NONINVASIVE CARDIAC EXAMINATION. THE FLASH LAMINOGRAPHY SYSTEM IS CAPABLE OF PROVIDING HIGH RESOLUTION, 3-D, FREEZE-FRAME, REAL-TIME HEART STOPPING ON 5 MSEC BLUR WITH 30 MSEC CENTERS. THE ELECTRONIC TECHNIQUE IS POTENTIALLY EVEN FASTER, BUT WITH LOWER RESOLUTION. ANY INDUSTRIAL PROCESS INVOLVING FLUID FLOW WITH SUSPENSIONS OR PARTICULATES IS A CANDIDATE FOR THESE METHODS. THE CAPABILITY FOR NEAR REAL-TIME IMAGING HOLDS POTENTIAL FOR NEW METHODS OF INDUSTRIAL PROCESS CONTROL.

BIO-TECHNICAL RESOURCES
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Topic#: 91-112 ID#: 91WML-412
Office: WL/ML
Contract #: F33615-91C-5636
PI:

Title: Biological Production of 4-Hydroxybenzocyclobutene

Abstract: Application of biotechnology to the production of 4-hydroxybenzocyclobutene will allow bulk manufacture of this polymer precursor by more economical means than is currently available. Development of such a process would allow industrial applications of BCB-based polymer materials.

BIODYNAMIC RESEARCH CORP.
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Topic#: 91-069 ID#: 91ARM-539
Office: ARMSTR
Contract #:
PI: DR JAMES H. RADDIN, JR.

Title: Adapting the ADAM Manikin Technology for Injury Probability Assessment

Abstract: The opportunity exists to extend the capabilities of the USAF Advanced Dynamic Anthropomorphic Manikin (ADAM) which has been developed to assess the influence of human responses on ejection seat performance. The more realistic articulations and vertical spinal response of ADAM can be supplemented with additional instrumentation to allow the definition of injury probability assessment criteria. Since criteria cannot be defined for all conceivable injuries, the proposed effort will select operationally significant injuries for assessment based on a review of USAF ejection injury experience and pertinent literature. Additional instrumentation requirements will be defined, with planned use of humerus and femur strain gauges or load cell inserts to avoid the necessity of measuring torques at major joints. Injury probability assessment criteria will be proposed for the selected injuries based on compilations and analysis of literature data and experience with criteria for mathematical models and other anthropomorphic test devices. Where possible, criteria will be defined in the form of probability functions using viscoelastic displacement or displacement-velocity functions rather than simple peak force thresholds. An example of this approach would be implementation of a "Mechanical Dynamic Response Index" for the spine. An outline of a realistic validation testing approach will also be constructed.

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Phone: (216) 368-3628
Title: MOLECULAR ELECTRONIC DEVICES
Abstract:

Topic#: 91-202 ID#: 91ASD-703
Office: ASD/NAF
Contract #:
PI: BARNEY SIMIC-GLAVASKI

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900 CORPORATE DRIVE
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Topic#: 91-025 ID#: 91ESD-567
Office: ESD
Contract #:
PI: JOSEPH KADIN

AIR FORCE ABSTRACTS OF SBIR PHASE I AWARDS

Title: THE SYNAPSISTEM TESTING AND EVALUATION

Abstract: BROADCOM PROPOSES TO TEST AND EVALUATE THE SYNAPSISTEM, A UNIQUE MILLI-METER WAVE COMMUNICATION SYSTEM WHICH WILL POTENTIALLY PROVIDE AUTOMATIC ACQUISITION AND HIGHLY DIRECTIONAL MOBILE AND/OR QUICK ERECT COMMUNICATIONS.

BURKE TECHNOLOGIES, INC.
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Topic#: 91-169 ID#: 91PXP-880
Office: PL/XPPP
Contract #:
PI: JOHN M. BURKE

Title: RELATIVISTIC MULTIWAVE CERENKOV GENERATOR DESIGN STUDY

Abstract: THESE DEVICES HAVE OBVIOUS APPLICATIONS FOR TACTICAL HPM. SHORTER-WAY MODERATE-POWER SOURCE ALSO HAVE A NUMBER OF DEFENSE APPLICATIONS, SUCH AS RADAR AND SPACE COMMUNICATION. A CONVENIENT, TUNABLE SOURCE AT THE SHORTER-WAVELENGTH END OF THE MILLIMETER-INFRARED REGION OF THE SPECTRUM HAS A BROAD RANGE OF APPLICATIONS IN BASIC RESEARCH AND APPLIED TECHNOLOGY. 9116908 ONEWAY OF IMPROVING THE OUTPUT POWER CAPABILITIES OF ULTRA-HIGH-POWER MICROWAVE RADIATION SOURCES IS THROUGH THE USE OF HIGHLY OVERMODDED RESONANT STRUCTURES. EXPERIMENTS PERFORMED IN THE SOVIET UNION ON THE RELATIVISTIC MULTIWAVE CERENKOV GENERATOR (MWCG) HAVE DEMONSTRATED OUTPUT POWER OF >10 GW AT FREQUENCIES OF 10 GHZ WITH CONVERSION EFFICIENCIES CLOSE TO 50%. WE PROPOSE TO THEORETICALLY MODEL THE BEAM-WAVE INTERACTION IN THE MWCG USING WEAKLY-IRREGULAR WAVEGUIDE THEORY. THIS WILL PRODUCE A NONLINEAR SELF-CONSISTENT FIELD MULTIMODE THEORY OF THE DEVICE. THE THEORY WILL BE EVALUATED NUMERICALLY ASSUMING ONLY ONE MODE IS PRESENT IN THE INTERACTION REGION. WE WILL THEN USE THE THEORY TO AID IN THE DESIGN A HIGHLY OVERMODDED MWCG EXPERIMENT TO BE PERFORMED IN PHASE II. A SUCCESSFUL DEVELOPMENT OF THE MWCG WOULD PRODUCE AN ULTRA-HIGH POWER CENTIMETER OR MILLIMETER WAVELENGTH RADIATION SOURCE. MWCG'S COULD BE DEVELOPED FOR ADVANCED DIRECTED ENERGY WEAPONS AND FOR SYSTEMS VULNERABILITY ASSESSMENT. THE MWCG COULD ALSO BE USED COMMERCIALY AS A SOURCE FOR HIGH POWER RADAR APPLICATIONS AND AS A POWER SOURCE IN ADVANCED ACCELERATOR DESIGNS.

CASCADE MICROTECH, INC.
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Topic#: 91-100 ID#: 91WEL-051
Office: WL/EL
Contract #: F33615-91C-1744
PI: ED GODSHALK

Title: LOW-LOSS MICROWAVE PROBES FOR NOISE PARAMETER MEASUREMENTS

Abstract: Noise parameter measurements of microwave transistors and MMICs are best performed with on-wafer, probe systems. Two key parameters of these systems is the loss from the input tuner to the device under test (DUT), and from the DUT to the receiver; this is typically dominated by the wafer probe. This phase I work will demonstrate a wafer probe prototype with significantly lower loss than currently available, while maintaining low return loss and high accuracy.

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Topic#: 91-139 ID#: 91WFO-006
Office: WL/PO
Contract #: F33615-91C-2122
PI: W. N. LAWLESS

Title: THERMAL STABILIZATION OF CERAMIC SUPERCONDUCTORS FOR AEROSPACE PULSED POWER

Abstract: A Ph I research program is proposed to develop baseline thermal data for dielectric materials in the range 20 to 77k for thermal-management applications with the new high temperature ceramic superconductors. These ceramic superconductors are being considered for a 1 MW Air Force generator. Candidate dielectric materials will be selected from previous programs on the enthalpy stabilization of the A15 superconductors and from the physics literature. Thermal conductivity data will be measured on these candidate materials, 20-77 k, and a compendium of thermal conductivity data will be compiled. Specific heat (20-77 k), thermal expansion (20-300 k), and dielectric properties (20-77 k) will be measured on selected samples having large

AIR FORCE ABSTRACTS OF SBIR PHASE I AWARDS

thermal conductivities. A minor effort will be devoted to reviewing the thermal and electrical properties of a cryovaristor for possible quench-protection applications in the 20-77 k temperature range. The anticipated benefit of the proposed research will be to establish a database of measured thermal properties, 20-77 k, on practical dielectric materials for use in the thermal management of wire-like structures of the new ceramic superconductors (e.g., tapes of the BiCaSrCu-oxide superconductor). A secondary benefit will be the review of the properties of a cryovaristor for potential quench-protection applications in the 20-77 k temperature range.

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Topic#: 91-131 ID#: 91WFO-432
Office: WL/PO
Contract #: F33615-91C-2128
PI: Mr Clifford E. Smith

Title: Innovative Fuel Injector/Flameholder Concept for Ramburners

Abstract: Recent studies of turboramjet propulsion systems have identified the need of advanced, in-stream fuel injection/flameholder schemes for ramburners. This project proposes to develop a new, close-coupled fuel injector/flameholder concept whose distinguishing characteristic is a corrugated flameholder surface. As compared to a conventional Integral Fuel Injector/Flameholder (IFF) concept, the new concept will have the following advantages: 1. Enhanced mixing/chemical efficiency due to increased axial vorticity; 2. Lower pressure loss due to reduced flameholder base blockage; 3. Wider blowout fuel/air limits due to dual-size injection orifices; and 4. Suppression of combustion instability due to variable flameholder width. In Phase I, both conventional and advanced concepts will be numerically analyzed using a validated, 3D body-fitted coordinate CFD code. Turbulent, gaseous combustion simulations will be used to assess and show the feasibility of the advanced concept. In order to gain confidence in the simulations, the IFF calculations will first be validated against recent experimental data from United Technologies Research Center. In Phase II, after parametric CFD studies for optimization, the advanced concept will be designed, fabricated and tested in a ramburner component test rig at United Technologies Chemical Systems Division or suitable test vendor. If successfully demonstrated, the advanced concept will be tested and evaluated in a turboramjet engine demonstrator in Phase III.

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Topic#: 91-189 ID#: 91OSR-311
Office: APOSR
Contract #: F49620-91-C-0042
PI: H. Q. YANG

Title: PRESSURE-BASED HIGH ORDER TVD METHODOLOGY FOR DYNAMIC STALL CONTROL

Abstract: The quantitative prediction of the dynamics of separating unsteady flows, such as dynamic stall, is of crucial importance. This study proposes several new methodologies of solving 3-D Navier-Stokes equations with pressure-based algorithm in both stationary and moving (body-fixed) coordinates. The proposed pressure-based algorithm is equally efficient for low speed incompressible and high speed compressible flows, and applicable to the laminar and turbulent flows. The convective term discretization by high-order TVD scheme to be developed requires no artificial dissipation, and can properly resolve the concentration tip vortices with minimum numerical diffusion. Proposed Newton's iteration technique not only can increase the convergence rate but also can strongly couple the interaction between pressure and velocities. The novel hyperbolization of pressure equation can significantly increase solver's efficiency. The proposed methodologies will be implemented by adapting an existing advanced CFD code, REFLEQS. In Phase I study, the modified code will be demonstrated by simulating dynamic stall on an oscillating three-dimensional wing-body configuration in subsonic flow regime. Further development and validation will be carried out in the Phase II.

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Topic#: 91-067 ID#: 91ARM-405
Office: ARMSTR
Contract #:
PI: DR GREG L. ZACHARIAS

Title: Passive Sensor Altitude and Terrain Awareness System

Abstract: The primary objective of the Phase I study is to evaluate the feasibility of developing a passive optical sensor altitude and terrain awareness system (ATAS). The basic technique proposed for study makes use of the optical flow-field present in

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all passively-imaged dynamic scenes, to develop evolving and autonomous estimates of relative time/range to all points in the imager field-of-view. The proposed architecture consists of a passive imaging sensor driving a flow-field computer, which generates measurements for a state/time estimator and down-stream terrain modeler. A virtual image helmet-mounted display provides the pilot with computed terrain-relative altitude, and an image of the local topography. We plan an initial application of ATAS to terrain-following flight and propose a Phase I feasibility assessment comprised of four tasks. We will: 1) define the overall system architecture for ATAS; 2) develop a simulation of both the external environment and the proposed system; 3) simulate overall operation, conduct performance trades, and specify sensor, signal processing, and computational requirements; and 4) define requirements for Phase II development and evaluation of a working prototype.

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Topic#: 91-138 ID#: 91WFO-460
Office: WL/PO
Contract #: F33615-91C-2123
PI: Dr K. L. Gopikanth

Title: Lithium-Composite Halide High Power Battery

Abstract: A phase I program to develop high density lithium-composite halide battery is being proposed. This system uses highly conductive inorganic electrolyte, lithium anode, and composite halide cathode, system not only has high potential, and can also deliver high current for burst/pulse applications. Use of composite halide improves the system energy density, storage life and cycle life characteristics. Phase I will explore and optimize the halide composite. Phase II will be to scale-up, and build prototype units for characterization and evaluation, and developing applications.

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Topic#: 91-126 ID#: 91WML-425
Office: WL/ML
Contract #: F33615-91C-5724
PI: Mike Flower

Title: Concurrent Engineering

Abstract: A concurrent engineering methodology for the design of electronic products, processes and the product life-cycle, is needed. Concurrent engineering is the simultaneous, interactive, cross disciplinary involvement of design, manufacturing and field support engineering that assures design performance, process support responsiveness, and life-cycle reliability of products and processes. Key to concurrent engineering is the front-end involvement of these cross-disciplinary functions to effect improved quality, reduced cost and abbreviated design to in-service cycle time. Successful application of concurrent engineering to electronic products and processes necessitates development of appropriate engineering methods that allow the interaction of constraints from the various disciplines as well as information structures and design decision support techniques that facilitate integration. In this Phase I proposal CIM Systems, Inc. addresses the application requirements and goals for a proof of concept concurrent engineering approach. This includes identification of the attributes that describe the function, size and behavior of the components involved in electronic product design. The final result will be a system capable of sharing complex design and manufacturing information needed in the concurrent design process.

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Topic#: 91-023 ID#: 91AED-029
Office: AEDC
Contract #: F40600-91-C0013
PI: CLIFF GUNSALLUS

Title: DYNAMIC STRESS ANALYSIS FOR PROJECTILES

Abstract:

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Topic#: 91-032 ID#: 91ROM-012
Office: ROMELAB
Contract #: F30602-91-C-0072
PI: RICHARD I. KITTREDGE

Title: TEXT GENERATION TECHNOLOGY FOR ADVANCED SOFTWARE ENGINEERING ENVIRONMENTS

AIR FORCE ABSTRACTS OF SBIR PHASE I AWARDS

Abstract: ADVANCED SOFTWARE ENGINEERING ENVIRONMENTS (SEEs) REQUIRE POWERFUL INTERFACES WHICH CAN REPORT ON THE STATUS OF SOFTWARE PROJECTS, AND HELP DOCUMENT THE SOFTWARE ITSELF THROUGHOUT ITS LIFE CYCLE. THIS PROJECT AIMS TO CAPITALIZE ON RECENT ADVANCES IN NATURAL LANGUAGE GENERATION TO BENEFIT SUCH INTERFACES, ALLOWING PROGRESS TEXTUAL REPORTS TO BE PREPARED AUTOMATICALLY IN ENGLISH FROM SEE DATABASES. IN PARTICULAR, PHASE II IS ORIENTED TOWARD INTRODUCING AUTOMATIC PRODUCTION OF PROJECT MANAGEMENT REPORTS INTO THE SOFTWARE LIFE CYCLE SUPPORT ENVIRONMENT (SLCSE). AFTER ANALYSIS OF PROJECT MANAGEMENT SUPPORT IN SLCSE, A CONCEPT DEMO PROTOTYPE WILL BE DEFINED AND IMPLEMENTED. THIS WILL SHOW THE FEASIBILITY OF PLANNING AND PRODUCING TEXTUAL PROGRESS REPORTS, WITH OR WITHOUT ACCOMPANYING TABLES AND GRAPHS, FOR VARIOUS TYPES OF SEE USERS. EXPERIMENTS WITH THE DEMO PROTOTYPE WILL HELP DETERMINE OPTIMAL IMPLEMENTATION PLAN FOR BUILDING A LANGUAGE GENERATION FACILITY INTO SLCSE DURING PHASE II. THROUGHOUT THE COURSE OF THE WORK, EXTENSIONS AND ADAPTATIONS OF THE APPROACH WILL BE CONSIDERED TO OTHER POSSIBLE REPORTING FUNCTIONS WITHIN SLCSE, INCLUDING THE PLANNED GENERATION OF PARTS OF SOFTWARE DOCUMENTATION.

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Topic#: 91-195 ID#: 91OSR-330
Office: AFOSR
Contract #: F49620-91-C-0036
PI: LEONID RUBIN

Title: A REAL TIME SYSTEM FOR MULTI-SENSOR IMAGE ANALYSIS THROUGH PYRAMIDAL SEGMENTATION

Abstract: Volumetric interpretation of multi-spectral sensor data as well as other image analysis tasks invariably involve a segmentation preprocessing step. The aim of this proposal is to implement a fast (real-time) and universal segmentation algorithm for multi-sensor and multiscale image data. The properties of this algorithm are the following. It is multiscale and pyramidal. In other words, it will not only compute one segmentation, but a hierarchy of segmentations from fine to coarse scales. The coarser segmentation will be deduced from the finer one by "merging" operations, giving thus a pyramidal structure to the computations. Moreover within each scale, various sensors data is integrated "fused". As a consequence of this pyramidal structure, the algorithm will be $O(N)$ - a linear time algorithm (on a sequential computer), that is, the computational time will be exactly proportional to the size of the datum or $(\log N)$ in concurrent implementation. The algorithm is universal, it does not depend on any a priori knowledge about image statistics. The algorithm is well-posed and converges to the proper solution.

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Topic#: 91-127 ID#: 91WML-427
Office: WL/ML
Contract #: F33615-91C-5628
PI: Maurice J. Brau

Title: Ultra-High-Purity Starting Materials for Infrared (IR) Detector Crystal Growth.

Abstract: Current IR focal plane arrays require detector material that is near-intrinsic in carrier concentration, of a low dislocation density, and, most importantly, free of precipitates and impurity clusters. Although higher purity starting materials are required to achieve near-intrinsic carrier concentrations, non-electrically active impurities such as iron, chromium, silicon, nickel, manganese and others can have a profound negative effect on final device performance. This program exploits a novel technique for removing many impurities, including oxygen, from II-VI starting materials. A distillation/zone refining technique is not sufficient to produce the quality of starting material needed for second generation focal plane arrays. An electro-migration process followed by distillation through an oxygen gettering media is exploited as a method of achieving higher purity materials.

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Topic#: 91-030 ID#: 91ESD-667
Office: ESD
Contract #:
PI: JAMES A. CRAWFORD

Title: ADVANCED MANPACK RADIO CONCEPT FOR UHF DAMA SATELLITE COMMUNICATIONS

Abstract: A NEW ADVANCED MANPACK RADIO CONCEPT FOR UHF DAMA SATELLITE COMMUNICATIONS IS

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PROPOSED FOR DATA AND VOICE COMMUNICATIONS. THE PROPOSED RADIO CONCEPT UTILIZES A NEW MULTI-CHANNEL DAMA APPROACH IN ORDER TO ACHIEVE INTER-SERVICE SATELLITE RESOURCE SHARING ON A PRIORITY BASIS AND INCREASED USER CONNECTIVITY WHILE MAINTAINING INTEROPERABILITY WITH EXISTING DAMA SYSTEMS SUCH AS USTS AND MINIDAMA.

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Topic#: 91-120 ID#: 91WML-421
Office: WL/ML
Contract #: F33615-91C-5627
PI: Randy Simon

Title: Infrared Detection By BKB Thin Films

Abstract: The discovery of a multitude of superconducting oxide materials has opened up new possibilities for developing infrared detectors. There has already been a considerable amount of effort expended on studying the detection properties of YBa₂Cu₃O₇ (YBCO) films. The best results on YBCO have come from studies on bolometers. However, some of the most intriguing results obtained from superconducting thin film detectors have come from studies of granular materials such as NbN/BN composites and BaPb_{1-x}Bi_xO₃ (BPB) films which can lead to non-bolometric detectors. The recent discovery of the 30 K perovskite superconductor Ba_{1-x}K_xBi₃O₃ (BKB) offers an opportunity to exploit the advantages of granular superconducting detectors at unprecedented high temperatures. Observations of non-bolometric (quantum) detection by granular superconducting films opens up the possibility of detectors that are both fast and sensitive. This program seeks to investigate the optical detection properties of BKB films and identify the correlations between physical properties of the films and their optical performance.

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Topic#: 91-061 ID#: 91ARM-520
Office: ARMSTR
Contract #:
PI: DR P. KELLY WATSON

Title: Application of Artificial Intelligence Technologies to Training Systems: Computer Based Diagnostic Testing System

Abstract: Using an existing Intelligent Tutoring System (ITS), project members will create the specifications for a student model that can be used to design an adaptive testing system. This testing system will be able to identify or diagnose student errors by analyzing the student's performance using several different factors. The project will also investigate the potential for developing a task generation subsystem that can generate problems to be used to test students or demonstrate/exemplify portions of the curriculum. The task generator would interface with the ITS' domain expert to "test" the problem against the expert capability of the system to determine the problem's suitability for students. Performance of this project will require a review of the psychometric issues related to diagnostic testing to ensure the inclusion of important testing features and capabilities.

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Topic#: 91-136 ID#: 91WFO-024
Office: WL/PO
Contract #: F33615-91C-2124
PI: DR VICTOR R. KOCH

Title: ULTRA HIGH CYCLE LIFE RECHARGEABLE ALUMINUM BATTERIES EMPLOYING INSERTION CATHODES

Abstract: The Air Force has a need for high performance, light weight, rechargeable power sources for a variety of space power applications including low earth orbit platforms. Our ongoing efforts in non-aqueous rechargeable battery R&D suggested that the intrinsically safe, highly efficient Al electrode may be coupled with a high voltage insertion cathode in an AlCl₃-based molten salt electrolyte. During Phase I we will synthesize and evaluate two rechargeable high energy density cathode materials in cells affording practical energy densities of 100 Wh/kg.

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Topic#: 91-059 ID#: 91ARM-481
Office: ARMSTR
Contract #:
PI: MR WALTER L. SWIFT

Title: Closed Loop Bleed Air Driven Cycle for On-Board Oxygen Generating Systems

AIR FORCE ABSTRACTS OF SBIR PHASE I AWARDS

Abstract: This project addresses the need for efficient and effective supply of oxygen on board combat and transport aircraft. The proposed effort specifically involves the development of a closed loop bleed air driven cycle for a hybrid oxygen system for on-board oxygen generation and storage. A closed loop cycle has the advantage over open-loop cycles of reducing or eliminating moisture, CO₂ and other contaminant buildup in the process heat exchanger and other cold components. In Phase I, the preliminary design of the cycle and individual components will be established. The key issues to be addressed include the cycle performance and the robustness of the gas bearing system in the turbo-compressor over the range of anticipated operation.

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Topic#: 91-119 ID#: 91WML-420
Office: WL/ML
Contract #: F33615-91C-5645
PI: G.M. Loiacono

Title: "CORRELATION OF OH CONTENT, IONIC CONDUCTIVITY, OPTICAL ABSORPTION AND GREY TRACKS IN KTP CRYSTALS"

Abstract: The inter-relationship of hydroxyl (OH-) content in KTP with the ionic conductivity, optical absorption at (400-500nm) and the onset of "grey track" formation will be determined. Measurements will be made on crystals grown by the hydrothermal, and high temperature solution methods. The effects of electric fields and thermal annealing treatments on OH-content will be evaluated. Correlations between these parameters could result in improved processing procedures which will result in KTP of significantly improved properties.

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Topic#: 91-037 ID#: 91ROM-002
Office: ROMELAB
Contract #: F30602-91-C-0148
PI: CHANDRA P. KHATTAK

Title: PRODUCTION OF SUBSTRATES FOR SUPERCONDUCTING THIN FILMS

Abstract: THIN FILMS BASED ON YBa₂Cu₃O₇ (YBCO) HAVE SHOWN POTENTIAL FOR SUPERCONDUCTING DEVICES; HOWEVER, THESE DEVICES ARE LIMITED IN PERFORMANCE BY THE AVAILABILITY OF SUITABLE SUBSTRATES. BEST RESULTS HAVE BEEN OBTAINED WITH PEROVSKITE SUBSTRATES, LaAlO₃ AND LaGaO₃; HOWEVER THEIR PHASE TRANSITIONS PRESENT PROBLEMS. THE IDEAL SUBSTRATES MUST MEET STRINGENT CRYSTALLOGRAPHIC, ELECTRICAL, MAGNETIC AND DIELECTRIC PROPERTIES. BASED ON AVAILABLE DATA LaSrAlO₄ AND La_{0.33}NbO₃ COMPOUNDS HAVE BEEN PROPOSED FOR SUBSTRATE APPLICATIONS. THESE MATERIALS ARE CURRENTLY NOT AVAILABLE. DURING THE PROPOSED PROGRAM SYNTHESIS OF LaSrAlO₄ AND La_{0.33}NbO₃ WILL BE INVESTIGATED IN DETAIL. IT IS INTENDED TO UTILIZE THE HEAT EXCHANGER METHOD (HEM) FOR DIRECTIONAL SOLIDIFICATION. THE MELTING AND SOLIDIFICATION BEHAVIOR, REACTIVITY WITH CRUCIBLE, AND HEAT TRANSFER PARAMETERS WILL BE DIED TO ESTABLISH VIABILITY FOR GROWTH OF LARGE SINGLE CRYSTALS. SAMPLES WILL BE EVALUATED FOR SUITABILITY OF THESE MATERIALS FOR SUBSTRATES FOR THIN FILM SUPERCONDUCTING DEVICES.

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Topic#: 91-137 ID#: 91WFO863
Office: WL/PO
Contract #: F33615-91C-2125
PI: Dr J. Michael Pinneo

Title: Aluminum/Beryllium/Diamond Composites for Aircraft Power Components

Abstract: The overall objective of this research is to determine the feasibility and performance of aluminum-matrix composites reinforced by diamond or diamond/beryllium elements for aircraft power components. It is expected that selected samples will exhibit tensile strength, thermal coefficient of expansion (TCE), and Young's modulus superior to that of any existing traditional metal or aluminum-based metal-matrix composite (MMC) system. Phase I focuses on manufacturing and characterizing a range of Al/D and Al/Be/D mixtures produced by one of several possible fabrication processes. Established MMC models will direct the production of test samples. Structural, performance, and fabrication tests will be performed to measure composite sample properties and establish its potential for a variety of airborne applications. Depending upon project results, a Phase II program will be proposed to optimize MMC chemistry and processing for more extensive evaluation of the material and its possible uses.

AIR FORCE ABSTRACTS OF SBIR PHASE I AWARDS

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Topic#: 91-025 ID#: 91ROM-122
Office: ROMELABS
Contract #: F30602-91-C-0118
PI: MICHAEL P. WHALEN

Title: COMMAND, CONTROL, AND COMMUNICATIONS (C3) SYSTEMS/SUBSYSTEMS
Abstract: HIGH SPEED TARGET TRACKING IS A CRUCIAL COMPONENT IS ADVANCED MILITARY AND CIVILIAN SURVEILLANCE SYSTEMS. THESE NEXT GENERATION SYSTEMS MUST BE CAPABLE OF ACCURATELY TRACKING MULTIPLE TARGETS MANEUVERING IN LARGER SURVEILLANCE AREAS. THIS IS A COMPLICATED PROBLEM DUE TO THE SENSITIVITY AND BANDWIDTH OF MODERN SENSORS, EFFECTIVE TARGET COUNTERMEASURES (E.G. SMALLER RADAR CROSS SECTION FIGHTERS). LOW POWER AND/OR APERTURE OF FIGHTER-BASED SYSTEMS, ETC. TO ACCOMPLISH THEIR GOALS, NEXT GENERATION SYSTEMS MUST TAKE ADVANTAGE OF RECENT ADVANCES IN COMPUTING PERFORMANCE IN ORDER TO IMPLEMENT MORE COMPUTATIONALLY COMPLEX ALGORITHMS. THIS PROPOSAL DESCRIBES AN EFFORT TO DEVELOP A COST EFFECTIVE, TRANSPUTER BASED, MULTIPLE TARGET AIR SURVEILLANCE TRACKING SYSTEM. THE PHASE I EFFORT WILL CONSIST OF ASSEMBLING THE ACTUAL HARDWARE TESTBED, CONSTRUCTING THE DESIGN ON A SINGLE TRANSPUTER SYSTEM AND DEMONSTRATION WHICH IMPLEMENTS A SIMPLE TARGET TRACKING ALGORITHM IN OCCAM2 WILL BE DEVELOPED DURING PHASE 1 AND IS USED TO ILLUSTRATE HOW HIGH-SPEED TRACKING IS POSSIBLE. A TRADEOFF ANALYSIS WILL ALSO BE CONDUCTED DURING PHASE I TO DETERMINE HOW SUCH FACTORS AS ALGORITHM COMPLEXITY; INPUT SENSOR QUANTITY AND BANDWIDTH; PARALLEL IMPLEMENTATIONS; MAXIMUM NUMBER OF TARGETS TRACKED; TRANSPUTER LOAD BALANCING, ETC. INFLUENCE TRACKING PERFORMANCE.

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Topic#: 91-051 ID#: 91CES-131
Office: AFCESA
Contract #:
PI: CHARLES J. JACOBUS, PH.D

Title: A HIGH ACCURACY ABSOLUTE NAVIGATIONAL SYSTEM FOR RAPID RUNWAY REPAIRERS
Abstract: NAVIGATION OF FIELD MOBILE ROBOTIC SYSTEMS REQUIRES A MEANS FOR THE ROBOTIC SYSTEM TO DETERMINE ITS ABSOLUTE LOCATION. THE USUAL MEANS IS TO USE A VEHICLE INERTIAL GUIDANCE SYSTEM WHICH IS PERIODICALLY UPDATED BY A GPS OR LORAN C RECEIVER. UNFORTUNATELY, GPS AND LORAN CAN ONLY PROVIDE ABSOLUTE POSITIONAL ACCURACY TO WITHIN 5 METERS OR SO WHICH LIMITS THE COMBINED INS/GPS/LORAN SYSTEM TO ABOUT THE SAME. ALSO, GPS AND LORAN C CAN BE JAMMED OR INTERFERED WITH BY LARGE CONDUCTIVE STRUCTURES (LIKE AIRCRAFT, BUILDINGS, OR REINFORCING STRUCTURES). IN THIS EFFORT WE PROPOSE TO DEVELOP AN ALTERNATIVE NAVIGATIONAL METHOD WHICH USES A COMBINATION OF DOWN-LOOKING GROUND TRACKING AND VERY INFREQUENTLY MOUNTED TARGETS TO PROVIDE RF FREE HIGHLY ACCURATE MOBILE SYSTEMS LOCATION DETERMINATION CAPABILITY.

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Topic#: 91-157 ID#: 91PAA-804
Office: PL/OLAA
Contract #: F19628-91-C-0097
PI: RANDALL W. ZYWICKI

Title: DOPPLER IMAGING PHOTOMETER
Abstract: A GROUND-BASED DOPPLER IMAGING PHOTOMETER CAN PROVIDE WIND IMAGES IN THE LOWER THERMOSPHERE. SUCH IMAGES PROVIDE INFORMATION ON THE COUPLING BETWEEN THE IONOSPHERE AND THE THERMOSPHERE. THE OBJECTIVE OF THE PHASE I RESEARCH IS TO DETERMINE THE FEASIBILITY OF DEVELOPING A DOPPLER IMAGING PHOTOMETER CAPABLE OF MEASURING UPPER ATMOSPHERE WIND VELOCITIES BY SENSING THE DOPPLER SHIFT OF ATMOSPHERIC EMISSIONS. THE CRITICAL CONCEPT THAT WILL BE INVESTIGATED WILL BE THE USE OF A FABRY-PEROT ETALON IN AN IMAGING SYSTEM. NEW INNOVATIVE CONCEPTS FOR DIVIDING THE IMAGE INTO DISCRETE PORTIONS SO A SINGLE ETALON MAY BE USED TO IMAGE MULTIPLE PIXELS AND NEW OPTICAL TECHNOLOGY TO OBTAIN VERY HIGH SENSITIVITY

AIR FORCE ABSTRACTS OF SBIR PHASE I AWARDS

ARE PROPOSED. THE KEY TO THE FEASIBILITY OF THIS INSTRUMENT IS TO PROVE THESE CONCEPTS. BOTH OPTICAL ANALYSIS AND EXPERIMENTAL BREADBOARD TESTS ARE PROPOSED TO VERIFY THAT THESE INNOVATIONS WILL PRODUCE A WORKABLE INSTRUMENT. DESIGN GOALS AREA: 50 RAYLEIGH SENSITIVITY, 10 KM/SEC FREE SPECTRAL RANGE, 630 NM AND 732 NM WAVELENGTH IMAGING, ALL-SKY COVERAGE, 5-MINUTE INTEGRATION TIME, NEAR REAL-TIME PROCESSING AND PORTABILITY. THE PROPOSED CONCEPT IS AN INNOVATIVE COMBINATION OF MULTIPixel IMAGING AND FABRY-PEROT INTERFEROMETRY. THE PHASE I RESEARCH WILL VERIFY FEASIBILITY AND PRODUCE A PRELIMINARY DESIGN FOR A PHASE II PROTOTYPE DEVELOPMENT. A DOPPLER IMAGING PHOTOMETER OF THE PROPOSED DESIGN CAN BE USED TO INSTRUMENT IONOSPHERIC DRIFT NETWORK STATIONS SPONSORED BY NSF. A DOPPLER IMAGER CAN ALSO BE OF USE IN ROCKET ENGINE AND HIGH MACH NUMBER WIND TUNNEL TESTS IN GOVERNMENT AND CIVILIAN TEST PROGRAMS.

DATA SECURITY, INC.
58 WILSON ROAD
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Phone: (617) 275-8231

Topic#: 91-025 ID#: 91ESD-618
Office: ESD
Contract #:
PI: HILARY H. HOSMER

Title: THE MULTIPOLICY MACHINE: A NEW PARADIGM FOR MULTILEVEL SECURE COMPUTER SYSTEMS
Abstract: THE MULTIPOLICY MACHINE IS A PARADIGM SHIFT IN MULTILEVEL SECURE (MLS) COMPUTER ARCHITECTURE. IT PERMITS AN MLS SYSTEM TO ENFORCE MULTIPLE, PERHAPS CONTRADICTIONARY SECURITY POLICIES. IN THE MULTIPOLICY MACHINE CONCEPT, EACH MLS COMPUTER NODE IS CAPABLE OF ENFORCING A VARIETY OF SECURITY POLICIES, AND DATA CARRIES POLICY DOMAIN CODES TO INDICATE WHICH SECURITY POLICIES APPLY. THUS, DATA CAN BE TRANSFERRED FROM ONE NODE TO ANOTHER AND STILL BE PROTECTED BY THE APPROPRIATE SECURITY POLICIES. METAPOLICIES COORDINATE THE INTERACTIONS OF SECURITY POLICIES.

DEACON RESEARCH, INC.
2440 EMBARCADERO WAY
PALO ALTO, CA 94303
Phone: (415) 493-6100

Topic#: 91-020 ID#: 91AED-002
Office: AEDC
Contract #: F40600-91-C0006
PI: ANTHONY O'KEEFE

Title: LASER REMOTE SENSOR FOR HYPERSONIC ENGINE INLET TESTING
Abstract:

DEFENSE GROUP, INC.
606 WILSHIRE BLVD., SUITE 706
SANTA MONICA, CA 90401
Phone: (213) 394-8599

Topic#: 91-026 ID#: 91ESD-636
Office: ESD
Contract #:
PI: MORGAN GROVER

Title: INNOVATIVE APPROACH FOR TRANSPORTABLE VLF/LF ANTENNAS
Abstract: THIS PROPOSAL DESCRIBES AN INNOVATIVE TECHNICAL APPROACH FOR DEVELOPING TRANSPORTABLE AND RAPIDLY DEPLOYABLE VLF/LF ANTENNAS, CAPABLE OF SUPPORTING THE FULL RANGE OF 616-A OPERATING MODES. OUR BASIC DESIGN CONCEPT INVOLVES THE USE OF FAST-WAVE TECHNIQUES, IN WHICH SERIES CAPACITORS ARE USED TO DRAMATICALLY INCREASE THE RADIATING EFFICIENCY OF SIMPLE, ON SURFACE WIRE ANTENNAS; OTHER DETAILED DESIGN OPTIMIZATION TECHNIQUES ARE ALSO INCLUDED. THE FAST-WAVE APPROACH DEPLOYMENT (AND RECOVERY) IN TWO HOURS OR LESS AT VIRTUALLY ANY SITE BY A TWO - TO THREE-MAN CREW.

DIGITAL INSTRUMENTS, INC.
6780 CORTONA DRIVE
SANTA BARBARA, CA 93117
Phone: (805) 968-8116

Topic#: 91-040 ID#: 91ROM-059
Office: ROMELAB
Contract #: F19628-91-C-0159
PI: VIRGIL ELINGS

AIR FORCE ABSTRACTS OF SBIR PHASE I AWARDS

Title: SCANNING TUNNELING MICROSCOPY FOR ADVANCED DEVICE PROCESSING

Abstract: SCANNING PROBE MICROSCOPES HAVE BECOME COMMON INSTRUMENTS FOR THE IMAGING OF SURFACE FEATURES WITH VERY HIGH RESOLUTION. THE FUNDAMENTAL CHARACTERISTICS OF SCANNING PROBE MICROSCOPES INCLUDE THE CAPABILITY TO POSITION A VERY SHARP PROBE WITH ULTRA-HIGH RESOLUTION IN THREE DIMENSIONS. THIS CAPABILITY HAS STIMULATED INTEREST IN EXTENDING SCANNING PROBE TECHNOLOGY TO THE CONSTRUCTION OF VERY SMALL STRUCTURES. THE GOAL OF THIS PROJECT IS TO FURTHER DEVELOP EXISTING TECHNIQUES TO USE A SCANNING TUNNELING MICROSCOPE (STM) TO MARK OR SCRIBE A SURFACE, SPECIFICALLY AS APPLIED TO THE LITHOGRAPHY PROCESS IN THE MANUFACTURE OF SEMICONDUCTOR DEVICES. AS THE MANUFACTURER OF THE LEADING COMMERCIAL SCANNING PROBE MICROSCOPE, THE NANOSCOPE, DIGITAL INSTRUMENTS HAS NATURALLY ALREADY HAD CONSIDERABLE INVOLVEMENT WITH STM LITHOGRAPHY. OUR CUSTOMERS INCLUDE HUNDREDS OF ACADEMIC, INDUSTRIAL, AND GOVERNMENT RESEARCHERS, MANY OF WHOM ARE INTERESTED IN USING THEIR INSTRUMENTS TO SCRIBE SURFACES. BECAUSE OF THE INTEREST, SOME LITHOGRAPHY CAPABILITY HAS ALREADY BEEN DEVELOPED AND PROVIDED TO OUR USERS. FROM THE EXPERIENCE THAT HAS BEEN GAINED WITH THE LITHOGRAPHY FUNCTIONS CURRENTLY AVAILABLE TO NANOSCOPE USERS, WE ARE IN AN EXCELLENT POSITION TO EVALUATE WHICH TECHNIQUES ARE SUCCESSFUL AND WHICH AREAS NEED FURTHER WORK. IN THIS PROJECT WE WILL USE THIS EXPERIENCE TO DEFINE THE TECHNICAL REQUIREMENTS FOR A SYSTEM TO CREATE PATTERNS IN SILICON IN THE 100 NANOMETER AND SMALLER SIZE RANGE, AND TO DEVELOP A SYSTEM DESIGN FOR SUCH A SYSTEM.

DYNACS ENGINEERING CO., INC.
34650 US HIGHWAY 19 NORTH, SUITE 301
PALM HARBOR, FL 34684
Phone: (813) 784-4035

Topic#: 91-153 ID#: 91PAC-772
Office: PL/OLAC
Contract #:
PI: RICHARD J. VANDERVOORT

Title: ON-ORBIT SUPERVISOR FOR CONTROLLING SPACE SYSTEMS

Abstract: MODERN SPACECRAFT CONSIST OF SEVERAL COMPLEX SUBSYSTEMS, SUCH AS THE STRUCTURE SUBSYSTEM, THERMAL MANAGEMENT SUBSYSTEM, ATTITUDE CONTROL SUBSYSTEM, ETC. INCREASING THE OPERATIONAL LIFE INVOLVES IMPROVING THE RELIABILITY OF EACH COMPONENT AS WELL AS PROVIDING FAULT DETECTION, ISOLATION AND RECOVERY (FIR) SYSTEMS. AN INNOVATIVE APPROACH USING A HIERARCHICAL EXPERT SYSTEM IS PROPOSED THAT WILL PROVIDE INTELLIGENT FDIR AT BOTH THE SUBSYSTEM AND SYSTEM LEVELS. THE PROPOSED SYSTEM WILL CONSIST OF TWO LEVELS. EACH SUBSYSTEM WILL BE MONITORED BY ITS OWN EXPERT SYSTEM. A SYSTEM LEVEL MONITOR WILL THEN PROVIDE HIGH-LEVEL FDIR CAPABILITIES. TO THE EXTENT POSSIBLE, THE LOCAL (SUBSYSTEM) MONITORS WILL PROVIDE THE REQUIRED FAULT-TOLERANCE. ONLY FAILURES THAT CANNOT BE COMPENSATED FOR WILL BE COMMUNICATED TO THE SYSTEM LEVEL SUPERVISOR. DISTRIBUTED PROCESSING WILL THEN BE POSSIBLE, AND THE SMALL LOCAL KNOWLEDGE BASES WILL ENSURE REAL-TIME RESPONSE. MEMORY AND INTERFACE REQUIREMENTS WILL ALSO BE SIMPLIFIED. THE SUPERVISOR WILL BE DESIGNED WITH A CLEAR SEPARATION BETWEEN THE KNOWLEDGE BASE AND THE INFERENCE MECHANISM, THUS MAKING IT EASILY ADAPTABLE TO OTHER APPLICATIONS. THE COMMERCIAL APPLICATIONS FORESEEN INCLUDE MONITORS FOR FLY-BY-WIRE AIRCRAFT SYSTEMS, MISSILE SYSTEMS, AND INDUSTRIAL PROCESS CONTROL.

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111 DOWNEY STREET
NORWOOD, MA 02062
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Topic#: 91-179 ID#: 91BMO-964
Office: BMO/MYSP
Contract #:
PI: K. M. ABRAHAM

Title: A HIGH VOLTAGE LITHIUM BATTERY

Abstract: THE DESIGN OF A HIGH-POWER, SHORT-LIVED LITHIUM BATTERY IS PROPOSED ALONG WITH EXPERIMENTAL STRATEGIES TO ACHIEVE THE DESIGN GOALS. THE EXPERIMENTAL TASKS INCLUDE THE DEVELOPMENT OF THIN CATHODES OF A HIGH-VOLTAGE CATHODE MATERIAL, OPTIMIZATION OF HIGHLY CONDUCTIVE ELECTROLYTES, AND EVALUATION OF CELL PERFORMANCE IN LABORATORY TEST CELLS. THE RESULTS FROM PHASE I WILL BE USED TO DESIGN AA-SIZE BATTERIES IN PHASE II. COMMERCIAL

AIR FORCE ABSTRACTS OF SBIR PHASE I AWARDS

APPLICATIONS OF A HIGH-POWER BATTERY INCLUDE NAIL GUNS, ELECTRIC DRILLS, SCREW DRIVERS, AND ENGINE STARTERS.

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3415 LOMITA BLVD
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Topic#: 91-079 ID#: 91ASD-567
Office: ASD
Contract #: F33657-91C-2176
PI: James Manly

Title: An Application of Technologies to Enhance the T-38 to meet BETS Requirements
Abstract: The USAF Trainer Masterplan developed short- and long-term strategies for meeting current and future Undergraduate Pilot Training (UPT) requirements. One element of the plan calls for the development of a Reconnaissance-Attack-Fighter System (BFTS) aircraft to replace the T-38 in the 2005 timeframe. Studies have been conducted to investigate aircraft alternatives which have ranged from new subsonic and new supersonic aircraft, to variations of existing fighters and trainers modified to meet BFTS requirements. This proposal suggests that a viable option has been overlooked as a BFTS candidate -- an enhanced and life extended T-38A, herein called the T-38X. This proposal seeks to study options in the relevant areas such as structures, aerodynamics, propulsion, avionics, etc. which would eliminate current T-38A deficiencies and allow the aircraft to meet, to the degree possible, the BFTS requirements.

ELECTRIC PROPULSION LABORATORY, INC.
440 N. GREEN STREET
TEHACHAPI, CA 93561
Phone: (805) 822-1933

Topic#: 91-148 ID#: 91PAC-743
Office: PL/OLAC
Contract #:
PI: DR. GRAEME ASTON

Title: HIGH PERFORMANCE, VARIABLE POWER AMMONIA ARCJET
Abstract: AN AGGRESSIVE ARCJET CONFIGURATION OPTIMIZATION PROGRAM IS PROPOSED TO DESIGN A HIGH PERFORMANCE, VARIABLE POWER AMMONIA ARCJET. A NOVEL TEST BED ARCJET AND MODULAR NOZZLE DESIGN APPROACH IS PROPOSED TO ALLOW LOW COST OPERATION AND TEST EVALUATION OF EXOTIC ARCJET NOZZLE CONFIGURATIONS. SIMPLE, BUT MEANINGFUL ARCJET PLUME DIAGNOSTICS ARE PROPOSED TO UNAMBIGUOUSLY IDENTIFY KEY VARIABLE POWER ARCJET DESIGN PARAMETERS. SUCCESSFUL EARTH ORBIT SPACE TRANSPORTATION SYSTEMS FOR THE 21ST CENTURY WILL NEED TO OFFER MORE PAYLOAD TRANSFER CAPABILITY AND SIGNIFICANTLY LOWER ORBIT TRANSFER VEHICLE COSTS. EFFICIENT, HIGH SPECIFIC IMPULSE ELECTRIC PROPULSION SYSTEMS OFFER THE MEANS TO ACHIEVE THESE SPACE TRANSPORTATION GOALS.

ELECTRO-OPTICS CORP.
3152 KASHIWA STREET
TORRANCE, CA 90505
Phone: (213) 534-3666

Topic#: 91-167 ID#: 91PXP-867
Office: PL/XPPP
Contract #:
PI: C. F. HUANG

Title: PBSSE/PBS DOUBLE HETEROJUNCTION LASER DIODE BY MBE
Abstract:

ELECTRO-RADIATION, INC.
39 PLYMOUTH STREET
FAIRFIELD, NJ 07006
Phone: (201) 808-9033

Topic#: 91-079 ID#: 91ASD-556
Office: ASD
Contract #: F33657-91C-2257
PI: Murray W. Rosen

Title: High Temperature Superconductivity (HTSC) ESM Augmentation System
Abstract: The project examines the feasibility of applying High Temperature Superconductivity (HTSC) technology to augment ESM receiver systems. HTSC is an enabling technology which potentially allows a device to be constructed which sorts high duty cycle (pulse) signals at direct RF. The isolated PD/CW and pulse environments are then easily handled by simple superheat and wide band receivers, respectively. The proposed Phase I effort established a system architecture and overall design, and specifies critical component requirements which will lead to the development of a breadboard technology demonstration in Phase

AIR FORCE ABSTRACTS OF SBIR PHASE I AWARDS

II.

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6905G OAKLAND MILLS ROAD
COLUMBIA, MD 21045
Phone: (301) 596-7000

Topic#: 91-105 ID#: 91WFI-693
Office: WL/FI
Contract #: F33615-91C- 104
PI: John P. Carpenter

Title: Projectile - Target Impact History Sensor

Abstract: The proposed program includes the analyses, investigations, and evaluations necessary to recommend a design of a miniature, low-cost, impact history sensor. The basic design consists of an triaxial accelerometer, anti-aliasing filters, analog-to-digital conversion, and digital signal processor and memory. A packaging prototype sensor will be built and tested during Phase I. Phase II will result in a calibrated and verified sensor capable of being used in any projectile, 23 mm or larger.

ELECTROSYNTHESIS COMPANY, INC.
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EAST AMHERST, NY 14051
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Topic#: 91-054 ID#: 91CES-166
Office: AFCESA
Contract #:
PI: J. DAVID GENDERS

Title: ELECTROCHEMICAL REDUCTION, ELECTRODIALYSIS AND PRECIPITATION FOR IRON CONTROL IN AIR-STRIPPING GROUNDWATER

Abstract: AN ELECTROCHEMICAL PROCESS THAT ALLOWS IRON TO BE REMOVED BY ELECTROCHEMICAL REDUCTION, ELECTRODIALYSIS AND PRECIPITATION IS PRESENTED IN THIS PHASE I PROPOSAL. THE ADVANTAGE OF THIS PROPOSED PROCESS OVER OTHER PROCESSES IS THAT BY USING ELECTRODIALYSIS PRECIPITATING CHEMICALS ARE NOT ADDED TO THE WHOLE PROCESS STREAM IN ORDER TO PRECIPITATE SMALL AMOUNTS OF IRON. A REUSABLE PRECIPITATING SOLUTION IS EMPLOYED WHERE ONLY THE AMOUNT OF SOLUTION NEEDED TO PRECIPITATE THE IRON IS USED. THIS REUSABLE STREAM SAVES CONSIDERABLY ON PRECIPITATING CHEMICAL COST AND REMOVES THE NEED FOR NEUTRALIZATION OF THE PROCESS STREAM. PHASE II WILL EXTEND THE PROCESS PERFORMANCE TO HANDLE THE BROADEST POSSIBLE RANGE OF GROUNDWATER CONDUCTIVITY AND ORGANIC CONTAMINATE CONCENTRATION AT A U.S. AIR FORCE APPROVED SITE.

ENVIROGEN, INC.
3371 ROUTE 1, SUITE 203
LAWRENCEVILLE, NJ 08648
Phone: (609) 936-9300

Topic#: 91-058 ID#: 91CES-242
Office: AFCESA
Contract #:
PI: BRIAN R. FOLSON

Title: LIQUID-PHASE BIOREACTOR FOR DEGRADATION OF TRICHLOROETHYLENE AND BENZENE

Abstract: THE OVERALL OBJECTIVE OF THIS PROJECT IS TO DESIGN AND OPERATE A LABORATORY-SCALE BIOLOGICAL TREATMENT SYSTEM CAPABLE OF DEGRADING TRICHLOROETHYLENE AND BENZENE, EACH PRESENT AT CONCENTRATIONS AS HIGH AS 50 PPM, TO CONCENTRATIONS OF 4 PPB OR LESS PER CONTAMINANT. THE PROCESS DESIGN WILL ENTAIL THE SIMULTANEOUS OR SUCCESSIVE DEGRADATION OF BOTH CONTAMINANTS BY A SELECTED ORGANISM(S) IN A SINGLE REACTOR CONFIGURATION. THE BIOREACTOR WILL OPERATE UNDER CONTROLLED CONDITIONS USING MICROBIAL CULTURES WITH WELL-DEFINED GROWTH AND DEGRADATION CHARACTERISTICS. TO ACHIEVE THE PROJECT OBJECTIVES, ONE OR MORE ORGANISMS WILL BE IDENTIFIED THAT CAN DEGRADE EITHER OR BOTH TCE AND BENZENE. TOWARD THIS END, THE DEGRADATIVE CAPABILITIES OF ENVIROGEN'S OWN STRAIN OF PSEUDOMONAS CEPACIA (TCE DEGRADER) WILL BE DETERMINED FIRST. THE METABOLIC REQUIREMENTS FOR TCE AND BENZENE CATABOLIC ENZYME PRODUCTION WILL BE DETERMINED IN THE SELECTED CULTURES, AND ANY ADVERSE INTERACTIONS BETWEEN MICROBIAL POPULATIONS AND CONTAMINANTS WILL BE ASSESSED. ONCE THESE TASKS ARE COMPLETE, A LABORATORY-SCALE REACTOR SYSTEM FOR THE DEGRADATION OF A MIXED WASTE STREAM CONTAINING TCE AND BENZENE WILL BE DESIGNED, FABRICATED, AND TESTED.

AIR FORCE ABSTRACTS OF SBIR PHASE I AWARDS

ENVIROSPACE SOFTWARE RESEARCH, INC.
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INDIALANTIC, FL 32903
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Topic#: 91-051 ID#: 91CES-129
Office: AFCESA
Contract #:
PI: STEPHEN R. GERIG, PH.D.

Title: A SYSTEM FOR UPDATING AN INS

Abstract: A SYSTEM IS PROPOSED FOR UPDATING THE INERTIAL NAVIGATION SYSTEM ABOARD A RAPID RUNWAY REPAIR ROBOT, ASSOCIATED WITH 3 CONCEPTS FORMING A NEW AND INNOVATIVE APPROACH: RING LASER GYRO STRAPDOWN SYSTEM OF INS; KALMAN FILTER SOFTWARE. WHEN COMBINED IN A UNIFIED SYSTEM, THEY CAN ACHIEVE THE SOLICITATION'S GOALS. THE NEW SURVEYING TECHNOLOGY IS THE INSTRUMENT GEODIMETER 4000. IT CAN TRACK AND MEASURE TO A MOVING TARGET (RRR ROBOT) AUTOMATICALLY IN "TRACKING MODE", WHERE IT OPERATES UNATTENDED SUITABLE FOR USE IN A HAZARDOUS ENVIRONMENT, PROVIDING COMPLETE POSITIONAL INFORMATION (SLANT RANGE, HORIZONTAL RANGE, HORIZONTAL AND VERTICAL ANGLES) OF HIGH ACCURACY. THE PROPOSED INS EMPLOYS A STRAPDOWN SYSTEM WITH THE RING LASER GYRO. WHICH USES OPTICAL PRINCIPLES AS OPOSED TO MECHANICAL ONES USED BY THE GIMBALED SYSTEM; THUS, MANY MOVING PARTS AND A LENGTHY PROCESS OF INITIALIZATION ARE ELIMINATED. THIS SYSTEM IS BECOMING INCREASINGLY MORE COMMON, AND WILL BECOME INCREASINGLY LESS EXPENSIVE THAN THE GIMBALED SYSTEM. THE PROPOSED KALMAN FILTER USES ALL AVAILABLE DATA, PAST AND PRESENT; OBSERVATIONS FROM THE INS, THE GEODIMETER 4000, AND THE ATTITUDE SENSORS. THE KALMAN FILTER UPDATES THE INS OPTIMALLY AND REDUNDANTLY IN REALTIME; THUS, ALL AVAILABLE DATA ARE USED TO PROTECT THE ROBOT.

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Topic#: 91-004 ID#: 91MNP-073
Office: WL/MNPB
Contract #:
PI: MR PETER T. TOULIOS

Title: ELECTRONICALLY SCANNED, RECONFIGURABLE MMW RADAR ANTENNA

Abstract: Weapons delivery systems for armaments require modernization to reflect the "smart skins" packaging concept which is under development for aircraft. Armaments are generally smaller and radar sensors and seekers will operate at shorter wavelengths, often in millimeter wavelengths. The development of a unified antenna/transceiver following "smart skins" technology requires an electronically scanned phased planar array against a planar transceiver in a flat package. Recognizing the hostile environment for these armaments, this concept may be enhanced of the planar array (or conformal) antenna can be reconfigured in the even of damage or the need to change the antenna radar cross-section (RCS). The Phase I research will have three baseline concerns: 1) investigate materials options for all elements of the "smart skin" package implementation, 2) develop and test a digital phase shifter to facilitate scanning of a previously demonstrated w-band phased array, and 3), develop a complete, "smart skins" package concept for a w-band armament sensor or seeker radar. During Phase II, this "smart skins" radar module will be fabricated and demonstrated including configuration and performance modification to alter its RCS through mechanical changes in the phase shifters. It will also be demonstrated that this reconfiguration could be done through changes in the programs which control the phase shifters for scanning.

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Topic#: 91-050 ID#: 91ROM-121
Office: ROMELAB
Contract #: F19628-91-C-0149
PI: P. R. HERCZFELD

Title: PHOTONIC/MICROWAVE DEVICES

Abstract: THIS PROPOSAL CONCERNS THE INTERFACE BETWEEN PHOTONICS AND MICROWAVES, A DYNAMIC AREA OF RESEARCH NOW MATURED TO A POINT WHERE MAJOR APPLICATIONS ARE FEASIBLE. THE OBJECTIVE IS THE DEVELOPMENT OF MONOLITHIC INTEGRATED PHOTONIC-MICROWAVE DEVICES, WHICH WOULD GREATLY ENHANCE THE PERFORMANCE OF HIGH-SPEED FIBEROPTIC LINKS. FOR MICROWAVE APPLICATIONS, THERE IS AN INTEREST IN TRANSMITTING OPTICAL SIGNALS TO AND FROM MMIC CHIPS.

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THUS, OPTICAL INPUT AND OUTPUT PORTS FOR MONOLITHIC MICROWAVE INTEGRATED CIRCUITS (MMIC) WILL BE DEVELOPED. WE WILL INVESTIGATE THE USE OF MESFETs AND HEMT_s, THE BASIC BUILDING BLOCKS OF MMICs, AS OPTICAL INPUT PORTS ON THESE CHIPS. USING FREE CARRIER INJECTION/DEPLETION AS THE BASIC INTERACTION MECHANISM, WE WILL ALSO STUDY THE DEVELOPMENT OF EXTERNAL MODULATORS ON MMICs AS OUTPUT PORTS. THE USE OF THIS MECHANISM INSTEAD OF THE ELECTROOPTICAL EFFECT PROVIDES A UNIQUE OPPORTUNITY TO MAKE HYBRID DEVICES VIA WELL DEVELOPED, RELIABLE, AND COST EFFECTIVE SEMICONDUCTOR PROCESSING AND FABRICATING METHODS. DEVICE INTERACTION WILL BE STUDIED TO DETERMINE THE EFFECTIVENESS OF THE EXTERNAL MODULATOR IN TERMS OF DYNAMIC RANGE, NOISE CHARACTERISTICS, AND OPERATING CONDITIONS. EMPHASIS WILL BE ON COMPATIBILITY WITH MMIC PROCESSING AND ON INNOVATIVE PACKAGING. PHASE I WILL STRESS ANALYTIC AND SIMULATION STUDIES THROUGH WHICH THE MOST PROMISING DEVICE CONFIGURATIONS WILL BE IDENTIFIED FOR EXPERIMENTAL IMPLEMENTATION UNDER PHASE II.

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Topic#: 91-045 ID#: 91ROM-083
Office: ROMELAB
Contract #: F30602-91-C-0085
PI: LAWRENCE H. DOMASH

Title: ACTIVE HOLOGRAPHIC SLM FOR OPTICAL INTERCONNECTS

Abstract: EMERGING OPTICAL TECHNOLOGIES SUCH AS CROSSBAR SWITCHING, OPTICAL INTERCONNECTS, OPTICAL NEURAL NETS OF OTHER OPTICAL COMPUTING ARCHITECTURES ALL PRESENTLY RELY ON ONE OF TWO TYPES OF DIFFRACTIVE ELEMENTS. SPATIAL LIGHT MODULATORS ARE PROGRAMMABLE BUT HAVE LOW RESOLUTION AND LOW DIFFRACTION EFFICIENCY. FIXED HOLOGRAMS OR DIGITALLY GENERATED BINARY OPTICAL ELEMENTS HAVE HIGH RESOLUTION AND 100 PERCENT DIFFRACTION EFFICIENCY BUT CANNOT BE RECONFIGURED. THE PROPOSED RESEARCH IS DIRECTED AT A NEW FAMILY OF ELECTRO-OPTICALLY TUNABLE HOLOGRAMS WHICH COMBINE HIGH RESOLUTION AND DIFFRACTION EFFICIENCY WITH ELECTRO-OPTIC SWITCHING BETWEEN DIFFRACTIVE ORDERS OR BETWEEN MULTIPLEXED HOLOGRAPHIC RECORDINGS IS POSSIBLE BY DYNAMIC ELECTRICAL OR OPTICAL CONTROL OF MODULATION DEPTH. THE TECHNIQUES TO BE EMPLOYED ARE BASED ON COMBINING ELECTRO-OPTICALLY ACTIVE LIQUIDS POSSESSING PICOSECOND RESPONSE TIMES WITH POLYMER HOLOGRAPHIC HOST MATERIALS. HIGH SPEED SWITCHABLE HOLOGRAMS HAVE APPLICATIONS FOR FIBER OPTIC SWITCHING ELEMENTS, LASER BEAM DIVIDERS, LASER PROTECTION DEVICES, TUNABLE AIRCRAFT CANOPIES AND ENERGY CONSERVING WINDOWS. BY FABRICATING ARRAYS OF INDEPENDENTLY ADDRESSABLE SMALL HOLOGRAMS, NEW TYPES OF SPATIAL LIGHT MODULATORS APPEAR POSSIBLE IN WHICH EACH ELEMENT PERFORMS A SOPHISTICATED DIFFRACTIVE EFFECT, OPENING MANY NOVEL FUNCTIONAL POSSIBILITIES.

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Topic#: 91-054 ID#: 91CES-169
Office: AFCESA
Contract #:
PI: DR HARRIS GOLD

Title: ANOXIC AIR STRIPPING OF GROUNDWATER FOR IRON CONTROL

Abstract: AIR STRIPPING IS ONE OF THE MOST ECONOMICAL PROCESSES FOR THE REMOVAL OF VOLATILE ORGANIC CHEMICALS (VOCs) FROM GROUNDWATER. HOWEVER, UNDER SOME CONDITIONS, THE FORMATION OF SCALE AND SLIME DUE TO THE OXIDATION OF DISSOLVED IRON FOULS THE PACKING AND REDUCES AIR FLOW AND TREATMENT EFFICIENCY. THE OBJECTIVE OF THIS PHASE I PROGRAM IS TO DETERMINE THE FEASIBILITY OF STRIPPING THE GROUNDWATER WITH A RECIRCULATING AIR STREAM THAT IS DEPLETED WITH OXYGEN (ANOXIC). RECENT CLEAN-AIR REGULATIONS REQUIRE THAT STRIPPING OFF-GASES BE PURIFIED BEFORE RELEASE TO THE ATMOSPHERE. ONCE THE CONTAMINANT VOCs HAVE BEEN REMOVED, HOWEVER, THE STRIPPING AIR CAN BE RECYCLED. IF THIS RECIRCULATING STREAM IS HEATED BY INJECTION OF FLUE GAS FROM A GAS BURNER, IT WILL BECOME DEPLETED IN OXYGEN AND RICH IN CO₂. THE TREATMENT COSTS ARE ESSENTIALLY ZERO SINCE THE HEATING IS, IN ANY CASE, REQUIRED FOR THE GAS PURIFICATION STEP. WATERS WITH HIGH PH/HIGH ALKALINITY MAY

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ADDITIONALLY REQUIRE PH REDUCTION BY ACID ADDITION FOR EFFECTIVE FOULING CONTROL. TESTS ARE PROPOSED IN PHASE I TO DETERMINE THE EXTENT TO WHICH ACID NEUTRALIZATION IS IN FACT REQUIRED WHEN STRIPPING WITH AN ANOXIC GAS.

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Topic#: 91-076 ID#: 91ASD-613
Office: ASD
Contract #:
PI: Ramakrishna Iyer

Title: Novel Aircraft Door/Panel Fastening System

Abstract: This effort is focused on the proof-of-concept of using optional classes of loop and hook material (Velcro)R in the development of fastening systems for aircraft doors and panels. System definition, material selection and overall program definition are the ultimate goals of the Phase I program.

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Topic#: 91-077 ID#: 91ASD-654
Office: ASD
Contract #:
PI: K. JAYARAJ

Title: AEROSPACE HIGH TEMPERATURE WIRE INSULATION

Abstract: Foster-Miller proposes to evaluate a series of new high temperature (over 250oC) materials and identify the most promising materials for use in aerospace wire insulation. We have assembled a uniquely qualified team to accomplish our goal. We have teamed with TRW to understand the use requirements and we will survey wire and cable manufacturers to address the cost and production concerns. Future aircraft and space systems will operate at higher voltages over wider temperature ranges, making today's insulation materials inadequate. New materials to be evaluated on this program will have better resistance to arc propagation, abrasion resistance, mechanical and electrical properties at high and low temperature, fluid resistance, and durability. Phase I will use a systematic approach to select the best materials without bias by means of an evaluation matrix with weighted coefficients on each key performance parameter. Each candidate material will be scored by a performance index and the feasibility of obtaining the material. At the end of Phase I, we select a small number of materials which offer the greatest potential for further development and evaluation. In Phase II, we will work with wire manufacturers and TRW to fabricate and test selected materials in flat and round wire constructions. Demonstration of a low cost, manufacturable insulation material capable of operating at temperatures exceeding 250oC, will establish a firm basis for a commercial Phase III.

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Topic#: 91-113 ID#: 91WML-411
Office: WL/ML
Contract #: F33615-91C-5644
PI: Dr. Mark A. Druy

Title: Novel In-situ Fiber Optic FTIR Process Monitor for Carbon-Carbon Structures

Abstract: Foster-Miller proposes to develop a novel fiber optic based Fourier Transform Infrared (FTIR) process monitor to sense and control the processing of advanced carbon-carbon composite structures planned for turbine engine, hot structure and space applications. In Phase I, Foster-Miller will demonstrate the key elements of the concept: The ability of new high optical quality sapphire fiber sensors to obtain IR spectral data in both the low temperature cure cycle of carbon/phenolic prepregs and in the high temperature carbonization process. The proposed system is capable of obtaining data at temperatures up to 1400C and should provide the first in-situ real-time information in both initial cure and the carbonization-pyrolysis reactions of carbon-phenolic materials. Critical data on reimpregnation will also be obtained. These tasks will lead to the resolution of key issues of practical implementation so that the system will be ready for immediate integration into a carbon-carbon reactor. This system will be based on Foster-Miller's highly successful remote fiber optic FTIR Polymer Reaction Monitor. This tool was developed by Foster-Miller to monitor and control chemical kinetics in organic resin systems in hostile environments such as autoclaves and high temperature presses and molds. It has been successfully applied to the cure of composite parts made from epoxies, bismaleimides and polyimides. It won a 1990 R&D-100 award. In Phase II, Foster-Miller will integrate the carbon-carbon monitor into a commercial process reactor. Reproducible production of carbon-carbon structures with improved structure/microstructure/property relationships in Phase II will form a firm basis for a commercially supported Phase III

AIR FORCE ABSTRACTS OF SBIR PHASE I AWARDS

program.

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Topic#: 91-133 ID#: 91WFO-447
Office: WL/PO
Contract #: F33615-91C-2127
PI: Glenn Freitas

Title: Automated Formation of Net Shape Multidirectional Fiber Architectures for Turbine Engine Rotor Bliks

Abstract: Candidate materials being considered for future high performance turbine engines include ceramic matrix, intermetallic matrix, and advanced carbon-carbon composites. Current fiber placement techniques are inadequate to fabricate the complex, multidirectional preforms required for blades, vanes, disks, or bliks of these materials. Foster-Miller is proposing an automated approach to produce multidirectional blik preforms. Braiding and weaving processes will be integrated to produce a net shape preform with integral blades. The method is not restricted to three orthogonal (polar) coordinates. The preform will contain a high percentage of hoop reinforcement in the disk region and predominantly radial and +0o orientations in the blade. Phase I will show feasibility by fabricating a representative blik sector. Phase II would involve detailed design and fabrication of a prototype weaving system which would be used to produce prototype blik preforms in several geometries and fiber materials. Preforms would be infiltrated with appropriate matrix precursors and pyrolyzed or sintered to produce demonstration blik(s). Participation of an engine manufacturer will be sought in Phase II. If Phase II is successful, Foster-Miller would seek to commercialize the technology with the assistance of an engine manufacturer.

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Topic#: 91-164 ID#: 91PXP-834
Office: PL/XPPP
Contract #:
PI: DR. LAWRENCE H. DOMASH

Title: PHOTOREFRACTIVE AND ELECTROREFRACTIVE NONLINEAR OPTICAL WAVEGUIDES

Abstract: PHOTOREFRACTIVE BULK CRYSTALS HAVE BEEN THE BASIS FOR DEMONSTRATING MANY STRIKING PHENOMENA OF NONLINEAR OPTICS BUT TEND TO BE SLOW IN RESPONSE SPEED AND SUITABLE ONLY FOR LABORATORY RESEARCH. SPEED OF RESPONSE, DEVICE UNIFORMITY AND PRACTICAL APPLICATIONS WOULD BE GREATLY ENHANCED IF PHOTOREFRACTIVE MECHANISMS WERE TO BE AVAILABLE IN THIN FILM WAVEGUIDE STRUCTURES. THE PROPOSED PHASE I RESEARCH WILL EXPLORE A NUMBER OF ALTERNATIVE MATERIALS AND FABRICATION TECHNIQUES TO IDENTIFY THE OPTIMUM PATH FOR PHOTOREFRACTIVE WAVEGUIDES. MATERIALS TO BE USED INCLUDE POLYCRYSTALLINE FILMS OF BARIUM TITANATE AND PLZT GROWN USING SOL-GEL WAVEGUIDE PROCESSING, AND FILMS OF SEMICONDUCTORS EMPLOYING LIFT-OFF FILM TECHNIQUES. FABRICATION AND CHARACTERIZATION OF A NUMBER OF ALTERNATIVE WAVEGUIDE STRUCTURES WILL LAY THE FOUNDATION OF PHASE II PRODUCTION OF EFFICIENT DEVICES WITH RESPECT TO SUCH PERFORMANCE MEASURES AS PHASE CONJUGATE REFLECTIVITY, TWO-BEAM COUPLING COEFFICIENT AND RESPONSE SPEED. PHOTOREFRACTIVE NONLINEAR OPTICAL WAVEGUIDES MAY PROVIDE A NEW LOW-COST, HIGH-PERFORMANCE DEVICE TECHNOLOGY FOR APPLICATIONS IN DIRECTED ENERGY WEAPONS, OPTICAL PHASE CONJUGATION, AMPLIFIERS AND SWITCHES COMPATIBLE WITH FIBER OPTICS TECHNOLOGY, OPTICAL COMPUTING, AND NEURAL NETWORKS.

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Topic#: 91-166 ID#: 91PXP-863
Office: PL/XPPP
Contract #:
PI: DR. WAYNE S. HILL

Title: MEASUREMENT OF FLUID QUALITY IN MICROGRAVITY WITH ULTRASOUND

Abstract: THE ABILITY TO REMOTELY DETERMINE THE CONDITION OF A TWO-PHASE FLOW WOULD BE VALUABLE FOR THE DIAGNOSIS AND OPERATION OF ADVANCED SPACE POWER, THERMAL MANAGEMENT, AND FLUID MANAGEMENT SYSTEMS. THE PROPOSED PROGRAM WILL DEVELOP A NONINVASIVE ULTRASONIC FILM THICKNESS MEASUREMENT SYSTEM SUITABLE FOR USE IN A BROAD RANGE OF FLUIDS,

AIR FORCE ABSTRACTS OF SBIR PHASE I AWARDS

FLOW CONDITIONS, AND OPERATING ENVIRONMENTS. WHEN COMBINED WITH A SEPARATE MEASUREMENT OF MASS, VOLUME, OR MOMENTUM FLOW, HIGH RESOLUTION FILM THICKNESS MEASUREMENT PROVIDES A SENSITIVE DETERMINANT OF FLOW QUALITY FOR ALL FLOW REGIMES. WITH RECENT ADVANCES IN COMMERCIAL ULTRASONIC EVALUATION EQUIPMENT, THIS CONCEPT PROMISES THE BEST COMBINATION OF ACCURACY, STABILITY, AND RELIABILITY OF ALL COMPETING TECHNOLOGIES. THE PHASE I EFFORT WILL DEMONSTRATE THE FEASIBILITY OF THE PROGRAM CONCEPT THROUGH FLOW MODELING AND LABORATORY TESTING WITH AN AIR-WATER TWO-PHASE FLOW SYSTEM. PHASE II WILL INCLUDE ADVANCED MODELING, HARDWARE DEVELOPMENT, AND KC-135 FLIGHT TESTING USING A TWO-PHASE FLOW SYSTEM DEVELOPED BY FOSTER-MILLER IN A PREVIOUS WEAPONS LABORATORY SBIR PROGRAM. PHASE III WILL INCLUDE THE DEVELOPMENT AND COMMERCIALIZATION OF AN INSTRUMENT SUITABLE FOR USE IN A BROAD RANGE OF TWO-PHASE FLOW SYSTEMS FOR SPACE AND TERRESTRIAL APPLICATIONS. IF SUCCESSFUL, THE PROPOSED PROGRAM WILL RESULT IN COMMERCIALIZATION OF AN ACCURATE, RELIABLE MEASUREMENT SYSTEM SUITABLE FOR THE DIAGNOSIS AND CONTROL OF TWO-PHASE FLOW SYSTEMS. POTENTIAL APPLICATIONS INCLUDE SPACE POWER, THERMAL MANAGEMENT, AND FLUID MANAGEMENT SYSTEMS, AS WELL AS IN TERRESTRIAL INDUSTRIES SUCH AS NUCLEAR POWER, MEDICAL INSTRUMENTS, AND CHEMICAL AND MANUFACTURING PROCESS SYSTEMS.

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Topic#: 91-168 ID#: 91PXP-868
Office: PL/XPPP
Contract #:
PI: DR. HARRIS GOLD

Title: CONTINUOUS GENERATION OF SINGLET DELTA OXYGEN AT HIGH PRESSURES

Abstract: THIS PHASE I PROPOSAL ADDRESSES THE DEVELOPMENT OF A MUTUALLY IMPINGING SPRAY SINGLET DELTA OXYGEN (SDO) GENERATOR (REACTOR) WHICH WILL OPERATE AT NEAR ATMOSPHERIC PRESSURE AND PROVIDE A CONTINUOUS AND STEADY-STATE FLOW OF OXYGEN AT A SDO PARTIAL PRESSURE OF 100 TORR. THE REACTOR PRESSURE IS AT LEAST A FACTOR OF 7.5 AND AS HIGH AS A FACTOR OF 1500 TIMES GREATER THAN THE PRESSURES FOUND IN CURRENT SDO GENERATORS. SINGLET DELTA OXYGEN IS USED TO COLLISIONALLY EXCITE ATOMIC IODINE LASING SPECIES IN OXYGEN-IODINE LASERS. OPERATING PRESSURES UP TO ONE ATMOSPHERE ARE REQUIRED BOTH (A) TO REDUCE THE PUMPING REQUIREMENTS FOR THE LASER SYSTEM AND (B) FOR HOMOGENEOUS SATURATION OF THE LASER, LEADING TO EFFICIENT FIBER OPTIC COUPLING AND POTENTIAL REMOTE APPLICATIONS OF THE OXYGEN-IODINE LASER. A CONCEPT DEMONSTRATION UNIT OF ONE-TENTH SCALE WILL BE BUILT AND TESTED IN THE PHASE I PROGRAM. THE MAJOR UNCERTAINTY TO BE RESOLVED IN THE PHASE I PROGRAM IS WHETHER THE INTERACTION OF THE MUTUALLY IMPINGING SPRAYS CAN PRODUCE HIGH YIELDS OF SDO WITHOUT SIGNIFICANT QUENCHING. THE PHASE II PROGRAM WILL ADDRESS THE DESIGN, FABRICATION AND TESTING OF A FULL-SCALE, CONTINUOUS, HIGH PRESSURE, SDO GENERATOR/CHEMICAL OXYGEN-LASER SYSTEM. THE MAIN APPLICATION OF THE HIGH PRESSURE, CONTINUOUS SDO GENERATOR WILL BE FOR THE REMOTE USE OF OXYGEN-IODINE LASERS, AS FOR EXAMPLE, FOR WELDING AND PRECISION METAL CUTTING. OTHER APPLICATIONS WOULD INVOLVE THE USE OF SDO AS AN OXIDIZING AGENT AT LOWER OXIDATION TEMPERATURES, AS FOR EXAMPLE, IN THE FORMATION OF SILICON OXIDE IN THE SEMICONDUCTOR INDUSTRY OR IN THE ANNEALING PROCESS OF HIGH TEMPERATURE CUPRATE SUPERCONDUCTORS.

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Topic#: 91-198 ID#: 91ASD-699
Office: ASD/NAF
Contract #:
PI: JOSEPH S. BOYCE

Title: Brazed Carbon-Carbon to Carbon-Carbon Joint with Through-the-Thickness Reinforcement

Abstract:

AIR FORCE ABSTRACTS OF SBIR PHASE I AWARDS

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Title: NOVEL DENDRITES TO JOIN REFRACTORY COMPOSITES AND DISSIMILAR MATERIALS
Abstract:

Topic#: 91-199 ID#: 91ASD-700
Office: ASD/NAF
Contract #:
PI: Ramakrishna Iyer

FRONTIER TECHNOLOGY, INC.
530 MONTECITO STREET, SUITE 105
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Phone: (805) 965-2477

Title: TOWED DECOY COUNTER-COUNTERMEASURES

Abstract: The proposed Phase I research program will define and evaluate techniques and tactics intended to counter the towed decoy electronic count-measure (ECM) threat to airborne radars. In the study candidate techniques will be evaluated as to their performance capabilities and their feasibility. Performance will be measured in terms of the radar's ability to discriminate between decoys and true targets. These performance evaluations, together with qualitative assessments of operation complexity, robustness and any adverse impacts on cost and system utility, will provide the basis for recommending one or more of the techniques for further development and evaluation in Phase II of the program. The phase I program also will specify the technology requirements, design data requirements and development requirements, for the selected techniques and recommend a Phase II program plan designed to achieve those goals.

Topic#: 91-089 ID#: 91WAA-085
Office: WL/AA
Contract #: F33615-91C-1774
PI: WALTER E.SHEPHERD

FRONTIER TECHNOLOGY, INC.
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Phone: (513) 429-3302

Title: Integrating A Cost Architecture Methodology Within A Dynamic Work Station Environment

Abstract: The proposed project will design a soup-to-nuts cost analysis methodology automated within a user-friendly computer work station environment. The tools available via the workstation will be capable of assessing the impact that DoD budgets and force structure decisions have on system costs and system affordability. At the opposite end of the spectrum of costing capability, tools will be available that can generate detailed unit costs with a complete component cost build-up when provided detailed system design data. In the middle ground area of costing capability are tools that will enable the design engineer, along with the cost analyst, to determine the impacts that upper-level design parameter trade-offs have on a system costs. For the first time, the preliminary designer can investigate the sensitivity that design parameters have on not only aircraft weight, performance, and effectiveness, but also on aircraft costs. Emphasis will be placed on estimating the costs associated with innovating new technologies into advance weapon systems. Phase I will establish sound and reasonable requirements for the cost estimating methodology. Based upon the requirements, a functional design will be developed. Candidate cost models for satisfying the functional design will be surveyed. An upper level spec will be developed. As a last task, a draft development plan will be generated, identifying required model modifications, model integrations and required new methodology development. Completion of Phase I ensures that all aspects of the problem have been thoroughly researched and resolved to minimize risk, so that a Phase II detailed system design and a development/procurement plan can be generated.

Topic#: 91-140 ID#: 91WTX-682
Office: WL/TX
Contract #: F33615-92C-3603
PI: John Denelsbeck

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Phone: (201) 842-9495

Title: Nondestructive Evaluation of Material Characteristics by High-Definition High-Speed Infrared Digital Imaging

Abstract: It is proposed to develop a nondestructive evaluation (NDE) method which combines a new high-definition high-speed infrared imaging system synchronized with the pulsed IR radiation shed on the objects. The high-performance IR imaging system for this method will include a new high-definition IR imager with PtSi Schottky barrier detectors and multiple video output poles so as to enable parallel data acquisition at high imaging rates. The new high-speed IR imaging system will have several special

Topic#: 91-116 ID#: 91WML-416
Office: WL/ML
Contract #: F33615-91C-5631
PI: Harout Jamgotchian

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features optimized for NDE not only of large size components in the field but also for those in the manufacturing stage. The features also include variable exposure and aperture, variable spectral imaging, multiple framing per shot for imaging of multiple-piece components at high-speed motion (e.g., rotating turbine blades), high dynamic resolution (12-bit) for quantitative NDE, and interface with our new IR borescope for NDE of hard-to-reach components. IR images (in total or designated spectral wavebands) can be captured using this high-performance digital system from objects either at normal operation temperatures (without additional heating) or at slightly elevated temperatures by using single or multiple pulsed IR radiation. In particular, the imaging that is synchronized with the pulsed heating, which helps to determine heat dissipation that reveals and amplifies a material's thermal properties and physical conditions, will lead us to identify and quantitatively evaluate various defects and failure progress (e.g., cracks, debond, lap-joint failure, abnormality of texture and even oxidation process). It is reemphasized that because of the features of the high-definition and high-speed imaging, the present data system will enable rapid NDE of components in a prompt manner so that one can conduct even the routine field inspections and (in situ) production line quality control.

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Topic#: 91-176 ID#: 91BMO955
Office: BMO/MYSP
Contract #:
PI: DR MONIEM ELSHERBINY

Title: INTERCONTINENTAL BALLISTIC MISSILE (ICBM) FLIGHT AND AERODYNAMIC STUDIES/RV FLOWFIELD MEASUREMENTS

Abstract: MEASUREMENT OF THE FLOWFIELD PARAMETERS DURING REENTRY IS ESSENTIAL FOR THE DESIGN OF ADVANCED TERMINAL GUIDANCE AND IMAGING SENSORS FOR BMO APPLICATION. NOVEL TECHNIQUES ARE PROPOSED TO MEASURE THE ELECTRON DENSITY PROFILE, BOUNDARY LAYER FLUCTUATION SPECTRA AND FLOWFIELD TEMPERATURE DURING REENTRY. ELECTRON DENSITY PROFILE MEASUREMENTS ARE PERFORMED THROUGH MILLIMETER WAVE IMAGING OF THE BOUNDARY LAYER. PLASMA FLUCTUATION SPECTRUM MEASUREMENT IS ACHIEVED USING HIGH RATE DATA SAMPLING/COMPRESSION INSTRUMENTATION SYSTEM, WHILE BOUNDARY LAYER TEMPERATURE IS DONE USING MULTI-SPECTRAL RADIOMETRIC TECHNIQUE. THE SUGGESTED INSTRUMENTATION IS EXPECTED TO SUBSTANTIALLY ENHANCE THE EFFECTIVENESS OF FUTURE FLIGHT TESTS CARRIED OUT BY BMO. POSSIBLE COMMERCIAL APPLICATIONS CAN BE IN THE FIELD OF SPACE TRANSPORTATION.

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Topic#: 91-018 ID#: 91MNP170
Office: WL/MNPB
Contract #:
PI: MR ALAN CRANDALL

Title: AIRFIELD RECOVERY ASSESSMENT SYSTEM

Abstract: GEO-CENTERS, INC. proposes a Phase I conceptual design of multisensor system for the detection, location, identification, and status of unexploded ordnance (UXO) used against both paved and unpaved airfield surfaces. Based on our experience in multisensor UXO detection, we believe a system of both mobile and embedded sensors can rapidly and accurately accomplish this goal. Routine area surveys will establish required sensor calibration and registration, as well as providing a valuable background data base. Data fusion algorithms will identify most likely target type based on multisensor data. Interactive routines will provide access to the developed airfield attack munitions/obstacle data base for additional UXO identification, status, and recommended recovery procedure. Output reports and maps will help field commanders assess their situation and efficiently direct recovery procedures to clear minimum operating surfaces.

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Topic#: 91-184 ID#: 91BMO004
Office: BMO/MYSP
Contract #:
PI: THOMAS K. MCKINLEY

Title: AERODYNAMICALLY STABLE ICBM BOOSTER DESIGN CONCEPTS

Abstract: A NEW APPROACH TO HIGH PERFORMANCE ICBM DESIGN HAS BEEN IDENTIFIED. THE END PRODUCT

AIR FORCE ABSTRACTS OF SBIR PHASE I AWARDS

IS A HIGHLY STABLE, LOW DRAG, TWO-STAGE BOOSTER WHICH IS LIGHTER, FASTER BURNING, MORE RELIABLE, AND LESS EXPENSIVE THAN AN EQUIVALENT, CONVENTIONAL, THREE-STAGE MISSILE. MAJOR PERFORMANCE IMPROVEMENTS ARE OBTAINED BY REPLACING THE TRADITIONAL, CYLINDRICAL UPPER MOTOR STAGES AND POST-BOOST VEHICLE (PBV) WITH A SINGLE, CONICAL MOTOR STAGE AND CONICAL PBV. THE REDUCED WEIGHT, IMPROVED STABILITY, AND RELATIVELY FAST BURN TIME ARE BY-PRODUCTS OF THE CONICAL UPPER STAGE DESIGN APPROACH. RELIABILITY AND COST BENEFITS RESULT FROM REPLACING THE TWO UPPER STAGE MOTORS WITH A SINGLE MOTOR. THE PHASE I TECHNICAL OBJECTIVES ARE TO DEVELOP CONCEPTUAL DESIGN APPROACHES FOR IMPROVING UPON THE BASIC, TWO-STAGE CYLINDER-CONE BOOSTER. ALTERNATIVE CONCEPTS WILL BE DEFINED AND CHARACTERIZED, TECHNOLOGY ISSUES IDENTIFIED, AND R&D PROGRAM REQUIREMENTS SPECIFIED. ALTERNATIVE AERODYNAMIC SHAPES AND PROPULSION SYSTEMS (INCLUDING "HYBRID" INTEGRATED STAGE CONCEPTS), NEW MATERIALS, AND IMPROVED STRUCTURES WILL BE TREATED. PHASE I RESULTS ARE EXPECTED TO PROVIDE THE AIR FORCE WITH NEW AND IMPROVED METHODS FOR DESIGNING HIGH PERFORMANCE BALLISTIC MISSILES AND WITH THE BOOSTER PERFORMANCE INFORMATION NEEDED TO IDENTIFY FUTURE BALLISTIC MISSILE TECHNOLOGY PROGRAM NEEDS.

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Topic#: 91-143 ID#: 91PAH-687
Office: PL/OLAH
Contract #: F04701-91-C-0040
PI: JOHN A. KOSEK, PH.D.

Title: DEVELOPMENT OF A NOVEL ELECTROCHEMICAL HYDRAZINE SENSOR

Abstract: THE DEVELOPMENT OF A RELIABLE, INEXPENSIVE, COMPACT SENSOR CAPABLE OF DETECTING 10 PPB UNSYMMETRICAL DIMETHYLHYDRAZINE, HYDRAZINE, AND MONOMETHYLHYDRAZINE WITH A RESPONSE TIME OF 10 MINUTES OR LESS IS PROPOSED. DURING PHASE I OF THE PROPOSED PROGRAM WE WILL DEVELOP AN ELECTROCHEMICAL SENSOR CELL BASED ON A PERFLUOROCARBON ANION SOLID POLYMER ELECTROLYTE. NOVEL METHODS TO MINIMIZE INTERFERENCE FROM OTHER ATMOSPHERIC CONTAMINANTS WILL BE INVESTIGATED. A BREADBOARD PROTOTYPE SENSOR WILL BE FABRICATED AND TESTED TO ESTABLISH THAT THE SENSOR FULFILLS THE SENSITIVITY, SELECTIVITY, REPRODUCTIBILITY, RESPONSE TIME, AND STABILITY REQUIREMENTS FOR THE PROPOSED APPLICATION. THE PROJECTED COST OF THE UNIT IN PRODUCTION QUANTITIES IS EXPECTED TO BE LESS THAN \$200. FOR PERSONNEL PROTECTION, RELIABLE, SENSITIVE SENSORS ARE REQUIRED EVERYWHERE HYDRAZINE FUELS ARE MANUFACTURED, STORED, OR USED. GOVERNMENT APPLICATIONS INCLUDE MONITORING OF AIR FORCE ROCKET INSTALLATIONS AND NASA FACILITIES. COMMERCIALY, HYDRAZINE SENSORS ARE REQUIRED IN THE PLASTICS, AGRICULTURAL, AND PHARMACEUTICAL INDUSTRIES.

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Topic#: 91-003 ID#: 91MNP-071
Office: WL/MNPB
Contract #: F19628-91-C-0137
PI: MR LEONARD REYNOLDS

Title: MICROWAVE MONOLITHIC INTEGRATED CIRCUIT TECHNOLOGY FOR AIR TARGET FUZING

Abstract: Hittite Microwave Corporation has demonstrated a GaAs chip which performs complete RF functions of an FM-CW radar designed for proximity fuze applications in artillery-fired munitions. The RF assembly for this fuze integrated with a single-patch antenna is about the size of a five cent coin. This proposal outlines an approach to extend the MMIC technology to meet the requirements of RF sensors for air-target fuzing. Functional requirements for the RF head will be determined, and MMIC design modifications necessary to meet those requirements will be identified. MMIC design approaches to meet the RF circuit requirements in typical air-to-air missile fuzes are presented. The small size of the RF assembly along with its low production cost, provides a wide range of flexibility in the configuration of the missile RF package. One example of such flexibility is the option of using more than one RF sensor (operating in more than one frequency, if necessary) for amiable/directional warheads.

AIR FORCE ABSTRACTS OF SBIR PHASE I AWARDS

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Topic#: 91-035
Office: ROMELAB
Contract #:
PI: BARAK MOAZ

ID#: 91ROM-080

Title: ACTIVE PROGRAMMABLE MICROWAVE DIRECTIONAL COUPLER

Abstract: PHASED ARRAY RECEIVERS AND TRANSMITTERS, IT IS OFTEN NECESSARY TO IMPLEMENT A METHOD OF INDEPENDENTLY CONTROLLING THE AMPLITUDE OF THE SIGNAL RECEIVED FROM OR TRANSMITTED TO EACH ELEMENT. IN PRACTICAL TERMS, THIS REQUIREMENT MAY BE SATISFIED BY A DIRECTIONAL COUPLER WITH A VARIABLE COUPLING RATIO. FOR APPLICATIONS IN MODERN MULTI-FUNCTION ARRAY, THE COUPLER DESIGN IS ADDRESSED TO THE NEED TO DEVELOP AN MMIC PROGRAMMABLE DIRECTIONAL COUPLER. SOME PRELIMINARY ANALYSES OF A POSSIBLE COUPLER DESIGN ARE PRESENTED TO SHOW THE EXPECTED PERFORMANCE CHARACTERISTICS. A METHOD OF CONTROLLING THE GAIN OF A COUPLED OUTPUT USING SEGMENTED DUAL-GATE FETs IS ALSO PRESENTED. WITH THIS APPROACH, AMPLITUDE CONTROL OF OVER 30 dB IS PREDICTED WITH NEGLIGIBLE PHASE DISTORTION. THE PROPOSED PROGRAM PLAN INCLUDES A STUDY OF ALTERNATE DESIGN APPROACHES AND COMPLETE ANALYSIS AND DESIGN/LAYOUT OF THE SELECTED CIRCUIT TOPOLOGY, WHICH IS FULLY COMPATIBLE WITH MMIC-BASED ACTIVE T/R MODULES

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Topic#: 91-029
Office: ESD
Contract #:
PI: ROY L. EISENBERG

ID#: 91ESD-661

Title: AUTOMATED, BATTLEFIELD RADIO-FREQUENCY MANAGER

Abstract: OFF-THE-SHELF WORKSTATION TO ASSIST RADIO FREQUENCY MANAGERS WITH AUTOMATIC ASSIGNMENT/REASSIGNMENT OF OPERATING FREQUENCIES. PHASE I WILL RESULT IN A FUNCTIONAL DESCRIPTION AND IMPLEMENTATION CONCEPT BASED ON DEFINITION OF REQUIREMENTS AND INTEGRATION OF APPROPRIATE CAPABILITIES AVAILABLE AT ECAC.

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Topic#: 91-034
Office: ROMELAB
Contract #: F30602-91-C-0088
PI: K.R. MATIS

ID#: 91ROM-028

Title: EFFICIENT NETWORK MODELS

Abstract: PHASE I INVESTIGATION IS PROPOSED TO DEVELOP CONCEPTS, ARCHITECTURES AND SOFTWARE STRUCTURES FOR THE COMPUTATIONALLY EFFICIENT MODELING, ANALYSIS AND SIMULATION OF MILITARY COMMUNICATION NETWORKS. THIS SIMULATION STRUCTURE WILL BE BASED ON A LAYERED ARCHITECTURE AND WILL EMPLOY A HIERARCHIAL MODELING AND SIMULATION AT VARIOUS LEVELS OF DETAIL. APPROPRIATE COMPUTER-AIDED DESIGN/MODELING TOOLS WILL BE INVESTIGATED FOR FACILITATING THE CAPTURE OF HIGH-LEVEL NETWORK FUNCTION DESCRIPTIONS IN EXECUTABLE SIMULATION MODELS. THE RESULTS OF THIS PHASE I EFFORT SHOULD PROVIDE THE BASIS FOR EXPLICIT DEVELOPMENT OF A COMPREHENSIVE NETWORK SIMULATION SOFTWARE PACKAGE IN A PHASE II FOLLOW-ON.

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Topic#: 91-026
Office: ESD
Contract #:
PI: JAMES D. HODGE

ID#: 91ESD-663

Title: ELECTRICALLY SMALL VLF AND LF ANTENNAS UTILIZING HIGH TEMPERATURE SUPERCONDUCTING COMPONENTS

Abstract: THIS PROPOSAL DESCRIBES A PROGRAM TO DEVELOP COMPACT, MOBILE OR TRANSPORTABLE

AIR FORCE ABSTRACTS OF SBIR PHASE I AWARDS

VLF/LF ANTENNA SYSTEMS WITH ENHANCED PERFORMANCE CHARACTERISTICS DUE TO THE INCORPORATION OF ULTRA-LOW LOSS HIGH TEMPERATURE SUPERCONDUCTOR (HTSC) COMPONENTS. OUR PHASE I PROGRAM WILL FOCUS ON THE DEVELOPMENT OF VLF/LF ANTENNA DESIGNS WHICH CAN MOST ADVANTAGEOUSLY USE HTSC MATERIALS FABRICATED USING CURRENTLY AVAILABLE MATERIALS AND PROCESS TECHNOLOGY. THE VIABILITY OF THESE DESIGNS WILL BE EVALUATED BY FABRICATING AND TESTING SELECTED HTSC COMPONENTS FOR THESE ANTENNA SYSTEMS. PHASE II OF THE PROGRAM WILL INVOLVE THE OPTIMIZATION OF THE SELECTED DESIGN AND THE CONSTRUCTION OF A PROTOTYPE ANTENNA FOR USE IN AN ACTUAL COMMUNICATIONS SYSTEM.

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Topic#: 91-126 ID#: 91WML-426
Office: WL/ML
Contract #: F33615-91C-5726
PI: Dr. Jay S. Karmarker

Title: Concurrent Engineering

Abstract: The concurrent engineering methodology to be developed will be based on multi-attribute utility theory, facilitating a systematic tradeoff analysis. The methodology will be supported by an object-oriented database and an associated user friendly expert shell to enable easy augmentation of the underlying information architecture, as technology evolves or missing parameters come to light. The methodology will enable the integrated design of product, manufacturing and support processes with an emphasis on efficiency (e.g., design, processing), produce performance (e.g., functional, electrical, thermal), quality assessment (e.g., process, product, reliability), and cost (e.g., life cycle, repair). The use of an expert shell to access the object-oriented database will enable both the technology specialist (e.g., thermal expert) and the novice user to input data, design choices, and design rules into the system and extract appropriate results and consequences from the design workstation system. The application requirements and proof-of-concept candidates generated in Phase I will lead to the subsequent implementation of the suite of interactive tools and their demonstration in Phase II, in a cost-effective manner.

INRAD, INC.
181 LEGRAND AVE,
NORTHVALE, NJ 07647
Phone: (201) 767-1910

Topic#: 91-058 ID#: 91CES-252
Office: AFCESA
Contract #:
PI: DR. ZHENYU ZHANG

Title: PHOTOCATALYTIC DEGRADATION OF CHLORINATED AND NONCHLORINATED ORGANICS IN WATER

Abstract: THE WIDESPREAD PRESENCE OF CHLORINATED AND NONCHLORINATED ORGANICS IN BOTH NATURAL AND TREATED WATER AT MANY AIR FORCE BASES POSES A SERIOUS ENVIRONMENTAL AND HEALTH PROBLEM, SINCE SUCH UBIQUITOUS HALOCARBONS AS TRICHLOROETHYLENE (TCE) AND CHLOROPFORM ARE CARCINOGENIC AND/OR TOXIC. CURRENTLY, THE MOST COMMON TECHNOLOGIES FOR REMOVING ORGANICS FROM GROUNDWATER ARE ACTIVATED CARBON ADSORPTION AND COUNTERCURRENT STRIPPING. HOWEVER, THEY MERELY TRANSFER THE CONTAMINANTS FROM ONE PHASE TO ANOTHER AND REQUIRE ADDITIONAL OPERATIONS FOR ACTUAL CHEMICAL DESTRUCTION. WE PROPOSE TO UTILIZE THE CATALYTIC ACTIVITY OF THE SEMICONDUCTOR TiO_2 AND THE ION EXCHANGE PROPERTIES OF ZEOLITES TO PREPARE A ZEOLITE- TiO_2 FILM TO TRAP AND TO THEN PHOTOCHEMICALLY MINERALIZE TCE AND BENZENE INTO INNOCUOUS PRODUCTS SUCH AS CARBON DIOXIDE AND HYDROCHLORIC ACID. THE ZEOLITE- TiO_2 FILM WILL BE PREPARED BY A SOL GEL TECHNIQUE WITH TiO_2 SERVING AS A PHOTOCATALYST. ZEOLITES AID IN ION AND ORGANIC REMOVAL. THE EXPERIMENTAL SETUP IS DESIGNED IN SUCH A WAY THAT ONLY THE EMBEDDED ZEOLITE ALLOWS THE PERMEATION OF AQUEOUS SOLUTION. SUCH A DESIGN WILL ALLOW OUR SYSTEM TO TRAP AND PHOTOCATALYTICALLY MINERALIZE THE ORGANIC CONTAMINANTS IN AQUEOUS SOLUTION, ABSORBED ON A TiO_2 MATRIX AND TRAPPED IN THE EMBEDDED ZEOLITE.

INTEGRATED SENSORS, INC.
255 GENESEE STREET
UTICA, NY 13501

Topic#: 91-012 ID#: 91MNP-146
Office: WL/MNPB
Contract #:

AIR FORCE ABSTRACTS OF SBIR PHASE I AWARDS

Phone: (315) 798-1377

PI: MR JEFFREY C. BRANDSTADT

Title: INFRARED/RADIO FREQUENCY SENSOR DATA FUSION

Abstract: Single sensor missile trackers are subject to the limitations of their solitary sensor. It's been conjectured that the combination of complementary missile seekers will help combat seeker problems like glint, multi-path, jamming, flare deployment, IR clutter, body/plume separation, etc. Integrated Sensors, Inc., proposes a combined RF doppler and dual-band IR seeker system to realize some of the expected goals. The integrated seeker design uses independent sensor signal processing chains and a combined fusion tract processor. Use of the existing receiver design makes the system near-term realizable and relatively low cost/low risk. The fusion tracker is a combination of a multiple input Kalman filter and a Bayesian classifier. The filter generates a single track on each target and clutter point, while the classifier accepts inputs from all system components and makes the final target decision. The result is better acquisition range, insensitivity to track fracture, and more accurate stable track.

INTEGRATED SOFTWARE, INC.

P. O. BOX 060295

PALM BAY, FL 32906

Phone: (407) 984-1986

Title: ATLAS to Ada Software Compilation System

Abstract: It is proposed that Integrated Software, Inc., with its teammate Westinghouse, research and develop an innovative ATLAS to Ada Software Compilation System, for eventual inclusion in an ATLAS/Ada Based Environment for Test (ABET). The phase I project objectives are: 1) to determine the ATLAS to ABET Translator Requirements from the ABET System requirements and current ATE systems, 2) to determine the most appropriate ATLAS to ABET translator architecture to meet the translator and system requirements and 3) to produce a design, a phase II implementation plan and a phase III commercialization plan for a ATLAS to ABET translator.

Topic#: 91-071

ID#: 91ASD-775

Office: ASD

Contract #: F33657-91C-2188

PI: William O. Wavering

INTELLIGENT MACHINE TECH CORP.

2110 VALLEYCREST DRIVE

ARLINGTON, TX 76013

Phone: (817) 429-3615

Title: SMART AUTONOMOUS GUIDANCE TECHNOLOGY STUDY

Abstract: There is a growing need for smart autonomous air delivery of conventional munitions. Precision all-weather autonomous guidance is a fundamental building block for such systems. The proposed concept synthesis study will investigate an integrated visual-inertial guidance concept that combines imaging sensors and inertial components with image flow algorithms, information analysis algorithms and situation control guidance techniques. Adaptive mission management methods based on in-flight acquired information will be a major consideration in avoiding detection and interception. The baseline concept has the following primary elements: 1. Passive millimeter wave sensor components. 2. Low-cost inertial navigation components. 3. Binocular and quadocular scene tracking, ranging and mapping algorithms. 4. A spherical sea level earth model containing local terrain elevation reference data, gravity vector, and calendar time. 5. A multi-processor computer, with an object-oriented operation system and realtime software for signal processing, navigation and mission management. These elements will be integrated to achieve all-weather precision closed-loop terrain elevation tracking and navigation. Six degree-of-freedom (twelve parameter) flight tracking will be implemented, i.e. three position, three velocities, three attitude angles, and three attitude angular rates. The objective will be to achieve less than one meter position accuracy and less than one milliradian angular accuracy during all critical phases of the mission.

Topic#: 91-001

ID#: 91MNP-035

Office: WL/MNPB

Contract #:

PI: MR JAMES D. BILLINGSLEY

INVENTIVE DEVELOPMENT COMPANY

38 QUINCY AVENUE BELMONT SHORE

BELMONT SHORE, CA 90803

Phone: (213) 433-5597

Title: Advanced Coldplates for Line Replaceable Modules

Abstract: ADVANCED AVIONICS COOLING FOR LRM/IAR OBJECTIVE: Develop a more efficient COLDPLATE for application to the Line Replaceable Modules to reduce the operating junction temperatures, and in addition, Develop an LRM

Topic#: 91-078

ID#: 91ASD-617

Office: ASD

Contract #:

PI: R. Al Morrison

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compatible Integrated Avionics Rack (IAR) with a DISTRIBUTED COOLING SYSTEM for improved LRM reliability in retrofit applications. DESCRIPTION: The Avionics functional chips within the LRM's are more sensitive to high operating temperatures than older electronics and require more cooling per cubic inch of functional circuits. Materials and materials combinations are available to optimize the LRM Coldplate. Present materials, such as aluminum alloy, are providing adequate stiffness but at the expense of the weight, thermal conductivity and thermal coefficient of expansion (CTE). A new "tailored" material combination can improve on all of these characteristics and can be applied to the LRM at a reasonable cost. The main goals, however, are the lowering of the junction operating temperatures and the matching of the CTE to circuit board assemblies. Adequate reliability of the VHSIC type LRM's will require both a reduced thermal resistance within the LRM and a lower rack coldwall temperature than can be provided by existing aircraft ECS's. It may be feasible to develop a miniature Freon compressor/condenser system that can be built into a retrofit IAR that will provide the lower operating temperatures and that will only require additional engine driven electrical power.

KARTA TECHNOLOGY, INC.
1892 GRANDSTAND
SAN ANTONIO, TX 78238
Phone: (512) 785-3384

Topic#: 91-065 ID#: 91ARM-500
Office: ARMSTR
Contract #:
PI: DR JOHN SCHMALZEL

Title: Personal Noise Dosimeter

Abstract: An instrumentation system for capturing environmental noise and companion human responses associated with aircraft flight operations and firing ranges is proposed. Functions performed by the personal noise dosimeter (PND) include: (1) continuously monitor environmental noise with storage of acoustic transients exceeding preset thresholds, (2) recording of selected human responses; for example, motion, and (3) recording of query-response data sessions. Features of the PND include: (1) portable—can be unobtrusively worn, (2) low-power—can be used for extended periods before data must be transferred, and (3) simple—operation of PND units before, during, and after experiments is easy.

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1340 CENTRE STREET, SUITE 202
NEWTON, MA 02159
Phone: (617) 527-0054

Topic#: 91-178 ID#: 91BMO-958
Office: BMO/MYSP
Contract #:
PI: ILYA SCHILLER

Title: WEATHER PREDICTION FOR REENTRY TEST LAUNCH DECISIONS

Abstract: THE OBJECTIVES WILL BE: (1) AN ASSESSMENT OF EXISTING ANALYTICAL TOOLS FOR PREDICTING CLOUD-FREE FIELDS-OF-VIEWS (CFFOV) AND (2) A SPECIFICATION OF A NEW MODEL FOR IMPROVING CFFOV FORECASTS. A REVIEW OF EXISTING CLOUD MEASUREMENT AND MODELING EFFORTS WILL BE MADE. AN IMPROVED MODEL ('CFFOV PREDICTOR') BASED ON GENERALIZED, NONLINEAR TEMPORAL PREDICTION BY NEURAL NETWORKS TRAINED ON CFFOV DATA WILL BE SPECIFIED WITH A WORKSTATION, GRAPHICAL USER INTERFACE (GUI) AND OFF-THE-SHELF HARDWARE. PREDICTOR INPUTS WILL BE GROUND AND SATELLITE CLOUD DATA AND VERTICAL WIND PROFILES FROM SITES AT THE U.S. ARMY KWAJALEIN ATOLL (USAKA) AND NEIGHBORING ATOLLS. OUTPUTS WILL BE BEST CFFOV'S FOR A RANGE OF TIMES IN THE NEAR FUTURE. THE PREDICTOR WILL ESTIMATE CLOUD ALTITUDES, FRACTIONAL CLOUD COVER IN THE FOV'S AND TIME WINDOWS FOR CLEAR VIEWING. THUS IR VIEWING PLANS CAN BE MADE TO SEE THROUGH CLOUD DECKS IN THE NEAR FUTURE. GOVERNMENT BENEFITS WILL BE A REVIEW OF SKY COVERAGE DATA AND MODELS, A FEASIBILITY ASSESSMENT OF AN IMPROVED CFFOV PREDICTOR TO AID IR COLLECTION, GROUND-BASED LASER AND SATELLITE LASER COMMUNICATIONS. COMMERCIAL BENEFITS INCLUDE PREDICTING VISUAL FLIGHT RULE (VFR) CONDITIONS AND SOLAR INSOLATION FOR ALTERNATIVE ENERGY SITES. SHORT-TERM PREDICTION OF VISIBILITY WILL BENEFIT AIR TRAFFIC CONTROL TASKS. GROUND-BASED LASER DEFENSE SYSTEMS (E.G., SDIO PROGRAM) AND SATELLITE FOUND COMMUNICATIONS (E.G., SUBMARINE BLUE-GREEN LASER DATA LINKS) WILL OPERATE BETTER WITH RELIABLE PREDICTIONS OF CFFOV'S. LONG-TERM PREDICTION OF INSOLATION WILL ALLOW EVALUATION OF AVAILABLE SUNLIGHT FOR AGRICULTURAL NEEDS AND EXPOSURE TO UV RAYS.

AIR FORCE ABSTRACTS OF SBIR PHASE I AWARDS

L & W RESEARCH, INC.
UNIT J, 121 NORTH PLAINS INDUSTRIAL RD.
WALLINGFORD, CT 06492
Phone: (203) 949-0142

Topic#: 91-116 ID#: 91WML-417
Office: WL/ML
Contract #: F33615-91C-5629
PI: Paul H. Leek PhD.

Title: One MeV Precision X-Ray Generator

Abstract: Present X-Ray generators are available up to 420 kV constant potential. Above this energy linear accelerators are available from 2 MeV upwards. This proposal would investigate building a 1 MeV constant potential X-Ray generator. The generator would be single ended with possible interchangeable anodes and a choice of dispenser or microfocus cathodes. The high voltage supply would be stable and accurately measured, it would be variable over a wide range. An X-Ray generator of this energy and precision with a variable energy would be very useful for industrial CT scanners. It would also fill a gap in the currently available sources.

LASER PHOTONICS TECHNOLOGY, INC.
1576 SWEET HOME ROAD
AMHERST, NY 14221
Phone: (716) 636-3626

Topic#: 91-190 ID#: 91OSR-355
Office: AFOSR
Contract #: F49620-91-C-0035
PI: RYSZARD BYRZYNSKI

Title: SOL-GEL PROCESSED MULTIFUNCTIONAL ORGANIC POLYMER-INORGANIC OXIDE COMPOSITES FOR ELECTRONICS AND PHOTONICS

Abstract: Multifunctional material with unique optical, electronic and structural characteristics are becoming increasingly important for variety of military and commercial needs ranging from new types of protective coating to optical signal processing and recording. Molecular composites demonstrate enormous potential in practical applications because of their homogeneity and ability to precisely control their composition to achieve or enhance desired properties. A new class of sol-gel processed oxide glass/organic polymer composites have excellent intrinsic properties and tailorability to meet the requirements of a wide range of electronics and photonics devices. The proposed Phase I program focuses on: 1) design and fabrication of a novel class of materials by redox coupling and inorganic oxide and a conjugated polymer using the sol-gel processing technique; 2) development of their applications as a) conductive coating, b) nonlinear optical materials, and c) optical recording media. Under Phase II, the results of this program will be used as a foundation for further development of materials and processing for specific applications.

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Topic#: 91-167 ID#: 91PXP-866
Office: PL/XPPP
Contract #:
PI: DR. ZE'EV FEIT

Title: LEAD-SALT MATERIALS DEVELOPMENT FOR LONG WAVELENGTH DIODE LASER

Abstract: LEAD-SALTS HAVE BEEN THE ONLY SEMICONDUCTOR ALLOYS OF CAPABLE OF DIODE LASER EMISSION IN THE MID-INFRARED (3-30 UM). THESE DEVICES WERE HOMOSTRUCTURE DIFFUSED DIODE LASERS WHICH OPERATED CONTINUOUSLY ONLY AT CRYOGENIC TEMPERATURES. SUBSTANTIAL IMPROVEMENTS IN LEAD-SALT DIODE LASER PERFORMANCE HAVE BEEN REALIZED IN THE LAST DECADE FOLLOWING THE INTRODUCTION OF MOLECULAR BEAM EPITAXY (MBE) TECHNOLOGY. THE ABILITY TO CONTROL PRECISELY THE EPITAXIAL GROWTH ENABLED THE DEVELOPMENT OF BURIED DOUBLE HETEROSTRUCTURE AND QUANTUM WELL LASERS WITH CONTINUOUS OPERATION ABOVE 200 K. FURTHER PROGRESS IN LEAD-SALT TECHNOLOGY REQUIRES BOTH OPTIMIZATION OF DEVICE PARAMETERS AND IMPROVEMENT IN DEVICE PROCESSING. WE PROPOSE TO CONDUCT A COMPREHENSIVE THEORETICAL ANALYSIS WHICH WILL ENABLE US TO PREDICT THE TEMPERATURE LIMITS OF CONTINUOUS WAVE OPERATION WHILE DETERMINING OPTIMAL LASER PARAMETERS SUCH AS DOPING PROFILES, CLADDING LAYER COMPOSITION AND THICKNESS AND ACTIVE LAYER THICKNESS AND SHAPE. THESE PARAMETERS WILL BE DETERMINED BY CONDUCTING OPTIMIZATION CALCULATIONS ON THE MINORITY CARRIERS LIFETIME, INFLUENCE ON THE FREE CARRIER ABSORPTION ON MINORITY CARRIERS INJECTION LEVEL AND THE INFLUENCE OF THE THERMAL CONDUCTIVITY ON LAYER THICKNESS AND DEVICE STRUCTURE. THE STATE-OF-THE-ART LEAD-SALT LASER TECHNOLOGY WILL BE ANALYZED IN ORDER TO RECOMMEND MATERIAL PROCESSING IMPROVEMENTS INTENDED TO REDUCE DISLOCATIONS WHICH ARE MAJOR

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CONTRIBUTOR TO NONRADIATIVE RECOMBINATIONS AND THEREFORE TO LOW DIFFERENTIAL QUANTUM EFFICIENCIES. THE DEVELOPMENT OF MID-IR DIODE LASERS CAPABLE OF OPERATION AT OR NEAR ROOM TEMPERATURE WILL LEAD TO MANY APPLICATIONS WHICH HAVE BEEN PREVIOUSLY PRECLUDED BY STRINGENT CRYOGENIC COOLING REQUIREMENTS. THESE INCLUDE MILITARY APPLICATIONS IN THE AREAS OF COMMUNICATIONS, IR SENSING, AND IR SYSTEM TEST AND CALIBRATION. COMMERCIAL APPLICATIONS INCLUDE LOW COST, HIGH PERFORMANCE SYSTEMS FOR INDUSTRIAL AND AIR POLLUTION MONITORING, MEDICAL DIAGNOSTICS, AND OTHER ANALYTICAL APPLICATIONS. 9116703WE PROPOSE TO FABRICATE DOUBLE HETEROJUNCTION (DH) PBS/PBSSE/PBS LASER DIODES USING MOLECULAR BEAM EPITAXY (MBE).

LASERGENICS CORP.
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Topic#: 91-005 ID#: 91MNP-079
Office: WL/MNPB
Contract #:
PI: DR RICHARD SCHLECHT

Title: FIBER SENSORS FOR EXPLOSIVES TESTING

Abstract: Extremely harsh environments exist in explosives testing. In order to monitor key physical parameters in these environments, it will be necessary to develop new concepts in sensor design to measure such things as temperature and pressure. Present day sensors will not operate reliably in this environment. Fiber optic sensors offer a possible solution to this problem. However, present fibers of glass or silica are not able to withstand the temperatures and pressures that exist. LaserGenics Corporation is proposing to investigate single crystal fibers of ZrO₂ and ZrSiO₄ for this application. These materials can withstand the harsh environment that will exist in this research. We are proposing a unique approach that would allow temperature and pressure measurement with a single fiber optic. This concept will be tested during the Phase I effort. For the Phase II effort we will determine sensor and data transmission link design characteristics usable in explosive experiments and develop a breadboard system for test.

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Topic#: 91-115 ID#: 91WML-414
Office: WL/ML
Contract #: F33615-91C-5623
PI: Dr. Richard Schlecht

Title: High Temperature Fibers of YAG and ZrSiO₄ for Composites

Abstract: Ceramic composite materials for military systems offer performance, weight and cost advantages over competing materials. Increasing demands on the strength and temperature tolerance for these materials will require innovative approaches in composition and fabrication. Composite materials composed of single crystal whiskers show promising tensile strength but have proven difficult to grow and have not been produced in useful lengths. LaserGenics Corporation is proposing to investigate the growth of single crystal fibers of YAG and ZrSiO₄ by the laser-heated pedestal-growth technique. The melting point of YAG is 1970°C and that of ZrSiO₄ is 2820°C making them difficult to grow in any configuration. We have achieved initial success in growing both of these materials but in order to achieve commercially interesting lengths of these materials, the growth must be optimized. Fibers of these materials will be grown, their crystal structure and morphology characterized and strength measurements made during the Phase I effort. Growth of single crystal fibers of multi-meter lengths of these very high melting point materials, incorporation into ceramic matrix composites and the testing of these composites will be the basis of the Phase II effort.

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Topic#: 91-134 ID#: 91WFO-473
Office: WL/PO
Contract #: F33615-91C-2126
PI: Richard Schlecht

Title: Temperature and Strain Sensors of Single Crystal Fibers of YAG and Y₂O₃

Abstract: Accurate real-time monitoring of temperature and strain in turbine engine components under operating conditions will require new concepts in sensor design. Available sensor devices will not perform in these environments. Fiber optic sensors offer a possible solution but available fibers of glass or silica cannot withstand the extreme vibrations and temperatures experienced in this application. Moreover, these materials cannot tolerate the high temperatures and thermal shock that the fibers will

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experience in being embedded in a metal or ceramic. LaserGenics Corporation is proposing to investigate the use of single crystal fiber optics which can be used at high temperatures. Using our novel approach, we will investigate the feasibility of sensing strain forces and temperature with single crystal fibers of Y2O3 and YAG. This concept will be tested during the Phase I effort and a system will be developed, characterized and tested in an Air Force system during the Phase II program.

LYNNTECH, INC.

111 EAST 27TH STREET, SUITE 204

BRYAN, TX 77803

Phone: (409) 822-3149

Topic#: 91-058

ID#: 91CES-232

Office: AFCESA

Contract #:

PI: OLIVER J. MURPHY

Title: A NOVEL ADVANCED OZONATION PROCESS FOR THE DESTRUCTION OF CHLORINATED AND NON-CHLORINATED ORGANICS

Abstract: "ADVANCED OZONATION PROCESSES" (I.E., THE COMBINATION OF OZONE WITH HYDROGEN PEROXIDE OR UV LIGHT), HAVE APPLICATIONS TO THE REMOVAL OF ORGANIC POLLUTANTS FROM WATER. ONE OF THE MAIN BARRIERS TO IMPLEMENTING AOPS HAS BEEN THE HIGH CAPITAL AND OPERATING COSTS FOR OZONE GENERATION. LYNNTECH, INC., HAS DEVELOPED AN ELECTROCHEMICAL DEVICE FOR THE PAIRED SYNTHESIS OF OZONE AND HYDROGEN PEROXIDE FROM WATER AND OXYGEN IN A PROTON EXCHANGE MEMBRANE-BASED ELECTROCHEMICAL CELL. THIS PROCESS FOR GENERATING OXIDANTS ELECTROCHEMICALLY CAN ELIMINATE MANY OF THE PROBLEMS IN MAKING AOPS COMMERCIALY ATTRACTIVE. THE ADVANTAGES OF PAIRED ELECTROCHEMICAL SYNTHESIS OF O3 AND H2O2 IN ELECTROLYTE-FREE WATER INCLUDE; (A) LOWER OPERATING COSTS, AS TWO OXIDIZING AGENTS CAN BE OBTAINED FOR THE PRICE OF ONE; (B) LOWER INITIAL CAPITAL COSTS OF OZONE GENERATION; (C) THE ELIMINATION OF THE NEED FOR TRANSPORTATION AND STORAGE OF OXIDANTS BY GENERATING THEM ELECTROCHEMICALLY WITHIN WATER ON DEMAND AT AN AMOUNT THAT IS PROPORTIONAL TO THE WASTE CONCENTRATIONS, AND (D) THE PROCESS CAN GENERATE SIGNIFICANTLY HIGHER AQUEOUS PHASE OZONE CONCENTRATIONS THAN CAN BE OBTAINED USING TRADITIONAL METHODS OF OZONE FORMATION. RESEARCH WILL FOCUS ON DEVELOPMENT OF A LABORATORY TEST SYSTEM FOR WATER TREATMENT INCORPORATING THE ELECTROCHEMICAL DEVICE AND A UV-LIGHT REACTOR. TESTING WILL DEMONSTRATE THE FEASIBILITY OF THE SYSTEM FOR THE DESTRUCTION OF DISSOLVED CHLORINATED AND NON-CHLORINATED ORGANICS AND WILL PROVIDE PARAMETRIC DATA FOR SCALE-UP ACTIVITIES.

M. L. ENERGIA, INC.

P.O. BOX 1468,

PRINCETON, NJ 08542

Phone: (609) 799-7970

Topic#: 91-057

ID#: 91CES-224

Office: AFCESA

Contract #:

PI: DR MOSHE LAVID

Title: DISPOSAL OF CHLOROFLUOROCARBONS AND HALONS

Abstract: CHLOROFLUOROCARBONS (CFC) AND HALONS HAVE GREAT UTILITY AS REFRIGERANTS, FIRE SUPPRESSANTS, CLEANING AGENTS, SOLVENTS, PROPELLANTS AND CONSTITUENTS OF BLOWN FOAMS. HOWEVER, BECAUSE THEY POSE A SERIOUS THREAT TO THE STRATOSPHERIC OZONE LAYER THEY MUST BE REMOVED FROM SERVICE. MOREOVER, CURRENT INVENTORIES OF THESE COMPOUNDS IN STORAGE AND IN CONTAMINATED SITES MUST BE EFFICIENTLY CONVERTED TO ENVIRONMENTALLY BENIGN PRODUCTS. UNFORTUNATELY, SUCH A CONVERSION TECHNOLOGY DOES NOT YET EXIST. THIS PHASE I PROPOSAL OFFERS AN INNOVATIVE TECHNIQUE FOR CONVERTING HALOGENATED ORGANIC COMPOUNDS INTO HYDROGEN HALIDES AND USEFUL ORGANIC MATERIALS. THE PROCESS IS DESIGNATED PHOTO-THERMAL HYDRODEHALOGENATION (PTH). IT USES ULTRAVIOLET LIGHT TO PHOTO-CATALYZE DEHALOGENATION. LIGHT INITIATES CHAIN REACTIONS BY DISSOCIATING CARBON-HALOGEN BONDS. SUBSEQUENT RADICAL REACTIONS WITH HYDROGENOUS BATH GAS UNDER APPROPRIATE CONDITIONS LEAD TO THERMODYNAMICALLY AND KINETICALLY FAVORED PRODUCTS WHICH ARE ENVIRONMENTALLY ACCEPTABLE. PHASE I IS A FEASIBILITY STUDY TO DETERMINE EFFICIENCY AND COST EFFECTIVENESS OF PTH. TO THIS END, A DETAILED WORK PLAN CONSISTING OF FIVE TASKS IS PROPOSED. THE FIRST TASK IS CONSTRUCTION OF A FLOW REACTOR. TASKS #2-4 DEFINE THE PHOTO-THERMAL PARAMETERS, CONVERSION EFFICIENCY, AND PRODUCTS COMPOSITION AND DISTRIBUTION. THE FIFTH TASK IS A

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PRELIMINARY COST ANALYSIS. IF PHASE I IS SUCCESSFUL, A COMPREHENSIVE PHASE II WILL BRING THE TECHNOLOGY TO COMMERCIALIZATION.

**MACH I, INC.
340 EAST CHURCH ROAD
KING OF PRUSSIA, PA 19406
Phone: (215) 279-2340**

**Topic#: 91-013 ID#: 91MNP-152
Office: WL/MNPB
Contract #:
PI: MR ROBERT TAYLOR**

Title: SURFACTANT FOR PBX & TNT BASED SYSTEMS

Abstract: This project will identify and characterize candidate surfactants for use in two different explosives systems. The objective is to improve processability by reducing viscosity by better dispersion of the fillers. This will permit higher explosive filler loading (PBX and TNT) and/or improve the suspension of solids (TNT). This project has a high probability of success. The program will systematically select surfactants, judiciously screen and evaluate for viscosity reduction, and evaluate the best of these for compatibility and effect on binder mechanical properties. A good dispersant is likely to suspend well. PBXN-109 will be used as a prototype for PBX systems (using ammonium sulfate as RDX simulant). H-6 simulant will be used as a prototype for TNT systems. Better dispersion of particles with surfactants should give higher tensile properties and improved shock insensitivity, as cited in several references. The dispersants frequently act as bonding agents also.

**MALIBU RESEARCH ASSOC.
26670 AGOURA ROAD
CALABASAS, CA 91302
Phone: (818) 880-5494**

**Topic#: 91-011 ID#: 91MNP-139
Office: WL/MNPB
Contract #:
PI: DR GERALD E. POLLON**

Title: NEAR FIELD RF HL SIMULATION

Abstract: Malibu Research has recently developed a FLAPS phased-surface technique for construction of thin electromagnetic structures having the capability of scattering incident RF energy in specific preferred directions and patterns. The design is based on arrays of printed circuit dipoles. To date we have used this technique for construction of antennas and conformal reflectors. This technique, combined with the near-field or "compact range", antenna measurement concept is ideally suited for construction of a near-field, RF, hardware-in-the-loop simulation. Under this design microwave or MMW moving targets are projected onto a 4' x 8' (nominal) FLAPS phased-surface screen to generate the target trajectory scenarios. The illumination spot is collimated to a far-field plane wave (as in a compact range) and re-directed towards the seeker under test by the FLAPS phased surface. The nominal focal distance is 4 ft to 8 ft with a 3 ft to 6 ft illuminator distance, leading to a very compact facility. Under the proposed project a design and analysis of the specifics and trade-offs of such a near-field HIL microwave/MMW technique using the FLAPS phased surface will be carried out.

**MARTIN SYSTEMS, INC.
3 LOOMIS STREET
BEDFORD, MA 1730
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**Topic#: 91-029 ID#: 91ESD-659
Office: ESD
Contract #:
PI: FRANK R. ROBERTS**

Title: AUTOMATED, BATTLEFIELD, RADIO-FREQUENCY MANAGER

Abstract: THE PROPOSED APPROACH WILL AUTOMATE PRODUCTION OF FREQUENCY ASSIGNMENTS, GRAPHS OF SPECTRUM OCCUPANCY, AND PROBABILITIES OF SUCCESSFUL COMMUNICATION. OBTAINING THE NEEDED DATA AND PROCESSING IT TO OBTAIN FREQUENCIES WILL BE FULLY AUTOMATIC BUT WITH PROVISION FOR MANUAL OVERRIDE/MODIFICATION. ANALYSIS WILL BE PERFORMED TO DETERMINE THE FEASIBILITY OF IMPLEMENTING THE OPTIMUM PROCEDURES IN A COMPACT COMPUTER SUITABLE FOR BATTLEFIELD. IF SUCH IMPLEMENTATION IF THE FULL-BLOWN OPTIMUM APPROACH IS INFEASIBLE, A BEST POSSIBLE FALL-BACK IMPLEMENTATION WILL BE DEFINED, TOGETHER WITH AN INDICATION OF THE PERFORMANCE PENALTY.

**MATERIALS AND ELECTROCHEMICAL RESEARCH
7960 S. KOLH ROAD**

**Topic#: 91-075 ID#: 91ASD-606
Office: ASD**

AIR FORCE ABSTRACTS OF SBIR PHASE I AWARDS

TUCSON, AZ 85706
Phone: (602) 574-1980

Contract #:
PI: Sumit Guha

Title: Development of Aluminum Alloys for Use in - 900F Fastener Applications

Abstract: There is a chronic need for lighter yet stronger materials for both ambient and elevated temperature applications in both military and commercial sectors. One requirement is for a 900degF aluminum fastener compatible with aluminum and titanium alloys. Mechanical alloying/rapid solidification processing using intermetallic and spinal dispersions have demonstrated promise for increasing the service temperature capability of aluminum alloys. However, these alloying approaches limit the compositions and concentrations of dispersions obtainable. Based on the current understanding of strength retention in Hi-based superalloys to near their melting temperatures, aluminum base alloys with microstructures analogous to the Hi-base superalloys, consisting of a fine dispersion of ordered f.c.c. (or spinels) precipitates in the aluminum matrix, possibly in combination with other dispersoids like oxides, borides, carbides, etc. will be investigated. This approach achieves the combined effects of semi-coherent precipitate-matrix interfaces, anomalous strengthening (in case of L12-structured dispersoids) and pinning of grain boundaries against migration at high temperatures which will result in mechanical properties (strength, ductility, modulus, creep resistance, etc.) adequate for >900degF fastener applications. A unique but demonstrated plasma synthesis process developed at MER will afford generation of microstructures with compositions and concentrations of dispersoids heretofore unobtainable.

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Topic#: 91-156 ID#: 91PAA-793
Office: PL/OLAA
Contract #: F19628-91-C-0110
PI: TRIVENI N. UPADHYAY

Title: ADVANCED GLOBAL POSITIONING SYSTEM (GPS)

Abstract: WE HAVE PROPOSED AN ADVANCED MODULAR GPS RECEIVER ARCHITECTURE WHICH IS OPTIMIZED FOR PERFORMANCE, SIZE, AND POWER FOR SPACE-BASED NAVIGATION AND ATTITUDE DETERMINATION AND CONTROL. THE PROPOSED RECEIVER ARCHITECTURE OVERCOMES THE LIMITATIONS OF THE CONVENTIONAL GPS RECEIVERS AND PROVIDES A COST-EFFECTIVE SOLUTION TO THE TECHNOLOGY CHALLENGES. AN IMPORTANT INNOVATION INCORPORATED IN OUR ARCHITECTURE IS THE REAL-TIME RECONFIGURATION CAPABILITY IN RESPONSE TO FDI COMMANDS. THE PHASE I RESEARCH WILL EVALUATE THE PROPOSED ARCHITECTURE AND DETERMINE ITS FEASIBILITY TO MEET THE AIR FORCE OBJECTIVES. THE PROPOSED RECEIVER ARCHITECTURE WILL BE VALIDATED BY A PROTOTYPE RECEIVER HARDWARE IN PHASE II WHICH WILL IMPLEMENT THE CRITICAL TECHNOLOGIES. THE RESULTS OF THE PHASE II PROTOTYPE DEMONSTRATION WILL OFFER AN ADVANCED TECHNOLOGY BASE THAT CAN BE EXPLOITED BY THE AIR FORCE, NAVY, AND DARPA TO SUPPORT THEIR SPACE MISSIONS AT A REDUCED COST. THE POTENTIAL COMMERCIAL APPLICATIONS OF THIS RESEARCH WILL BE THE SPIN-OFF TO OTHER SPACE PROGRAMS. THE EUROPEAN SPACE AGENCY REPRESENTS A SIGNIFICANT COMMERCIAL BUSINESS OPPORTUNITY TO EXPLOIT THE GPS RECEIVER DEVELOPED UNDER THIS PROGRAM.

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Topic#: 91-025 ID#: 91ESD-620
Office: ESD
Contract #:
PI: DONALD B. WARMUTH

Title: TACTICAL COMPUTATION AND DISPLAY SYNCHRONIZATION SYSTEM

Abstract: PHASE ONE OF THE TACTICAL COMPUTATION AND DISPLAY SYNCHRONIZATION SYSTEM (TCADS) IS TO DETERMINE IF IT IS FEASIBLE TO DEVELOP A VIABLE CAPABILITY TO PROVIDE USERS AT GEOGRAPHICALLY DISPERSED FACILITIES WITH THE SAME COMPUTER GENERATED INFORMATION AND DISPLAYS WHILE DRAMATICALLY REDUCING THE LOAD REQUIREMENTS ON EXISTING COMMUNICATIONS. PHASE ONE WILL DETERMINE WHETHER THE TECHNOLOGY IS AVAILABLE TO PRODUCE SUCH A CAPABILITY AT A REASONABLE COST WITHIN A REASONABLE TIME AND STILL BE SUPPORTABLE IN THE FIELD. THE SECOND RESULT OF PHASE ONE WILL BE A FUNCTIONAL DESCRIPTION OF THE TCADS WHICH CAN BE USED AS THE SPECIFICATION FOR THE CONSTRUCTION OF A BASIC DEMONSTRATION MODEL OF THE TCADS IN PHASE ONE AND A FULL PROTOTYPE IN PHASE TWO. THE THIRD RESULT OF PHASE ONE WILL BE A WORKING BASIC DEMONSTRATION MODEL. THE FOURTH RESULT WILL BE AN IMPLEMENTATION CONCEPT

AIR FORCE ABSTRACTS OF SBIR PHASE I AWARDS

FOR THE TCADS. THIS CONCEPT PLAN WILL INCLUDE A PROPOSED PLAN FOR THE DEVELOPMENT AND TESTING OF FULL PROTOTYPES DURING PHASE TWO, AN INITIAL PRODUCTION PLAN FOR MOVING THE TCADS INTO FULL SCALE PRODUCTION, AND AN INITIAL PLAN FOR THE FIELDING OF PRODUCTION VERSIONS.

**MEMBRANE TECHNOLOGY AND RESEARCH, INC.
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**Topic#: 91-060 ID#: 91ARM-445
Office: ARMSTR
Contract #:
PI: MR JURGEN KASCHEMEKAT**

Title: Waterfall Stripping Water-Treatment System

Abstract: Water curtains and waterfall stripping systems are widely used in painting operations. The water used in these systems becomes contaminated with particulates, paint solvents and metal ions. Current treatment technologies are inadequate and these waters have often to be sent to hazardous waste treatment facilities for disposal. This proposal describes the development of a combined filtration, reverse osmosis and pervaporation system to treat such waste streams. The unit would use a microprocessor control to switch between various operating modes to maximize water recycle and night time use of the treatment system. In this way, a small, economical system could be used to handle the flow produced by a large waterfall operation. The major technical innovations are the use of a pervaporation system for VOC removal and the microprocessor control unit.

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**Topic#: 91-187 ID#: 91BMO-023
Office: BMO/MYSP
Contract #:
PI: JURGEN KASCHEMEKAT**

Title: FREON-TYPE, SOLVENT-RECYCLING SPRAY BOOTH

Abstract: THIS PROPOSAL DESCRIBES THE DESIGN OF A SOLVENT SPRAY BOOTH THAT USES A MEMBRANE SYSTEM TO RECOVER AND RECYCLE SOLVENT. SOLVENT SPRAY CLEANING AND SOLVENT DEGREASING SYSTEMS ARE WIDELY USED IN A NUMBER OF CRITICAL CLEANING APPLICATIONS IN THE AEROSPACE INDUSTRY. CLEANING BOOTHS USE CFC-113, 1,1,1-TRICHLOROETHANE AND VARIOUS HCFC SOLVENTS. EMISSION OF THESE SOLVENT VAPORS TO THE ATMOSPHERE IS NO LONGER ACCEPTABLE. THE AIR FORCE IS INTERESTED IN DEVELOPING SOLVENT SPRAY BOOTH/VAPOR DEGREASER SYSTEMS THAT CONTAIN THE SOLVENTS AND CAN RECYCLE ANY VAPORS PRODUCED BACK TO THE SYSTEM. MEMBRANE TECHNOLOGY AND RESEARCH, INC. (MTR) HAS BEEN DEVELOPING MEMBRANE-BASED CFC/AIR SEPARATION SYSTEMS FOR SEVERAL YEARS AND HAS INSTALLED A NUMBER OF SMALL COMMERCIAL UNITS. THESE UNITS ARE ABLE TO REMOVE 98-99% OF CFC VAPORS FROM EFFLUENT AIR STREAMS, PRODUCING A CONCENTRATED CFC-CONTAINING PERMEATE STREAM THAT CAN BE RECYCLED. MTR BELIEVES THAT MEMBRANE-BASED SOLVENT RECOVERY UNITS OF THIS TYPE WOULD FORM AN IDEAL BASIS FOR THE ENVIRONMENTALLY ACCEPTABLE SYSTEMS THAT DOD REQUIRES. MEMBRANE TECHNOLOGY HAS MANY COMPELLING ADVANTAGES OVER CARBON ADSORPTION OR CRYOGENIC RECOVERY. IN THE PHASE I PORTION OF THIS PROGRAM, MTR PROPOSES TO SELECT AN EXISTING SPRAY BOOTH/VAPOR DEGREASER SYSTEM THAT CAN BE MODIFIED TO ACCEPT A TAILOR-MADE MEMBRANE SOLVENT RECOVERY AND RECYCLE SYSTEM. A COMPLETE DESIGN FOR THIS UNIT INCLUDING APPROPRIATE EMISSIONS MONITORING INSTRUMENTATION WILL BE PREPARED. IN THE PHASE II PROGRAM, THE COMPLETE UNIT WOULD BE CONSTRUCTED AND EVALUATED, FIRST IN THE LABORATORY AND LATER AT A DOD SITE. IT IS ESTIMATED THAT UP TO 300,000 TONS OF SOLVENT ARE EMITTED BY SOLVENT-CLEANING OPERATIONS ANNUALLY. A SPRAY BOOTH FITTED WITH MEMBRANE SYSTEMS TO ESSENTIALLY ELIMINATE SOLVENT EMISSIONS AND RECOVER THE SOLVENT FOR REUSE WOULD FIND NUMEROUS APPLICATIONS THROUGHOUT THE AEROSPACE, ELECTRONICS, PHARMACEUTICAL, AND OTHER "HIGH-TECH" INDUSTRIES.

**METROLASER
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**Topic#: 91-009 ID#: 91MNP-117
Office: WL/MNPB
Contract #:**

AIR FORCE ABSTRACTS OF SBIR PHASE I AWARDS

Phone: (714) 553-0688

PI: DR CECIL F. HESS

Title: MINIATURIZED PARTICLE CHARACTERIZATION SYSTEM

Abstract: This proposal describes a program to develop a system to measure the spatial and temporal distributions of particle size, liquid water content, and velocity at the engine inlet of advanced aircraft. The system uses miniaturized and rugged components which are capable of electronic focusing allowing it to measure the needed distribution across the inlet span without moving the probe itself. Automatic adjustment of the photodetector gain would result in a particle size dynamic range of 400:1. A second level of technology is also proposed to complement the probe measurements with instantaneous particle distribution everywhere in the inlet. A laser sheet would illuminate the engine inlet or any other cross section along the duct, and a 2-D miniaturized detector system would image the scattered light distribution onto a CCD array. The laser sheet measurements would provide qualitative and in some cases, quantitative comparisons of the droplet distribution anywhere in the duct, and would also indicate the most strategic locations to place the particle sizing probe. Phase I will include analytical and experimental research which define optimum strategies and test them on a breadboard under controlled conditions.

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Topic#: 91-015

ID#: 91MNP-159

Office: WL/MNPB

Contract #:

PI: DR JAMES D. TROLINGER

Title: DEV OF AN INTERFEROMETRY/TOMOGRAPHY DATA REDUCTION SYSTEM

Abstract: The object of the research is to produce an interferogram reduction system which will allow the comparison and integration of three dimensional experimental interferometric data with that derived from CFD codes. Interferometric techniques provide an important source of data in aeroballistic ranges; however, the available data reduction and interpretation methods are severely limiting in terms of their ability to provide quantitative information. New automated methods will be developed to extract data from the interferograms faster and more accurately and to determine three dimensional quantities using tomography. This project will evaluate available algorithms, software and hardware and will demonstrate the selected algorithms and software through application to experimental and computer-generated interferograms relevant to aeroballistics. The Phase I effort will bring the required expertise in aerodynamics, holography, interferometry, tomography, image processing, and software development to integrate innovative data acquisition schemes with state of the art data reduction and interpretation techniques.

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Phone: (714) 553-0688

Topic#: 91-101

ID#: 91WFI-690

Office: WL/FI

Contract #: F33615-91C-3003

PI: Dr. James D. Trolinger

Title: Optically Smart Surfaces for Wind Tunnel Measurements

Abstract: This is a proposal to develop a new diagnostics tool for wind tunnels called an optically smart surface. Optically smart surfaces are surfaces which have been prepared with specially chosen diffraction properties which allow them to augment the measurement of properties of the surface or of the environment around the surface. An optically smart surface is designed to receive a beam of light from a transmitter, to impress information of interest upon the light beam, and then to return it to a receiver which extracts the information. Possible measurements include velocity of gas over the surface, temperature, model detection, pressure, flow properties, skin friction, and others. The proposed research has three major divisions. The first shows how the diffraction properties of wind tunnel walls or models can be associated with aerodynamic properties of interest in wind tunnels. The second shows how the surface can be addressed by an illuminating beam and transfer desired information and carry it to a receiver. The third will determine how to physically produce the desired surfaces on wind tunnel or model surfaces to survive the tests. The emerging technologies of binary and holographic optics make optically smart surfaces possible. If successful, this research will lay the groundwork for a new class of instrumentation for wind tunnel testing.

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Topic#: 91-064

ID#: 91ARM-434

Office: ARMSTR

Contract #:

PI: MR JOHN PASOUR

Title: Development of an RF Current Monitor to Measure Currents Induced in the Human Body

AIR FORCE ABSTRACTS OF SBIR PHASE I AWARDS

Abstract: The goal of the proposed program is to develop a current monitor suitable for measuring RF currents induced in the human body. It has been found that currents of hundreds of milliamps can be induced in a standing human exposed to vertically-polarized RF electric fields at a level of 1 mW/cm² in the frequency range of tens of MHz. Large currents can also be induced when a human comes in contact with an ungrounded metallic object located in such an RF field. The monitor proposed for development in this program is designed to be used in either a research environment or in routine work environments to warn of hazardous current levels and to ensure compliance with safety regulations. The monitor can be worn around the ankle or other part of the body to continuously measure induced current levels. The monitor is designed to operate over a frequency range of 10 kHz to 100 MHz and to sense current levels from 1 mA to 1 A. During Phase I, we will design, fabricate, and test a prototype version of the current monitor in our laboratory. During the tests, the prototype will be optimized to achieve maximum bandwidth and sensitivity. The results of the laboratory tests will be used to design a complete, fieldable version of the current monitor, which will be developed and tested during Phase II. This monitor can be configured to provide a variety of information, e.g., an audible warning when a threshold level is exceeded and a measure of the average and peak current levels detected over a given period of time.

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Topic#: 91-093 ID#: 91WAA-054
Office: WL/AA
Contract #: F33615-91C-1757
PI: HERBERT L. HIRSCH

Title: MULTI-THREAT ENGAGEMENT SIMULATOR (MTES)

Abstract: MTL proposes to perform the preliminary design for a Multi-Threat engagement simulator (MTES), and to demonstrate the critical aspects of that design through simulation. The approach will be to utilize CM Characterization, proved and effective system for multi-spectral, multiple threat simulation. The CM Characterization technique will be embedded within a TMES system which will provide ready re-configuration, easy addition of new threats, and efficient interfacing to an electronic combat simulator, such as the integrated defensive Avionics Laboratory (IDAL) at WRDEC. State chart techniques, implemented through neural nets, cellular automated, or MIMD architectures will be considered as means for implementing the CM Characterization in real-time. As a part of the design effort, critical aspects of the design will be identified, simulated, tested and demonstrated, to ensure a low-risk design and subsequent implementation of the MTES.

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Topic#: 91-110 ID#: 91WKT-024
Office: WL/KT
Contract #:
PI: HERB HIRSCH

Title: RAPID FLIGHT LINE DETECTION OF DEGRADED ELECTRONIC COCKPIT INSTRUMENTS

Abstract: MTL Systems proposes to develop a rapid 'go-no-go' test method to provide flight-line assessment of performance degradation of both CRT and matrix cockpit displays. The Phase I program is structured to provide demonstration with low cost, commercially available equipment that: - Simple test patterns can be generated readily with content adequate for assessing displays degradation. - A realistic sensor such as a CCD video camera can be employed as the monitoring device. - Digital comparative processing can assess degradation by indicating differences between the input test pattern and the displayed image. The Phase I program will culminate in a well quantified design that can be utilized as the starting point in the Phase II Model System Development program.

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Topic#: 91-156 ID#: 91PAA-800
Office: PL/OLAA
Contract #: F19628-91-C-0090
PI: ALISON BROWN

Title: ADVANCED GPS RECEIVER FOR SPACE APPLICATIONS

Abstract: AN INNOVATIVE NEW RECEIVER ARCHITECTURE IS DESCRIBED IN THIS PROPOSAL FOR AN ADVANCED GPS RECEIVER DESIGN SUITABLE FOR SPACE APPLICATIONS. THE DESIGN ALLOWS FOR A SINGLE RECEIVER ARCHITECTURE TO BE EASILY ADAPTED FOR A VARIETY OF APPLICATIONS. THE AGR DESIGN PROPOSED INCLUDES THE CAPABILITY FOR HIGH-PRECISION SPACECRAFT NAVIGATION, TRACKING,

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ATTITUDE DETERMINATION, AND CAN BE EASILY ADAPTED TO IMPLEMENT A FAULT-TOLERANT GPS RECEIVER ARCHITECTURE. THE AGR DESIGN INCREASES THE RELIABILITY OF THE HARDWARE AND MINIMIZES THE RECEIVER SIZE THROUGH THE USE OF THE DIGITAL FRONT END (DFE) CHIP UNDER DEVELOPMENT BY JPL. A TRADE-STUDY WILL BE PERFORMED IN PHASE I ON THE RELATIVE MERITS OF PERFORMING THE GPS SIGNAL PROCESSING USING A CUSTOM GATE-ARRAY OR BY USING A HIGH SPEED MICROPROCESSOR. BENCHMARK TESTS PERFORMED BY NAVSYS HAVE DEMONSTRATED THAT THE I&O SIGNALS FROM A GPS RECEIVER CAN BE PROCESSED IN REAL-TIME USING CURRENT MICROPROCESSOR TECHNOLOGY. THE TRADE STUDY WILL RESOLVE WHETHER THE FIRMWARE OR SOFTWARE ARCHITECTURE WILL BEST MEET THE REQUIREMENTS OF FLEXIBILITY, ACCURACY, AND MINIMUM SIZE, WEIGHT, AND POWER. BASED ON THE RESULTS OF THE TRADE-STUDY, THE FINAL DESIGN FOR THE AGR WILL BE SELECTED AND A PROTOTYPE RECEIVER WILL BE CONSTRUCTED AND TESTED UNDER PHASE II. THE AGR DESIGN PROVIDES A HIGHLY FLEXIBLE RECEIVER ARCHITECTURE WHICH ALLOWS COMMON HARDWARE TO SERVE A WIDE VARIETY OF APPLICATIONS. BY TAKING ADVANTAGE OF RECENT TECHNOLOGY ADVANCES, THE SIZE AND WEIGHT OF THE RECEIVER HAVE BEEN REDUCED WITHOUT IMPACTING THE PERFORMANCE OR NUMBER OF CHANNELS. THE AGR DESIGN WILL BE IDEALLY SUITED TO MANY DOD AND COMMERCIAL SPACE PROGRAMS.

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Topic#: 91-171 ID#: 91WSM-882
Office: WSM/XP
Contract #:
PI: MARK A. STURZA

Title: MINIATURE GLOBAL POSITIONING SYSTEM (GPS) DIGITAL TRANSLATOR DEVELOPMENT

Abstract: GPS TRANSLATORS ARE CURRENTLY USED ON A NUMBER OF PROGRAMS FOR INSTRUMENTING MISSILE TESTS. TRANSLATORS ALLOW HIGH-DYNAMIC VEHICLES TO BE TRACKED THROUGH ACCELERATIONS UP TO 50 GS WHILE MINIMIZING THE SIZE, WEIGHT, AND COST OF THE EXPENDABLE FLIGHT HARDWARE. THE ANALOG NATURE OF EXISTING TRANSLATORS PREVENTS ENCRYPTION OF THE DOWNLINK SIGNAL AND REQUIRES HIGHLY COMPLEX AND COSTLY GROUND STATIONS. THE SIZE AND WEIGHT OF THE CURRENT TRANSLATORS PROHIBIT THEIR USE ON MANY APPLICATIONS. THE RAJPO BALLISTIC MISSILE TRANSLATOR (BMT) IS 40 CUBIC INCHES AND WEIGHS 5 POUNDS. UNDER THIS CONTRACT A MINIATURIZED DIGITAL TRANSLATOR WILL BE DEVELOPED. THE DIGITAL TRANSLATOR DESIGN TAKES ADVANTAGE OF CURRENT DIGITAL DEVICES TO FUNCTIONALLY SIMPLIFY THE GPS SIGNAL TRANSLATION. THE RESULTING DIGITAL DOWNLINK SIGNAL IS READABLY ENCRYPTABLE AND SUPPORTS THE DOWNLINK OF IRU OR TELEMETRY DATA. USING THIS APPROACH, A LOW-COST MINIATURE DIGITAL TRANSLATOR CAN BE DEVELOPED THAT CAN BE PACKAGED IN 4.25" X 2" X 0.5" (5 CUBIC INCHES) AND WEIGHS ONLY 10 OUNCES. THE TRANSLATOR CAN BE POWERED USING FOUR LITHIUM/MANGANESE DIOXIDE BATTERIES WHICH WOULD REQUIRE A FURTHER 2 CUBIC INCHES OF VOLUME AND WEIGH LESS THAN 2.5 OUNCES. THE LOW-COST, SMALL SIZE, AND LIGHT WEIGHT OF THE MINIATURE DIGITAL TRANSLATOR WILL MAKE IT IDEAL FOR USE IN A WIDE VARIETY OF MILITARY AND COMMERCIAL TRACKING APPLICATIONS. THESE INCLUDE DOD MISSILE TRACKING PROGRAMS, RADIOSONDES, SMALL PROJECTILES, SUCH AS BRILLIANT PEBBLES, AND SPACE-BASED SYSTEMS. THE DIGITAL DESIGN APPROACH SUPPORTS DATA ENCRYPTION, IRU DATA INCORPORATION, AND SIGNAL RECEPTION AT CONVENTIONAL TELEMETRY FACILITIES.

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Topic#: 91-173 ID#: 91WSM-888
Office: WSM/XP
Contract #:
PI: ALISON K. BROWN

Title: GPS RAWINSONDE DEVELOPMENT

Abstract: THE METEOROLOGICAL SOUNDING SYSTEM (MSS) USED BY THE NATIONAL RANGES USE A GROUND TRANSMITTING RANGING SYSTEM FOR SPACE POSITION LOCATION OF THE RADIOSONDE INSTRUMENT. SINCE THESE RADIOSONDES USE A BROAD BAND RECEIVER, MULTIPLE RADIOSONDE DEPLOYMENT AND OPERATION IN A GIVEN AREA IS NOT FEASIBLE. THESE RANGING RADIOSONDES ARE ALSO HIGHLY

AIR FORCE ABSTRACTS OF SBIR PHASE I AWARDS

SUSCEPTIBLE TO INTERFERENCE FROM OTHER RF SOURCES AT, OR NEAR, THEIR OPERATING FREQUENCY. SPACE POSITION DATA PROVIDED BY A NAVIGATIONAL AID SYSTEM (NAVAID), SUCH AS GPS, PROVIDES AN EXCELLENT SOLUTION TO THESE PROBLEMS. GPS IS THE BEST SOLUTION FOR SPACE POSITION DATA ACQUISITION OVER ALL OTHER NAVAID SYSTEMS BECAUSE IT IS OPERATIONAL WORLDWIDE, PROVIDES BETTER PRECISION, IS INDEPENDENT OF STATIONS OPERATED BY OTHER GOVERNMENTS, AND IS FREE OF INTERFERENCE FROM ATMOSPHERICS, ETC. NAVSYS CORPORATION HAS A PROPRIETARY DESIGN FOR A LOW-COST GPS SENSOR SUITABLE FOR RAWINSONDE APPLICATION. THIS SENSOR (TIDGET), WAS DEVELOPED WITH IN-HOUSE FUNDS FOR LOW-COST TRACKING APPLICATIONS AND CAN BE PACKAGED IN THE CURRENT MSS RADIOSONDE HOUSING. WITH THE TIDGET, THE GPS C/A CODE-PHASE IS MEASURED AND RELAYED TO THE MSS TO COMPUTE POSITION USING DATA FROM A GPS REFERENCE RECEIVER. OTHER DATA, THAT IS, PRESSURE, TEMPERATURE, HUMIDITY, AND WINDS WOULD BE PROCESSED IN THE NORMAL MANNER. UPPER ATMOSPHERIC OBSERVATIONS ARE REQUIRED WORLDWIDE IN SUPPORT OF TOTAL DOD REQUIREMENTS. CURRENTLY, THERE IS NO SYSTEM THAT WILL SUPPORT THE REQUIREMENTS OF GLOBAL COVERAGE, SILENT OPERATIONAL REQUIREMENTS, PRECISION, AND SIMPLICITY OF GROUND STATION EQUIPMENT. A GPS OPERATIONAL RAWINSONDE SYSTEM WOULD SATISFY TOTAL DOD REQUIREMENTS FROM MISSILE RANGE OPERATIONS TO BATTLEFIELD DEPLOYMENT. SUCH A SYSTEM WOULD ALSO SATISFY THE NATIONAL WEATHER SERVICE REQUIREMENTS FOR A COMPACT AUTOMATED SYSTEM TO SUPPORT THEIR OPERATIONS AT 100 UPPER AIR STATIONS. TOTAL U.S. RADIOSONDE REQUIREMENTS IS OVER 100,000 ANNUALLY. THIS QUANTITY SUPPORTS THE DEVELOPMENT OF A RELATIVELY LOW-COST GPS-TYPE RAWINSONDE SYSTEM.

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Topic#: 91-189 ID#: 91OSR-313
Office: APOSR
Contract #: F49620-91-C-0037
PI: DAVID NIXON

Title: A STUDY OF COMPRESSIBLE TURBULENCE

Abstract: Because of the resurgence of interest in hypersonic flight it is important to understand all of the flow phenomenon is turbulence at hypersonic speeds since there are strong implications that it is different from the widely studied turbulence at low speeds. It is proposed to perform a numerical simulation of a mixing layer with as high a convective Mach number as possible so as to delineate the characteristics of "hypersonic turbulence" as much as possible.

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Topic#: 91-102 ID#: 91WFI-688
Office: WL/FI
Contract #: F33615-91C-3403
PI: George F. Denehy Jr.

Title: In-Place Data Recorder for Aircraft Transparency Systems

Abstract: By utilizing magnetoresistive random access memory (MRAM) in combination with sensor technologies, NVE will design a complete data gathering and storage system for aircraft transparency systems which will record operational data during flight as well as during shipping and storage. Fabrication and assembly information can either be entered after manufacturing operations are complete, or during the manufacturing process. In addition, all maintenance activities will be recorded into the same system. All data may be accessed by a standard serial port to a DEC- or IBM-compatible system making the history readily available to all maintenance and reliability personnel. NVE's "Real Time Data acquisition and Maintenance Assistance System" (RTDMAS) will be installed in and remain in the transparency nodule. Using the highly reliable solid state approach of the MRAM technology with its inherent bit writable capabilities, unlimited endurance and excellent retentivity, NVE proposes to design a system that will allow the Air Force to store the complete relevant history of the Transparency system.

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Topic#: 91-162 ID#: 91PAA-815
Office: PL/OLAA
Contract #: F19628-91-C-0109
PI: DR. EDWARD M. TOMLINSON

AIR FORCE ABSTRACTS OF SBIR PHASE I AWARDS

Title: LASER TECHNOLOGY APPLICATIONS FOR DISSIPATION OF WARM FOG AT AIRFIELDS

Abstract: RESTRICTED VISIBILITY AT AIRPORTS CAUSED BY FOG SIGNIFICANTLY IMPACTS COMMERCIAL AND MILITARY AVIATION BY PRESENTING A HAZARD TO SAFE OPERATIONS AND BY IMPOSING ECONOMIC BURDENS. AT CRITICAL LOCATIONS IN THE FINAL APPROACH, TOUCHDOWN AND ROLLOUT PHASES OF LANDINGS, CLEAR AND UNOBSTRUCTED VISUAL CONTACT PROVIDES THE WIDEST MARGIN OF SAFETY. SOPHISTICATED AVIONICS HAVE ALLOWED THE INDUSTRY, TO SOME EXTENT, TO ADAPT TO VISIBILITY-REDUCING WEATHER ELEMENTS. VARIOUS TECHNIQUES TO ELIMINATE THE VISIBILITY RESTRICTION DUE TO WARM FOG HAVE BEEN INVESTIGATED, BUT NONE HAS PROVEN TECHNOLOGICALLY AND ECONOMICALLY VIABLE. RECENTLY, VERY SUCCESSFUL, EFFICIENT LASER DISSIPATION OF FOG IN A LABORATORY ENVIRONMENT WAS CARRIED OUT UNDER SDIO SPONSORSHIP. THE TECHNIQUE PRESENTS AN INNOVATIVE AND PRACTICAL APPROACH FOR ELIMINATING AIRPORT WARM FOG. A THOROUGH STUDY OF TRANSITIONING THE LABORATORY LASER DISSIPATION TECHNIQUE TO AIRFIELD APPLICATION WILL BE MADE IN PHASE I. WE WILL INVESTIGATE THE VARIOUS TYPES OF CLEARING LASERS AS WELL AS THE OPTIONS FOR ENERGY PRODUCTION TO PUMP THE LASERS. BOTH RADIATION AND ADVECTION FOGS WILL BE CONSIDERED USING SEVERAL DROP SIZE DISTRIBUTIONS FOR EACH TYPE. THE EFFECT OF THE LASER ENERGY WITHIN THE EFFECTED VOLUMES ON TEMPERATURE, RELATIVE HUMIDITY, TOTAL LIQUID WATER AND DROP SIZE DISTRIBUTIONS AS A FUNCTION OF TIME WILL BE INVESTIGATED. CONSIDERABLE DETAIL ON THE OPTICAL SYSTEM ARCHITECTURE SUCH AS BEAM CONTROL, LASER GAS HANDLING AND RELIABILITY THROUGH REDUNDANCY WILL BE ADDRESSED. AN ASSESSMENT WILL ALSO BE MADE OF THE POTENTIAL ENVIRONMENTAL IMPACTS AND SAFETY ASPECTS. LABORATORY EXPERIMENTS STRONGLY INDICATE THAT AN EFFECTIVE, PRACTICAL LASER FOG CLEARING SYSTEM IS POSSIBLE. GUIDED BY PHASE I RESEARCH, A DIRECTED ENERGY FOG DISSIPATION SYSTEM (DEFDS) WILL BE DEVELOPED AT THE SUB-SCALE PROTOTYPE LEVEL DURING PHASE II AND AT THE FULL-SCALE LEVEL DURING PHASE III. EXPRESSIONS OF FINANCIAL SUPPORT FOR BOTH PHASE II AND PHASE III EFFORT HAVE BEEN RECEIVED FROM KAMAN AEROSPACE.

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Topic#: 91-169 ID#: 91PXP-878
Office: PL/XPPP
Contract #:
PI: DR. RICHARD J. ADLER

Title: MULTI-WAVE CERENKOV GENERATOR STUDY

Abstract: WE PROPOSE TO INVESTIGATE MULTIWAVE CERENKOV MICROWAVE GENERATORS IN A COMPREHENSIVE PHASE I STUDY USING A TEAM MADE UP OF NORTH STAR RESEARCH CORPORATION AND DARTMOUTH COLLEGE. WE WILL PERFORM ANALYTIC AND NUMERICAL STUDIES OF MULTIWAVE STRUCTURES WITH EMPHASIS ON UNDERSTANDING THE RANGE OF OPTIMUM INTERACTION AND THE EFFECT OF THE BUNCHING REGIONS USED IN THESE STRUCTURES. THE BUNCHING LENGTH WILL BE STUDIED USING AN EXPERIMENT ON EXISTING HARDWARE AT DARTMOUTH IN ORDER TO VALIDATE THE THEORY. PHASE II EXPERIMENT DESIGN WILL BE BASED ON PERFORMANCE OF AN EXPERIMENT USING A 750 KV, 8 KA DRIVER WITH A 0.5 MICROSECOND PULSE LENGTH AND AN ANNULAR BEAM SUBJECT TO ANY REVELATIONS IN THE PHASE I PROGRAM.

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Topic#: 91-025 ID#: 91ROM-123
Office: ROMELABS
Contract #: F30602-91-C-0152
PI: JACQUES LUDMAN

Title: INDEX INTERFEROMETEP

Abstract: THE REFRACTIVE INDEX OF SCIENTIFIC MATERIALS IS OFTEN A VERY IMPORTANT PARAMETER. MANY CLASSICAL OR CONVENTIONAL TECHNIQUES FOR MEASURING INDEX OF MATERIALS REQUIRE COMPLICATED APPARATUS AND OFTEN REQUIRE SPECIAL SAMPLE PREPARATION, SUCH AS FABRICATING PRISMS OF THE MATERIAL. THIS MAY RENDER THE MATERIAL UNSUITABLE FOR USE, AS IN THE CASE WHERE IT MUST BE IN SLICES TO BE USEFUL. THIS NEW TECHNIQUE PERMITS THE DETERMINATION OF THE

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INDEX OF ANY SLICE OF MATERIAL, WITHOUT ANY SPECIAL SURFACE PREPARATION OTHER THAN SIMPLE POLISHING. THE TECHNIQUE IS ACCURATE TO FIVE SIGNIFICANT FIGURES AND PROVIDES THE INDEX AT ANY DESIRED WAVELENGTH, AS WELL AS A PROFILE OF THE INDEX OF THE ENTIRE SAMPLE. THE TECHNIQUE COMPARES THE FRINGE PATTERN FROM THE TOP SURFACE WITH THAT FROM A REFERENCE MIRROR TO DETERMINE THE THICKNESS. THEN, WITH THE AID OF A WHITE LIGHT SOURCE, THE INTERFERENCE PATTERN FROM THE BACK SURFACE IS COMPARED WITH THAT FROM THE FRONT TO YIELD THE OPTICAL THICKNESS OF THE SAMPLE. THE COMBINATION OF THE TWO MEASUREMENTS GIVES THE INDEX. THE BACK SURFACE FRINGE PATTERN ITSELF GIVES THE INDEX PROFILE.

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Topic#: 91-006 ID#: 91MNP-089
Office: WL/MNPB
Contract #:
PI: MR MAURICE V. THOMAS

Title: 3-D VOLUMETRIC LASER DISPLAY WORKSTATION FOR 3-D AERODYNAMIC FLOW-FIELD ANALYSIS

Abstract: Current volume rendering techniques for flow-field visualization rely on 3D graphic projections onto a two-dimensional CRT based display. This creates a serious problem because a comprehensive understanding of complex 3D aerodynamic data can only be obtained by analyzing it in a full 3D context. In addition, current analysis techniques do not fully utilize the capabilities of graphic workstations for interpreting and rendering a three-dimensional database. A new 3D volumetric laser display system and volume rendering techniques that exploit the capabilities of this display is proposed. The display system consists of a raster scan laser beam array which is modulated by a multiple channel acousto-optic modulator (AOM) and synchronized with a rotating translucent helix surface. A key feature of this display is that it can be viewed from all angles, with the naked eye. Display capabilities include high spatial resolution, multiple colors and realtime animation. Phase I effort will consist of a detailed design of the 3D laser display system interfaced to a graphic workstation. Volume rendering techniques that exploits the capabilities of this new display will be developed and their applicability to a representative subset of steady, three-dimensional, aerodynamic data will be demonstrated.

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Topic#: 91-060 ID#: 91ARM-444
Office: ARMSTR
Contract #:
PI: MR ROBERT J. EIN

Title: Development of a Medical Waste Disposal Processor System

Abstract: A Medical Waste Processor (MWP) is proposed to safely eliminate medical wastes generated at military and civilian health facilities. It will be designed to occupy minimum space, control sanitary conditions, and will provide a non-toxic recyclable bi-product. The MWP will satisfy present and projected environmental specifications for disposal of medical wastes. R&D will address the issue of optimizing all desirable properties as to disposition of medical wastes even in restrictive incinerator locations and conditions. For example, the MWP will not require special storage or handling of the generated bi-products. The system design will utilize new technology for fly-ash recovery processing along with low cost, high reliability, ease of construction and implementation. This R&D effort will optimize structural, safety, and sanitary requirements at the same time. Other properties requiring tradeoff optimization include: facility constraints, health, habitability, handling of the processed waste, size, weight and power requirements. Design will take into account conforming the system for shaping to minimize use of present incinerator interior spaces.

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Topic#: 91-095 ID#: 91WEL-020
Office: WL/EL
Contract #: F33615-91C-1737
PI: ANURAG CUPTA

Title: COMPUTER-AIDED DESIGN & SYNTHESIS SYSTEM FOR ELECTRONIC SYSTEM DESIGN

Abstract: There is a rapidly growing need for tools for the design and synthesis of electronic systems and multi-device circuits: to support greater clock speeds; packaging densities and circuit complexity; to enable designers to rapidly create and compare alternative design concepts; to eliminate multiple re-design cycles; and to enable reuse of prior design knowledge. There are

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no CAE tools commercially available today that meet the above needs. Based on eight years of previous, successful work in investigating and developing such tools, Omniview's project team members have developed the concept of Synthesis-by-Composition as the one most likely to succeed. The architecture of the proposed Design & Synthesis System based on this concept is composed of five major subsystems: a friendly User Interface; a Design Synthesis Engine; a Design Knowledge Repository; a Family of Design Advisors to Design Synthesis Engine; a Design Knowledge Repository; a Family of Design Advisors to Design Space Exploration, Packaging, Reliability, Testability, and Manufacturability/Cost; and a Design Partitioning Expert. System output can also be interfaced to available CAE/CAD tools, e.g., PC layout. Omniview's Phase I Technical Objectives are to demonstrate the feasibility of its overall system concept, to evaluate new subsystem concepts for Design Partitioning, and to complete the system architecture and specifications, leading to a Phase II implementation and demonstration plan that is highly likely to succeed. Omniview' Project team is one of the most experienced in the world in this specific area, based on its 20 man-years of direct, prior work and 20-plus publications, including six by the Principal Investigator. The team also has 30 years of additional, relevant, experience in BHD, simulation, high-density electronics packaging, testability, etc.

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Topic#: 91-046 ID#: 91ROM-093
Office: ROMELAB
Contract #: F30602-91-C-0086
PI: ROBERT F. KALMAN

Title: SEMICONDUCTOR OPTICAL AMPLIFIER INTERCONNECTS

Abstract: A SIGNIFICANT PROBLEM IN IMPLEMENTING OPTICAL INTERCONNECTS IS THE INHERENT ATTENUATION CAUSED BY THE SPLITTING AND COMBINING OF OPTICAL SIGNALS. ACTIVE INTERCONNECTS USING SEMICONDUCTOR OPTICAL AMPLIFIERS (SOAs) SHOW GREAT PROMISE FOR OVERCOMING THOSE INHERENT LOSSES, AND FOR IMPROVING INTERCONNECT SPEEDS FROM MEMORY, PROCESSORS AND DISPLAYS IN DIGITAL SIGNAL PROCESSING APPLICATIONS. HOWEVER, THESE DEVICES ARE CURRENTLY LIMITED BY INADEQUATE TECHNIQUES FOR INTERFACING THE DEVICES TO OPTICAL FIBER. OPTVISION PROPOSES A SYSTEMATIC APPROACH FOR INTERFACING ACTIVE OPTICAL INTERCONNECTS WITH SOAs, BASED ON (1) APPLICATION-DRIVEN INTERFACE PERFORMANCE SPECIFICATIONS, (2) A THEORETICAL ANALYSIS OF OPTICAL MODE MATCHING AND ALIGNMENT TOLERANCES, (3) SOA DEVICE MODELLING, TEST, EVALUATION, AND DESIGN, AND (4) PACKAGING DESIGN AND IMPLEMENTATION. THE APPROACH STRESSES THE DEVELOPMENT OF A FLEXIBLE PACKAGE DESIGN WHICH CAN BE APPLIED TO A WIDE VARIETY OF PROTOTYPE DEVICES AND CAN BE IMPLEMENTED AT THE PHOTONICS LABORATORY WITH RELATIVELY LOW CAPITAL COSTS. OPTVISION'S PREVIOUS ROLE IN MODELING, TEST, AND EVALUATION OF SOA INTERCONNECT DEVICES AT THE PHOTONICS LABORATORY, AND ITS ABILITY TO WORK WITH A NUMBER OF DEVICE MANUFACTURERS AND PACKAGING VENDORS ENABLES US TO EVOLVE AN ECLECTIC SOLUTION WHICH IS NOT CONSTRAINED BY ANY ONE PROPRIETARY DEVICE DESIGN OR PACKAGING TECHNIQUE.

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Topic#: 91-001 ID#: 91MNP-003
Office: WL/MNPB
Contract #:
PI: DR NAHUM GAT

Title: INTELLIGENT MISSILE SEEKER

Abstract: A novel concept of a miniaturized, rugged, permanently aligned, all-solid-state spectrometer sensor is proposed for a missile seeker. A set containing two or three such sensors can resolve the complete UV through IR spectrum of a source in the field-of-view. It is intended to demonstrate that this spectrum when processed via spectral-domain algorithms can produce a countermeasure-immune missile seeker with a target recognition/decoy rejection capabilities. The algorithm is based on a statistical pattern matching approach, using memory stored spectra of decoys and targets, possibly augmented by a heuristic knowledge system. Powerful digital signal processing or a neural network processor provides the speed required for a real-time system. The approach relies on mature technology making this a low-risk, high-payoff project. The primary emphasis is on the spectrometer sensor development with a secondary emphasis on the algorithm and processor architecture. The objectives of Phase I are to develop a list of performance and operational requirements, to conduct a top level conceptual design, and to

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prepare a hardware/software development plan for Phase II. In Phase II a breadboard design-verification and software-development system will be built, followed by a laboratory prototype fabrication for hardware-in-the-loop tests.

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Title: A MINIATURE SEPARATION SENSOR FOR WIND TUNNEL MODELS
Abstract:

Topic#: 91-021 ID#: 91AED-015
Office: AEDC
Contract #: F40600-91-C0011
PI: MICHAEL HERCHER

OPTRON SYSTEMS, INC.
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Phone: (617) 275-6100

Topic#: 91-025 ID#: 91ESD-610
Office: ESD
Contract #:
PI: THOMAS HORSKY

Title: HIGH DEFINITION MEMBRANE PROJECTION DISPLAY

Abstract: THE MPD SYSTEM MAKES USE OF OPTRON'S PROPRIETARY HIGH-DENSITY MULTI-CONDUCTOR CHARGE TRANSFER PLATE WHICH ENABLES AN ELECTRON-GUN-DEPOSITED CHARGE DISTRIBUTION TO ELECTROSTATICALLY DEFORM A HIGHLY REFLECTIVE METALLIZED MEMBRANE THAT IS STRETCHED OVER WELLS ETCHED INTO THE CHARGE TRANSFER PLATE. HIGH BRIGHTNESS AND MULTICOLOR IMAGE REGISTRATION ARE ACHIEVED. THE DEVICE OFFERS FLICKERLESS OPERATION BY VIRTUE OF THE FACT THAT OLD FRAMES ARE SIMPLY UPDATED ON A PIXEL BY PIXEL BASIS TO GENERATE NEW FRAMES, RATHER THAN BLANKING AND REWRITING ENTIRE FRAMES.

OR CONCEPTS APPLIED
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Topic#: 91-082 ID#: 91ASD-745
Office: ASD
Contract #: F33657-91C-2172
PI: DR. RUBIN JOHNSON

Title: FUTURE SYSTEM CONCEPTS AND RELATED, INNOVATIVE, ANALYSIS TOOLS: A DESKTOP ROUTE PLANNING TOOL

Abstract: We propose to demonstrate the feasibility of automated route planning algorithms fast enough and small enough for desktop analysis tools. We have developed innovative concepts in route planning that make it possible to avoid threats and terrain, perform masking analysis, and schedule sensors without time-consuming ray tracing algorithms. The routes generated optimize survivability weighted mission attainment measures.

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Topic#: 91-033 ID#: 91ROM-018
Office: ROMELAB
Contract #: F30602-91-C-0069
PI: JOEL PASLASKI

Title: HIGH MODULATION RATE WAVEGUIDE PHOTODIODES

Abstract: AT FREQUENCIES ABOVE 10 GHZ, CONVENTIONAL PHOTODIODES MUST SACRIFICE QUANTUM EFFICIENCY FOR SPEED SINCE THE THIN ACTIVE LAYERS REQUIRED DO NOT ABSORB ALL OF THE LIGHT PASSING THROUGH THEM. A WAVEGUIDE PHOTODIODE STRUCTURE ALLOWS ABSORPTION OVER A MUCH GREATER LENGTH ALONG THE ACTIVE LAYER THUS PROMISING BOTH SPEED AND EFFICIENCY. SUCH A PHOTODIODE REQUIRES A MORE SOPHISTICATED APPROACH FOR EFFICIENT COUPLING TO AN OPTICAL FIBER. WE PROPOSE TO DEMONSTRATE A FIBER-COUPLED PACKAGED WAVEGUIDE PHOTODIODE WITH AN EFFICIENCY OF >80% AND A 3 dB FLAT RESPONSE TO >20 GHz.

AIR FORCE ABSTRACTS OF SBIR PHASE I AWARDS

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Topic#: 91-147 ID#: 91PAH-732
Office: PL/OLAH
Contract #: F04701-91-C-0041
PI: MICHELE HINNRICHS

Title: INFRARED CLUTTER REJECTION AND TARGET IDENTIFICATION SENSOR SYSTEM

Abstract: IDENTIFICATION OF DISTANT, PASSIVE THREATS IN A COMBAT ENGAGEMENT WHERE LARGE CLUTTERED BACKGROUNDS ARE PRESENT IS OF MAJOR CONCERN TO INFRARED SENSOR SYSTEMS. THE IDENTIFICATION OF BOTH THREAT, FRIENDLY AND NEUTRAL, TARGETS IN A CLUTTERED SCENE ARE NECESSARY IN ORDER TO MAINTAIN THE ADDED EDGE NEEDED FOR SMART BATTLE MANAGEMENT AND SURVIVABILITY. IN MANY CASES THE DETECTION AND DECLARATION OF A DISTANT POINT CAN GIVE THE ADDED TIME TO MAKE AN INTELLIGENT RESPONSE OR NON-RESPONSE TO A SITUATION. IN THE SPACE COMBAT ENVIRONMENT THE THREATS SUCH AS AIRCRAFT, DECOYS, MISSILES, ETC., JUST TO NAME A FEW, HAVE UNIQUE SPECTRAL SIGNATURES. MEASUREMENT OF THESE SPECTRAL SIGNATURES WILL ALLOW POSITIVE IDENTIFICATION OF THE POTENTIAL OR NON-POTENTIAL THREAT. EARLY DETECTION OF THREATS USING INFRARED SENSORS IN A CLUTTERED ENVIRONMENT REQUIRES A HIGH SIGNAL TO CLUTTER NOISE RATIO, I.E., EFFECTIVE CLUTTER REJECTION. THREE GENERIC CLUTTER REJECTION TECHNIQUES THAT ARE USED ARE: (1) SPATIAL DISCRIMINATION, (2) SPECTRAL DISCRIMINATION, (3) TEMPORAL DISCRIMINATION. THE USE OF SPECTRAL ANALYSIS BESIDES BEING AN EFFECTIVE TECHNIQUE FOR IDENTIFICATION OF TARGETS ALSO ENABLES DIFFERENTIATION OF TARGET FROM CLUTTER. WE PROPOSE IN THIS SBIR TO INVESTIGATE THE FEASIBILITY OF USING A NEW INNOVATIVE TECHNIQUE. "POINT MULTI-SPECTRAL SENSING" (PMSS), FOR MEASURING THE SPECTRAL SIGNATURES OF DISTANT POINT-LIKE OBJECTS. THIS TECHNIQUE USES LIGHT WEIGHT INEXPENSIVE DIFFRACTION OPTICS, COUPLED WITH SIMPLE DIGITAL SIGNAL PROCESSING ALGORITHMS IMPLEMENTED WITH A PARALLEL PROCESSOR. THIS PROPOSED TECHNIQUE CAN IDENTIFY TARGETS AT RANGES COMPARABLE TO OR EXCEEDING THE RANGE AT WHICH THEY MAY BE DETECTED WITH MONOCHROMATIC INFRARED SURVEILLANCE AND WARNING SYSTEMS. THIS PROPOSED PROJECT HAS SEVERAL POTENTIAL USES FOR THE DOD IN THE AREA OF BALLISTIC MISSILE DEFENSE, NON-COOPERATIVE TARGET RECOGNITION (NCTR), RECONNAISSANCE, AND STRATEGIC MISSILE WARNING JUST TO NAME A FEW.

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Topic#: 91-052 ID#: 91CES-144
Office: AFCESA
Contract #:
PI: TILL W. LIEPMANN

Title: ROLLING DEFLECTION AND ELEVATION SENSOR

Abstract: AN INNOVATIVE, AUTOMATIC METHOD FOR RAPIDLY AND ACCURATELY MAPPING RUNWAY LOAD DEFLECTION TOPOGRAPHY IS PROPOSED. THIS TECHNIQUE FEATURES A STATIONARY PROPRIETARY ELEVATION REFERENCE AND ROVING SENSOR. THE SYSTEM MAPS THE DEFLECTION OF THE TESTED SURFACE USING A LOADED WHEEL. BECAUSE THE SYSTEM PROVIDES A LEVEL REFERENCE PLANE, DIRECT DEFLECTION MEASUREMENT OVER LARGE PORTIONS OF A RUNWAY CAN BE MEASURED IN A CONTINUOUS FASHION. THE ROVING SENSOR ACQUIRES ALL DEFLECTION AND POSITIONAL INFORMATION IN REAL-TIME FOR SUBSEQUENT ANALYSIS BY A STANDARD MICROCOMPUTER. THE FINAL OUTPUT IS USED FOR RUNWAY REPAIR QUALITY ASSESSMENT. THE LOADED SENSOR WHEEL ON THE ROVER CAN BE ADJUSTED TO SIMULATE A RANGE OF DEFLECTION LOADINGS. THE SENSOR COULD BE A SELF-PROPELLED AUTOMATIC ROBOT. THIS SYSTEM DIRECTLY MEASURES DEFLECTION (NOT RADIUS OR CURVATURE), IS LOW IN TECHNICAL RISK, AND COULD USE COMMERCIALY AVAILABLE COMPONENTS FOR A LOW COST-TO-DEVELOP SYSTEM.

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Topic#: 91-073 ID#: 91ASD-582
Office: ASD
Contract #:
PI: Mr. Sung Tark

AIR FORCE ABSTRACTS OF SBIR PHASE I AWARDS

Title: New Canopy/Windshield Design to Extend Life of Cockpit Displays

Abstract: A Phase I program is proposed to establish the feasibility of using photochromic dyes previously developed for thermal protection Systems to achieve passive solar control characteristics in aircraft cockpit transparencies. The photochromic response to sunlight would cause the transmittance of the transparency to vary with sunlight intensity. Light levels entering the cockpit under brilliant sunlight conditions would be reduced and the readability of CRT displays would be improved, eliminating the necessity of operating them at high power levels. The response of photochromic dyes incorporated into samples representative of selected aircraft transparency cross-sections will be subjected to realistic solar exposures and the transmittance responses will be measured and analyzed. The resultant compilation of data will provide a meaningful assessment of the feasibility of the approach. A test fixture for cyclical exposure of prepared samples to natural sunlight, along with the well-developed photochromic dyes and realistic host transparency design cross-sections will assure that the resultant conclusions are valid and will form a basis for Phase II activities. A Phase II program would extend the testing to include accelerated aging, physical property tests of laminated transparencies, efforts to verify compatibility of the dyes will full scale process conditions and analytical modeling of the optical responses.

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Topic#: 91-186 ID#: 91EMO-016
Office: BMO/MYSP
Contract #:
PI: PAULA M. GALLAGHER

Title: FREON (CFC-113) SOLVENT REPLACEMENT: A NEW PROCESS FOR PRECISION PARTS CLEANING

Abstract: THE PROPOSED PHASE I EFFORT INCLUDES A SURVEY AND ASSESSMENT OF CURRENT AND EMERGING CLEANING PROCESSES FOR GYROSCOPE COMPONENTS AND SIMILAR PRECISION PARTS THAT CAN MEET THE REQUIREMENTS OF THE U.S. AIR FORCE, AND AN EXPERIMENTAL PROGRAM ON A NEW PROCESS THAT EMPLOYS SUPERCRITICAL CARBON DIOXIDE TO DISSOLVE THE CONTAMINANT OILS AND A FLUOROCARBON/FLUOROETHER SURFACTANT TO REMOVE PARTICULATES NORMALLY ASSOCIATED WITH GYROSCOPE PARTS FROM THE MANUFACTURING PROCESS. CARBON DIOXIDE EXHIBITS OBVIOUS ENVIRONMENTAL ADVANTAGES OF SAFETY AND ACCEPTABILITY AND ITS ABILITY TO DISSOLVE EVERY OIL THAT IS ENUMERATED IN THE TOPIC DESCRIPTION PLACES IT IN THE FOREMOST POSITION OF THE EMERGING CFC- AND VOC-FREE CLEANING PROCESSES. THE PROPOSAL PRESENTS DATA ON THE SOLUBILITY OF THE OILS IN SUPER-GYROSCOPE PARTS CLEANING TESTS. THE ABILITY OF THE FLUOROCARBON/FLUOROETHER SURFACTANT TO REMOVE BOTH LOW AND HIGH DENSITY SUBMICRON PARTICULATES FROM BERYLLIUM PARTS, SILICON WAFERS, AND POLYMER SURFACES IS DETAILED, AND THE RESULTS PRESENTED POINT OUT THAT THE PHASE I TECHNICAL OBJECTIVES CAN EASILY BE MET. BECAUSE QUESTIONS OF THE ECONOMICS OF MANY NEW PROCESS ARE IMPORTANT FOR ASSESSING ITS VIABILITY RELATIVE TO COMPETING TECHNOLOGIES, THE PHASE I PROGRAM INVOLVES THE ASSESSMENT OF ECONOMICS OF A CLEANING FACILITY THAT PROCESSES PARTS OF A TYPE AND PRODUCTION RATE STIPULATED BY THE U.S. AIR FORCE CONTRACT MONITOR. THE RESULTS OF THE ECONOMIC ASSESSMENT COUPLED WITH THE ACHIEVEMENT OF TECHNICAL OBJECTIVES WILL ALSO POINT OUT THE MERITS OF A PHASE II PROGRAM. THE SUCCESSFUL COMPLETION OF PHASE I AND PHASE II EFFORTS WILL RESULT IN THE DEVELOPMENT OF AN ENVIRONMENTALLY ACCEPTABLE CLEANING PROCESS TO REPLACE CFC-113 FOR APPLICATION TO PRECISION PARTS CLEANING. AN OBJECTIVE ASSESSMENT OF ALTERNATIVE CLEANING TECHNOLOGIES ON PHASE I WILL ADD TO THE KNOWLEDGE BASE FOR ASSISTING BOTH INDUSTRIAL AND GOVERNMENT CONCERNS IN SELECTING TECHNICALLY AND ECONOMICALLY VIABLE CFC REPLACEMENTS.

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Topic#: 91-007 ID#: 91MNP-108
Office: WL/MNPB
Contract #:
PI: MR ROGER K. BUNTING

Title: INTERPENETRATING POLYMER NETWORK CAPACITORS

Abstract: This research is intended to determine the feasibility of fabricating high energy density capacitors by means of an ionic polymer membrane as electrolyte material and an electronically conducting polymer as electrode. The necessary high degree of surface area contact between electrode and electrolyte will be effected by intermixing the contacting surfaces to provide an

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interpenetrating polymer network. Techniques of preparing the interpenetrating polymer networks and characteristics of their electrical properties will be studied, and functional capacitors will be fabricated if the methods are proved successful.

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Topic#: 91-161 ID#: 91PAA-812
Office: PL/OLAA
Contract #: F19628-91-C-0096
PI: DR. WARREN P. MOSKOWITZ

Title: A TRANSPORTABLE LIDAR FOR DENSITY AND TEMPERATURE MEASUREMENTS TO 110 KM
Abstract: WE PROPOSE TO GENERATE THE DETAILED DESIGN FOR A LIDAR SYSTEM CAPABLE OF MEASURING THE RANGE RESOLVED ATMOSPHERIC DENSITY AND TEMPERATURE PROFILES TO 110KM. THE SYSTEM WILL BE DESIGNED TO OPERATE FROM THE GROUND AT REMOTE FIELD SITES. THE PROPOSED CONCEPT COMBINES A SODIUM FLUORESCENCE LIDAR, A RAYLEIGH LIDAR, AND A N2 VIBRATIONAL RAMAN LIDAR. THE RAYLEIGH AND RAMAN LIDARS ARE ALREADY OPERATIONAL IN THE GL HIGH ALTITUDE MOBILE LIDAR TRAILER. THE SODIUM FLUORESCENCE LIDAR REQUIRES THE MAJORITY OF THE INNOVATIVE DEVELOPMENT OF THE PROPOSED EFFORT. INTEGRATION OF THE THREE LIDARS, BOTH IN HARDWARE AND IN DATA ANALYSIS CONSTITUTES THE REMAINDER OF THE WORK. THE FLUORESCENCE LIDAR WILL NEED A PULSED, HIGH ENERGY, NARROW BANDWIDTH, TUNABLE DYE LASER TRANSMITTER, AND A NARROW BANDWIDTH RECEIVER. THE TRANSMITTER MUST BE CAPABLE OF SELECTIVELY EXCITING DIFFERENT REGIONS OF THE DOPPLER BROADENED HYPERFINE SPECTRUM OF MESOSPHERIC SODIUM. TUNING OF THE LASER WILL BE UNDER COMPUTER CONTROL, AND MUST BE RELIABLE ENOUGH FOR MANY HOURS OF UNINTERRUPTED DATA ACQUISITION. THE RECEIVER WILL BE EQUIPPED WITH A NEWLY DEVELOPED ATOMIC FILTER TO PROVIDE NARROW-BANDWIDTH, WIDE ANGULAR-ACCEPTANCE, AND HIGH QUANTUM EFFICIENCY. SUCCESSFUL COMPLETION OF THIS PHASE I STUDY WILL LEAD DIRECTLY TO THE CONSTRUCTION AND USE OF A POWERFUL, PORTABLE, HYBRID LIDAR SYSTEM CAPABLE OF MEASURING ROUTINELY AND CONTINUOUSLY A REGION OF THE ATMOSPHERE CURRENTLY ACCESSIBLE ONLY BY ROCKETS. IT IS ANTICIPATED THAT MULTIPLE COPIES OF THE RESULTANT COST-EFFICIENT SYSTEM COULD BE CONSTRUCTED FOR SIMULTANEOUS USE AT DIFFERENT LOCATIONS.

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Topic#: 91-027 ID#: 91ESD-649
Office: ESD
Contract #:
PI: EVA STRZELECKI

Title: A REMOTE HIGHLY SURVIVABLE, FIBER OPTIC SENSOR REPORTING SYSTEM
Abstract: PHYSICAL OPTICS CORPORATION (POC) PROPOSES A FIBER OPTIC SENSOR-REPORTING SYSTEM FOR DETECTING KNOWN CHEMICAL AND BIOLOGICAL AGENTS AT REMOTE LOCATIONS. THE FIBER OPTIC SYSTEM IS INSENSITIVE TO ELECTROMAGNETIC INTERFERENCE AND JAMMING WHICH WOULD RENDER A CONVENTIONAL ELECTRONIC OR RADIO TRANSMISSION SYSTEM MORE LIKELY TO FAIL. IT OFFERS VERY HIGH DATA CAPACITY AND CAN HANDLE A LARGE NUMBER OF SENSOR SIGNALS WITH VERY LOW CROSSTALK LEVELS. POC'S INNOVATIVE WAVELENGTH DIVISION MULTIPLEXING TECHNOLOGIES ARE CONSIDERED FOR THE SYSTEM DESIGN.

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Topic#: 91-038 ID#: 91ROM-051
Office: ROMELAB
Contract #: F19628-91-C-0164
PI: TIN AYE

Title: TERNARY AND QUATERNARY SPATIAL LIGHT MODULATORS BASED ON POLARIZATION HOLOGRAPHIC FABRY-PEROT SWITCHING
Abstract: PHYSICAL OPTICS CORPORATION (POC) PROPOSES A NOVEL 2-D SLM THAT IS: 1) ELECTRICALLY ADDRESSABLE; 2) PHASE DOMINANT; 3) POLARIZATION MODULATED AND; 4) HAS 3- AND 4-STATE ARCHITECTURE. THE SUCCESSFUL DESIGN OF AN SLM THAT SIMULTANEOUSLY SATISFIES ALL OF THESE

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FEATURES IS ACHIEVABLE USING THREE EXISTING POC TECHNOLOGIES; 1) HIGH-EFFICIENCY VOLUME HOLOGRAPHY; 2) COHERENTLY-COUPLED TUNABLE HOLOGRAPHIC FABRY-PEROT ETALONS AND; 3) BIREFRINGENCE DYE-POLYMER TECHNOLOGY. THE PROPOSED SLM CONSISTS OF A THIN LAYER OF LOW-VOLTAGE, FAST-SWITCHING ELECTROOPTIC MATERIAL (E.G., LIQUID CRYSTAL) SANDWICHED BETWEEN COHERENTLY-COUPLED, POLARIZATION-REFLECTION HOLOGRAMS (FORMING A FABRY-PEROT ETALON) ACTING AS A MEMORY STORAGE OF STATE VECTORS. WHEN A CHARACTERISTIC VOLTAGE IS APPLIED, A PARTICULAR STATE VECTOR IS RESONATED THROUGH FABRY-PEROT COUPLING AND IS RETRIEVED OR SWITCHED "ON". INDEPENDENT PHASE AND POLARIZATION MODULATIONS ARE POSSIBLE WITHOUT AFFECTING THE AMPLITUDE OF THE COHERENT OUTPUT BEAM BECAUSE RELATIVE PHASES BETWEEN STATES ARE HOLOGRAPHICALLY RECORDED IN A BIREFRINGENT MATERIAL. THE PROPOSED SLM SHOULD RESULT IN SUPERIOR PHASE UNIFORMITY, HIGH CONTRAST (> 1000:1) AND SNR, HIGH RESOLUTION (<20um), HIGH SPEED (<100us), LOW COST AND RUGGEDNESS. DURING PHASE I OF THIS PROJECT, POC WILL FABRICATE PROOF-OF-CONCEPT 4 x 4 PIXEL 3- AND 4-STATE SLM PROTOTYPES.

PHYSICAL OPTICS CORP.
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Topic#: 91-044 ID#: 91ROM-078
Office: ROMELAB
Contract #: F30602-91-C-0089
PI: GAJENDRA SAVANT

Title: A COHERENTLY-COUPLED MULTILAYER 3-D MEMORY BASED ON A VECTORIAL RECORDING MEDIUM
Abstract: PHYSICAL OPTICS CORPORATION (POC) PROPOSES TO INVESTIGATE POLARIZATION HOLOGRAPHIC COMPOUND COHERENTLY COUPLED (PHC3) MEDIUM FOR 3-D OPTICAL MEMORY. THE PHC3 MEDIUM IS A THICK STRUCTURE CAPABLE OF RECORDING, BY POLARIZATION VECTOR PHOTOINDUCED BIREFRINGENCE, POLARIZATION SELECTIVE HOLOGRAMS WITH GOOD RECORDING QUALITIES, HIGH DIFFRACTION EFFICIENCY, AND HIGH SELECTIVITY. INCORPORATING PHC3 MEDIUM INTO A NOVEL MULTILAYER PAGE ORIENTATED HOLOGRAPHIC MEMORY (MPOHM) ARCHITECTURE, POC IS PREPARED TO DEMONSTRATE THE FEASIBILITY OF A NEW 3-D OPTICAL MEMORY DEVICE. THE MPOHM CONCEPT IS THE FIRST TO SPATIALLY SEPARATE AND ACCESS HOLOGRAMS IN THREE DIMENSIONS. MEMORY LOCATIONS ARE ADDRESSED BY AN ACOUSTOOPTIC BEAM DEFLECTOR AND ELECTROOPTIC POLARIZATION SWITCHES. WITH AN ADDRESSING SPEED OF ONE MICROSECOND OR LESS, THE RANDOM ACCESS RATE APPROACHES AN IMPRESSIVE 1.0×10^{15} BYTES/SECOND. IN PHASE I, THE MEMORY MEDIUM PHC3 WILL BE OPTIMIZED AND DEMONSTRATED IN A MPOHM ARCHITECTURE. PHASE II WILL MAXIMIZE STORAGE CAPACITY AND ACCESS RATE OF THE MPOHM DEVICE.

PHYSICAL SCIENCES, INC.
20 NEW ENGLAND BUSINESS CENTER,
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Topic#: 91-057 ID#: 91CES-221
Office: AFCESA
Contract #:
PI: DR MARK E. FRASER

Title: DISPOSAL OF CHLOROFLUOROCARBONS BY DISCHARGE-INDUCED POLYMERIZATION
Abstract: CONVENTIONAL INCINERATOR COMBUSTION OF CHLOROFLUOROCARBONS AND HALONS PRODUCES AN EFFLUENT CONTAINING HALIDES AND UNCONSUMED FEED WHICH CANNOT BE SAFELY VENTED TO THE ATMOSPHERE. PHYSICAL SCIENCES INC. (PSI) PROPOSES TO DEVELOP A CLOSED SYSTEM DISCHARGE-INDUCED POLYMERIZATION TECHNIQUE SPECIFICALLY DESIGNED TO DISPOSE OF THESE COMPOUNDS SAFELY. THE TECHNIQUE INVOLVES PASSING THE COMPOUNDS THROUGH A DISCHARGE IN A REDUCING ENVIRONMENT TO FACILITATE POLYMERIZATION. THE DISCHARGE CONDITIONS WILL BE SPECIFICALLY OPTIMIZED TO MAXIMIZE POLYMER YIELD AND MINIMIZE TOXIC, GASEOUS BYPRODUCTS. THE GAS PRODUCTS THAT ARE PRODUCED WILL BE CRYOGENICALLY TRAPPED FOR CONVENTIONAL DISPOSAL. THE SOLID POLYMER PRODUCT MAY FIND USE IN A COMMERCIAL APPLICATION OR MAY BE DISPOSED IN A LANDFILL. THE GOAL OF THE PHASE I PROGRAM WILL BE TO DEMONSTRATE THE FEASIBILITY OF THE PROPOSED TECHNIQUE WITH A SIMPLE CAPACITIVE DISCHARGE. DECOMPOSITION EFFICIENCIES AND POLYMER FORMATION WILL BE DIRECTLY DETERMINED AS WELL AS THE YIELD OF OTHER GASEOUS PRODUCTS. ONCE THE PROOF-OF PRINCIPLE HAS BEEN ESTABLISHED, SCALE-UP OF THE

AIR FORCE ABSTRACTS OF SBIR PHASE I AWARDS

SYSTEM TO PROCESS A KILOGRAM OF MATERIAL IN A REASONABLE TIME FRAME WILL BE PERFORMED AS PART OF A PHASE II PROGRAM.

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Topic#: 91-144 ID#: 91PAH-694
Office: PL/OLAH
Contract #: F04701-91-C-0059
PI: DR. CHARLES T. BUTLER

Title: RETRIEVAL OF ATMOSPHERIC MOISTURE PROFILES FROM DMSP DATA WITH A NEURAL NETWORK
Abstract: THE PROPOSED STUDY WILL DEMONSTRATE THE FEASIBILITY OF USING A NEURAL NETWORK TO RETRIEVE ATMOSPHERIC MOISTURE, ONE OF THE ENVIRONMENTAL PARAMETERS DISCUSSED IN THE 1986 JOINT CHIEFS OF STAFF MEMORANDUM MJCS 154-86. PSI HAS ALREADY SHOWN THAT NEURAL NETWORKS ARE CAPABLE OF RETRIEVING TEMPERATURE PROFILES WITH HIGH ACCURACY FROM SATELLITE DATA, AND WORK BY OTHERS HAS SHOWN THAT CLOUD PARAMETERS CAN SIMILARLY BE OBTAINED USING NEURAL NETWORKS. BECAUSE NEURAL NETWORKS ARE INHERENTLY PATTERN PROCESSORS, THEY ARE EXCELLENT CANDIDATES TO PROCESS THE OUTPUTS OF SATELLITE-BORNE SOUNDERS. A NETWORK IMPLEMENTED ON A DESKTOP COMPUTER WILL BE TRAINED USING SIMULATED DMSP SOUNDING DATA GENERATED FROM RADIOSONDE MOISTURE AND TEMPERATURE MEASUREMENTS MADE OVER LAND AND OCEAN, IN TROPICAL THROUGH SUBARCTIC REGIONS, AND IN DIFFERENT SEASONS. IT WILL THEREAFTER BE ABLE TO QUICKLY SYNTHESIZE MOISTURE PROFILES FROM NEW SOUNDING DATA, EVEN IF THE DATA WERE COLLECTED UNDER CONDITIONS NOT CLOSELY MATCHING THOSE REPRESENTED IN THE TRAINING SET. PHASE I OF THE PROJECT WILL ESTABLISH THE FEASIBILITY AND ACCURACY OF THE METHOD. THE ULTIMATE GOAL OF LATER PHASES OF THE RESEARCH IS TO COMBINE INPUTS FROM SEVERAL TYPES OF SENSORS TO RETRIEVE, WITHOUT CUING, THREE-DIMENSIONAL MOISTURE AND TEMPERATURE PROFILES AND OTHER ATMOSPHERIC PARAMETERS SUCH AS CLOUD TYPE AND FRACTION, SURFACE EMISSIVITY, AND SURFACE TEMPERATURES IN REAL-TIME OVER LARGE GEOGRAPHIC AREAS USING ONLY A DESKTOP COMPUTER AND DATA OBTAINED BY DIRECT SATELLITE DOWN-LINK. SINCE THE METHOD IS INHERENTLY NONLINEAR AND REQUIRES ONLY A DESKTOP COMPUTER, IT SHOULD BE FASTER, LESS EXPENSIVE, AND MORE ACCURATE THAN CURRENT METHODS. IT CAN POTENTIALLY COMBINE INPUT FROM SEVERAL SENSORS TO RETRIEVE CONTOURS OF ATMOSPHERIC PARAMETERS OVER LARGE GEOGRAPHIC AREAS IN REAL-TIME. SUCH SYSTEMS WILL ALLOW PRIVATE WEATHER, AGRICULTURE, AVIATION, AND NEWS ORGANIZATIONS TO USE SATELLITE DATA IN REAL-TIME FOR LOCAL WEATHER FORECASTING.

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Topic#: 91-181 ID#: 91BMO-990
Office: BMO/MYSP
Contract #:
PI: VICTOR DICRISTINA

Title: ENHANCED HEATSHIELD CAPABILITY FOR MARV APPLICATION
Abstract: SEVERAL MATERIAL CONSTRUCTION CONCEPTS ARE PROPOSED FOR HIGH PERFORMANCE MANEUVERING REENTRY VEHICLE HEATSHIELD APPLICATIONS. RECENT ADVANCES IN HIGH TEMPERATURE RESINS, HIGH STRENGTH FIBERS, AND AUTOMATIC WEAVING TECHNIQUES TOGETHER WITH TAILORED PROCESSING METHODS PROVIDE THE BASIS FOR APPLICABLE DESIGN CONCEPTS. COMBINATIONS OF FIBER REINFORCED LOW DENSITY INSULATORS INTEGRATED INTO THREE-Dimensionally WOVEN ABLATORS USING HIGH STRENGTH FIBER PLACEMENTS FORM TYPICAL COMPOSITE STRUCTURES. THE GOAL IS TO DETERMINE THE REQUIREMENTS FOR AND DEVELOP THE ANALYTICAL CAPABILITY TO EVALUATE POTENTIAL MATERIAL COMPOSITE ARCHITECTURES WHICH WILL PERFORM AS EFFICIENT HP MARV HEATSHIELDS. PSI'S THERMAL ANALYZER CODES WILL BE EVALUATED AND MODIFIED TO OPERATE WITH A PC BASED CAD CODE TO PERFORM HEATSHIELD WEIGHT AND SIZING TRADEOFFS. PSI PROPOSES TO USE TEXTRON DEFENSE SYSTEMS AS A SUBCONTRACTOR TO PROVIDE SYSTEM REQUIREMENTS AND MATERIAL DESIGN SUPPORT IN PHASE I AND FOR MATERIAL FABRICATION AND TEST SUPPORT IN PHASE II. THE SUCCESSFUL COMPLETION OF THE PROPOSED EFFORT WILL PROVIDE THE ANALYTICAL PROCEDURES NEEDED TO EVALUATE THE THERMAL PERFORMANCE OF COMPOSITE HEATSHIELDS, THE DESIGN INPUT

AIR FORCE ABSTRACTS OF SBIR PHASE I AWARDS

REQUIREMENTS, AND CANDIDATE MATERIAL CONCEPTS APPLICABLE TO HIGH PERFORMANCE REENTRY VEHICLE APPLICATION.

PHYSICAL SCIENCES, INC.
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Phone: (508) 689-0003
Title: OPTICAL DIAGNOSTICS AND FUEL MIXING STUDIES FOR SUPERSONIC COMBUSTORS
Abstract:

Topic#: 91-200 ID#: 91ASD-701
Office: ASD/NAF
Contract #:
PI: TERENCE E. PARKER

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3325 TRIANA BOULEVARD, SUITE A
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Topic#: 91-116 ID#: 91WML-418
Office: WL/ML
Contract #: F33615-91C-5635
PI: David O'Hara

Title: A Neutron Beam Concentrating Optic for Neutron Radiography NDE

Abstract: Thermal and cold neutron radiography non-destructive evaluation (NDE) should have many advantages over x-ray radiography in aerospace applications. Unfortunately, the generation of thermal neutrons results in low beam flux and diffuse sources resulting in long exposure times and poor resolution. Physicon proposes the use of a novel optic to collimate and concentrate neutron beams which will lower exposure times and produce better resolution. This optic is based upon grazing incidence reflection from the channel walls of a bent microchannel plate. Such an optic would have a large aperture and small linear dimension perpendicular to the aperture plane. We expect to produce fluence gains of at least 10 with the prototype constructed in Phase I and higher gains in Phase II. The optic will also be able to produce a bright near point source of cold neutrons which will allow very high resolution imaging. We will construct the reflector from thin aluminum strips coated with a very thin, very smooth coat of nickel. The strips are wound on a tapered mandrel to form a spiral microchannel with a very high open area ratio and very smooth channel walls. Our spiral will then have its end faces shaped and the resulting device will act very much like a neutron lens. A concentrator/collimator of this sort will greatly enhance the capabilities of neutron radiography and make mobile radiography sources practical.

POTOMAC PHOTONICS, INC.
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LANHAM, MD 20706
Phone: (301) 459-3031

Topic#: 91-196 ID#: 91OSR-318
Office: AFOSR
Contract #: F49620-91-C-0040
PI: C. PAUL CHRISTENSEN

Title: COMPACT SELF-CONTAINED ARF LASERS

Abstract: A small, self-contained, waveguide ArF laser with microwave discharge excitation will be investigated. In the Phase I activity, emphasis will be upon identification of operating conditions that optimize the laser efficiency, evaluation of the potential average power capability of a waveguide ArF laser, and development of a miniature, integrated gas supply.

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Phone: (518) 383-1167

Topic#: 91-128 ID#: 91WFO-237
Office: WL/PO
Contract #: F33615-91C-2132
PI: DR PRADEEP K. GUPTA

Title: ANIMATED COMPUTER GRAPHICS MODELING OF ROLLING BEARINGS DYNAMICS

Abstract: An animated graphics model to simulate dynamic motions in rolling bearings is proposed. For a typical turbine engine ball bearing, and existing bearing dynamics computer program shall be used to obtain a real-time simulation of general motion of the bearing elements. This simulated motion shall then be used to compute fundamental coordinate transformations which will be applied on graphics segments, which contain the shape of bearing elements under consideration, to obtain an animated motion. In the proposed Phase I effort, two-dimensional graphic displays in a plane normal to the bearing axis shall be considered. This will provide an animated pictorial representation of the bearing from a view angle along the bearing axis. Both the cage and ball motions shall be considered, and the feasibility of the overall technical approach shall be demonstrated by the animated ball/cage

AIR FORCE ABSTRACTS OF SBIR PHASE I AWARDS

interactions and the resulting dynamic motions. Once the feasibility of the modeling approach is proven a more rigorous development of generalized three-dimensional motion with arbitrary view angles shall be considered in phase II. Aside from the general motion, these complex pictorial displays shall include temperature and stress contours in appropriate bearing elements at any point in time.

PRECISION MEASUREMENT COMPANY
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Phone: (313) 995-0041
Title: AIRCRAFT TIRE WEAR PREDICTION TECHNIQUES
Abstract:

Topic#: 91-197 ID#: 91ASD-698
Office: ASD/NAF
Contract #:
PI: SAMUEL K. CLARK

Q-DOT, INC.
1069 ELKTON DRIVE
COLORADO SPRINGS, CO 80907
Phone: (719) 590-1112

Topic#: 91-086 ID#: 91WAA-078
Office: WL/AA
Contract #:
PI: DAVID E. REED

Title: BURST COMMUNICATIONS LPI/JR SYSTEM ANALYSIS AND SYNTHESIS

Abstract: Q-DOT proposes the development of burst communication (BURSTCOMM) low probability of intercept/jamming resistant (LPI/JR) signals for low-rate data/voice line-of-sight communications between multiple aircraft. Performance measures will be developed and used to optimize the LPI/JR BURSTCOMM system. The study will include models for nonstationary noise and detector limitations and incorporate LPI and JR performance measures into simplified expressions which can be used for system design trades and scenario analyses. The signal design will take advantage of emerging modem technology to yield a significant advance in LPI/JR capability. Performance analyses, recommendations, and a Phase II development plan will be generated.

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KENT, WA 98032
Phone: (206) 872-9500
Title: DYNAMIC STRESS ANALYSIS FOR PROJECTILES
Abstract:

Topic#: 91-023 ID#: 91AED-030
Office: AEDC
Contract #: F40600-91-C0008
PI: ALAN C. MUELLER

QUEST INTEGRATED, INC.
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Phone: (206) 872-9500
Title: DYNAMIC MODEL TESTER
Abstract:

Topic#: 91-024 ID#: 91AED-041
Office: AEDC
Contract #: F40600-91-C0009
PI: JACK J. KOLLE

QUEST INTEGRATED, INC.
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Topic#: 91-052 ID#: 91CES-141
Office: AFCESA
Contract #:
PI: ROGER F. JOHNSON

Title: SENSOR TECHNOLOGY FOR ROLLING DEFLECTION MEASUREMENTS TO ASSESS THE REPAIR QUALITY OF BOMB-DAMAGED RUNWAYS

Abstract: A RUNWAY STIFFNESS MEASUREMENT SYSTEM WHICH APPLIES A KNOWN FORCE TO THE RUNWAY IS PROPOSED. THIS TECHNIQUE DYNAMICALLY MEASURES VERTICAL GROUND DISPLACEMENTS USING AN ELECTRO-OPTICAL HEIGHT SENSOR TO BE PROTOTYPE IN THIS WORK. THE DEVELOPED SYSTEM WILL BE

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COMPOSED OF A TRACTOR-DRIVEN ROLLING LOAD, A POSITION SENSITIVE LASER SENSOR MOUNTED ON THE AXLE OF THE TRACTOR, AND A SELF-LEVELING, ROTATING LASER BEAM FOR GENERATION OF A HORIZONTAL PLANE OF LIGHT. THIS PLANE OF LIGHT IS CONTINUOUSLY MAINTAINED IN THE LEVEL CONDITION. THE PHASE I EFFORT WILL CONCENTRATE ON DEVELOPMENT OF A HIGH SPEED POSITION SENSITIVE DIFFERENTIAL DETECTOR WHICH WILL MEASURE THE HEIGHT OF THE LASER BEAM ABOVE THE RUNWAY SURFACE WITH AN EXPECTED ACCURACY OF 0.001 INCHES. THE HORIZONTAL LASER PLANE SOURCE WILL BE A COMMERCIALY AVAILABLE DEVICE CAPABLE OF SCANNING THROUGH 360 DEGREES OF ARC.

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Topic#: 91-079 ID#: 91ASD-686
Office: ASD
Contract #: F33657-91C-2163
PI: DR. PETER LIU

Title: PORTABLE WIND SHEAR DETECTION AND WARNING SYSTEM FOR AERONAUTICAL MISSIONS

Abstract: The development of a portable wind shear detection and warning system (WSDWS) is proposed for improving the safety of aeronautical missions during takeoff and landing. The WSDWS will be an upgraded version of an existing patented system with emphasis on rapid deployment for military operations. The proposed system will include 10 to 15 stations installed alongside the runway at small or large airfields. Each station will be equipped with cup/vane or propeller/vane anemometers for wind measurements, at a minimum of 20 feet above ground level. The wind pattern near the ground will be derived from the measurements and displayed on video screens in aircraft cockpits and in the control tower. A visual display consisting a set of color-coded lights may be installed on each station as a backup system or for use in small or private airfields. The displayed wind information will include direction, speed, and wind shear. The heart of the WSDWS will be a microprocessor-based data acquisition and control system. The WSDWS with the on-board display would provide all-weather wind shear information to aircraft for safe takeoffs and landings. During Phase I, we will fabricate two scale models of WSDWS stations and conduct a series of field tests to demonstrate the performance of the WSDWS.

RADIATION MONITORING DEVICES, INC.
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WATERTOWN, MA 02172
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Topic#: 91-042 ID#: 91ROM-069
Office: ROMELAB
Contract #: F19628-91-C-0179
PI: PIERRE DE ROCHEMONT

Title: BRAGG-FILTERS USING HIGH-SCATTERING EFFICIENCY VOLUME HOLOGRAPHIC RECORDING GLASS

Abstract: IT HAS RECENTLY BEEN SHOWN THAT AMORPHOUS SOLIDS CAN BE UTILIZED AS VOLUME HOLOGRAPHIC RECORDING MEDIA USING SUFFICIENTLY INTENSE WRITE BEAMS AT APPROPRIATE WAVELENGTH(S). THE COMMERCIAL POTENTIAL FOR PASSIVE MICRO-OPTICAL COMPONENTS MANUFACTURED FROM THE GLASSY STATE IS SIGNIFICANT. GLASS CAN BE EASILY SHAPED, WORKED, READILY DRAWN INTO FIBER AND OTHER OPTICAL WAVEGUIDE STRUCTURES, AND VOLUME MANUFACTURED AT LOW COST. PERMANENT HOLOGRAPHIC GRATINGS INDUCED IN GLASS CAN BE OPTICALLY OR THERMALLY ERASED WITHOUT DAMAGING THE MATERIAL, SUGGESTING A POTENTIAL APPLICATION IN ALL-OPTICAL READ/WRITE ERASE THREE-DIMENSIONAL MEMORY ARCHITECTURES. IN ORDER TO TAP THE FULL POTENTIAL FOR BRAGG-FILTER DEVICES FABRICATED WITH GLASS A NUMBER OF CHALLENGES MUST BE OVERCOME. ORDER OF MAGNITUDE IMPROVEMENTS IN THE GRATINGS' SCATTERING EFFICIENCIES MUST BE ACHIEVED TO PRODUCE TECHNICALLY APPEALING PASSIVE OR ACTIVE OPTICAL COMPONENTS. UNFORTUNATELY, THE PHYSICAL MECHANISM(S) RESPONSIBLE FOR GRATING FORMATION AND RELATED PHENOMENA IN GLASS AND OPTICAL FIBER CANNOT BE READILY EXPLAINED USING CONVENTIONAL SOLID STATE OPTICS THEORY APPLIED TO CRYSTALLINE MATERIALS. THIS PROPOSAL ADDRESSES THOSE CHALLENGES BY REVIEWING AND IDENTIFYING PHYSICAL MECHANISMS ALREADY KNOWN TO PARTICIPATE IN GRATING INFORMATION. IT ADVANCES A NEW THEORY AND REPRESENTS RESEARCH IN A NEW FIELD OF SOLID STATE MATERIAL SCIENCE. AN EXPERIMENTAL PROGRAM IS PROPOSED TO CONCLUSIVELY DETERMINE THE VALIDITY OF THIS MODEL IN PHASE I.

AIR FORCE ABSTRACTS OF SBIR PHASE I AWARDS

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Topic#: 91-173
Office: WSM/XP
Contract #:
PI: RUSS JOHNSON

ID#: 91WSM-887

Title: RAWINSONDE SYSTEM WITH RADIO FREQUENCY REJECTION CAPABILITY

Abstract: CURRENT RAWINSONDE SYSTEMS (1990) ARE USED ON TEST RANGES TO MEASURE AND TELEMETER BALLOON POSITION, ALTITUDE, UPPER ATMOSPHERE WINDS, TEMPERATURE, RELATIVE HUMIDITY, AND BAROMETRIC PRESSURE. THE LORAN-C SIGNAL USED TO DETERMINE SONDE POSITION IS SUBJECT TO NATURALLY OCCURRING INTERFERENCE DURING STORM ACTIVITY. THE METEOROLOGICAL CHANNELS USED TO TELEMETER SONDE DATA TO THE GROUND ARE ALSO SUBJECT TO MAN-MADE AND NATURAL CO-CHANNEL AND ADJACENT CHANNEL INTERFERENCE. THE GPS NAVIGATIONAL SYSTEM IS IMMUNE TO INTERFERENCE AND IS HIGHLY ACCURATE. THE ARS SYSTEM WILL STUDY UTILIZING A GPS FRONT-END ON THE BALLOON AND GPS PROCESSING ON THE GROUND TO PRODUCE AN INEXPENSIVE, HIGHLY ACCURATE SYSTEM IMMUNE TO INTERFERENCE. THE GPS SIGNAL IS SNAPSHOT DIGITIZED AND TELEMETERED TO THE GROUND OVER EXISTING METEOROLOGICAL CHANNELS. THE GPS SIGNAL WILL BE PROCESSED BY THE GROUND PROCESSOR YIELDING INEXPENSIVE SONDE ELECTRONICS. INTERFERENCE CANCELLATION IS APPLIED TO THE METEOROLOGICAL CHANNEL AT THE GROUND RECEIVING STATION. THE ROBUST MORE PROPERTY RESTORAL BEAMSTEERING ALGORITHM IS UTILIZED TO ACHIEVE BLIND ADAPTIVE INTERFERENCE CANCELLATION WITHOUT THE NEED FOR CALIBRATION DATA OR SONDE DOA VECTORS. THE SYSTEM IS CAPABLE OF TRACKING MULTIPLE SONDES. THE INTERFERENCE CANCELLATION CONCEPTS DEVELOPED HERE SHOULD HAVE BROAD APPLICATION TO COMMERCIAL SYSTEMS. THE EXPLOSIVE GROWTH OF COMMERCIAL SATELLITE AND MOBILE/CELLULAR TELEPHONY SYSTEMS IN THE PAST DECADE HAS RESULTED IN INCREASED SPECTRAL CROWDING OVER MANY REGIONS OF THE ELECTROMAGNETIC SPECTRUM. THE USE OF THE SPATIAL INTERFERENCE CONCEPTS DEVELOPED HERE CAN BE DIRECTLY APPLIED TO THESE EXISTING SYSTEMS BY ADDING NEW RECEIVER FRONT ENDS.

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3304 WESTMILL DRIVE
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Topic#: 91-049
Office: ROMELAB
Contract #: F30602-91-C-0071
PI: JOE CLAYTON

ID#: 91ROM-116

Title: AUTOMATED VIBRATION AND THERMAL ANALYSIS OF ELECTRONIC DEVICES

Abstract: AN AUTOMATED VIBRATION AND THERMAL ASSESSMENT OF ELECTRONIC DEVICES USING CLOSED FORM PROCEDURES IS PROPOSED. IT WILL ADDRESS MECHANICAL DESIGN THAT IS CONSISTENT WITH SIMPLIFIED ANALYSIS. DESIGNS THAT DEPEND ON FUNDAMENTAL LARGE FEATURE WILL PASS THE ASSESSMENT. PROBLEM FEATURES CAN QUICKLY BE IDENTIFIED FOR A MORE FORMAL FINITE ELEMENT OR FINITE DIFFERENCE SCHEME TO SIMULATE ALL CONTRIBUTING EFFECTS FOR AN ACCEPTABLE CONFIGURATION. THE SIMPLIFIED ANALYTICAL TECHNIQUES WOULD BE USED WITH DATA INPUT BY AN INTERACTIVE COMPUTER FORMAT. PHASE I WILL DEMONSTRATE TECHNICAL PROOF OF CONCEPT USING A COMPUTER CODE THAT CARRIES OUT SIMPLIFIED DYNAMIC AND THERMAL ANALYSIS. PHASE II WILL DEVELOP A CODE THAT CAN ANALYZE A WIDE VARIETY OF ELECTRONIC DEVICES AND SUBSYSTEMS.

RESEARCH PARTNERSHIP
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Phone: (415) 494-8061
Title: MODEL LAUNCH LOAD TEST DEVICE
Abstract:

Topic#: 91-024
Office: AEDC
Contract #: F40600-91-C0012
PI: CHARLES A. POWERS

ID#: 91AED-040

AIR FORCE ABSTRACTS OF SBIR PHASE I AWARDS

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Topic#: 91-159 ID#: 91PAA-808
Office: PL/OLAA
Contract #: F19628-91-C-0108
PI: ROBERT F. CRABBS

Title: A BALLOON-BORNE SOLAR VECTOR MAGNETOGRAPH

Abstract: SOLAR FLARE PREDICTION IS A CRITICAL NEED FOR AIR FORCE SPACE AND COMMUNICATIONS OPERATIONS. THE KEY TO FLARE PREDICTION IS IN THE HIGHLY STRUCTURED MAGNETIC FIELDS PRECEDING FLARE ERUPTION. THE PROPOSED INSTRUMENT WILL ACHIEVE HIGH-SPATIAL-RESOLUTION MEASUREMENT OF THESE FIELDS BY OPERATION FROM A STRATOSPHERIC BALLOON, ABOVE THE DISTORTING EFFECTS OF THE EARTH'S ATMOSPHERE. THE PROPOSED SBIR PHASE I RESEARCH WILL DETERMINE THE FEASIBILITY OF ACHIEVING THE OPTICAL, MECHANICAL, AND ELECTRO-OPTIC STABILITY REQUIREMENTS OF A SOLAR VECTOR MAGNETOGRAPH TAKING LONG TIME EXPOSURES FROM A BALLOON PLATFORM UNDER SOLAR ILLUMINATION. THE PROPOSED BALLOON-BORNE, HIGH-RESOLUTION SOLAR VECTOR MAGNETOGRAPH WILL SUPPORT THE DEVELOPMENT OF AN UNDERSTANDING OF THE FORMATION OF FLARES WITH EXPERIMENTAL DATA FAR SUPERIOR TO ANY AVAILABLE FROM GROUND-BASED OBSERVATORIES. THE UNDERSTANDING WILL BE ESSENTIAL FOR THE DEVELOPMENT OF A FLARE PREDICTION CAPABILITY, WHICH IS NEEDED FOR THE PROTECTION OF SATELLITES, HUMANS IN SPACE, AND ELECTRICAL UTILITY DISTRIBUTION SYSTEMS.

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Topic#: 91-150 ID#: 91PAC-753
Office: PL/OLAC
Contract #:
PI: OLIVIER BARNOUIN

Title: CRITICAL TECHNOLOGY DEMONSTRATION OF PLASMA FOCUS TYPE MPD THRUSTER

Abstract: THIS PROJECT INVOLVES EXPERIMENTAL STUDIES WITH AN EXISTING 10-KJ GAS-INJECTED PLASMA FOCUS FACILITY INTENDED TO DEVELOP THE DATABASE NEEDED TO DESIGN AND BUILD AN OPTIMIZED 1-MJ FOCUS. THE ULTIMATE OBJECTIVE IS TO DEMONSTRATE THE FEASIBILITY AND ATTRACTIVENESS OF THIS CONCEPT FOR VERY HIGH SPECIFIC IMPULSE SPACE PROPULSION. THE FOCUS CONCEPT EMPLOYS JXB PLASMA ACCELERATION TO GENERATE THRUST IN A MANNER SIMILAR TO THE CONVENTIONAL MAGNETO PLASMA DYNAMIC (MPD) THRUSTER. HOWEVER, THE FOCUS HAS THE ADDED ADVANTAGE OF GENERATING ADDITIONAL THRUST FROM FUSION ENERGY RELEASED DURING THE PINCH PHASE OF THE ARC RUNDOWN. EXPERIMENTS PROPOSED INCLUDE STUDIES OF ELECTRODE DIMENSIONAL EFFECTS, VARIATION OF PERFORMANCE WITH OUTER ELECTRODE FLOW PASSAGE SIZE, AND ALTERNATE GAS INJECTION POINTS. A VARIETY OF DIAGNOSTICS WILL BE EMPLOYED TO MEASURE PLASMA PARAMETERS AND THE NET THRUST GENERATED BY THE ACCELERATED PLASMA. THE DATA WILL PROVIDE A PARAMETRIC BASIS FOR OPTIMIZING THRUST GENERATION AND FOR THE SCALE-UP TO LARGER ENERGY DEVICES. THIS PROJECT CAN DEMONSTRATE KEY TECHNOLOGY THAT IS ESSENTIAL FOR USE IN FUTURE DEEP SPACE MISSIONS. SUCH TECHNOLOGY COULD SIGNIFICANTLY SHORTEN TRIP TIMES COMPARED TO CONVENTIONAL PROPULSION CONCEPTS. THE THRUSTER TECHNOLOGY COULD PROVIDE PRIVATE COMPANIES WITH A MANUFACTURING OPPORTUNITY IN THE FUTURE ANALOGOUS TO JET ENGINE PRODUCTION FOR PRESENT AIRCRAFT.

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Topic#: 91-059 ID#: 91ARM-435
Office: ARMSTR
Contract #:
PI: MR PAUL G. RUDOLF

Title: Development of an "Intelligent" Remote Identification System

Abstract: The feasibility of constructing a device which can identify the shape of remote objects will be investigated. Current radar and sonar systems can provide only limited information about the target they have detected. The theory has been worked out for an apparatus which can identify targets through computer analysis of the reflected return. The device would work with microwaves or sound waves. This study will computer model systems to indicate the feasibility of implementation of that theory,

AIR FORCE ABSTRACTS OF SBIR PHASE I AWARDS

to determine what constraints will impinge on design, and to find the extent to which target identification can be delegated to artificial intelligence within the system.

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Phone: (603) 673-5831
Title: RARE EARTH PEROVSKITE SINGLE CRYSTAL RIBBON
Abstract:

Topic#: 91-037 ID#: 91ROM-041
Office: ROMELAB
Contract #: F19628-91-C-0163
PI: HERBERT E. BATES

SCHMIDT INSTRUMENTS, INC.
2476 BOLSOVER, SUITE 234,
HOUSTON, TX 77005
Phone: (713) 529-9040
Title: DISPOSAL OF CHLOROFLUOROCARBONS AND HALONS

Topic#: 91-057 ID#: 91CES-229
Office: AFCESA
Contract #:
PI: DONALD E. PATTERSON

Abstract: THIS PROPOSAL IS FOCUSED ON DEVELOPING A TECHNOLOGY THAT WILL PROVIDE FOR THE CONVERSION OF CFCs AND HALONS INTO ENVIRONMENTALLY BENIGN MATERIALS WHILE AT THE SAME TIME, PRODUCE NEW AND NOVEL MATERIALS WITH SIGNIFICANT MARKET VALUE, NAMELY, DIAMOND FILMS. THIS PROGRAM WILL EMPHASIZE THE CONVERSION OF CFCs AND HALONS INTO DIAMOND FILMS VIA A RECENTLY DEVELOPED TECHNIQUE EMPLOYING A HALOGEN-ASSISTED METHOD FOR CHEMICAL VAPOR DEPOSITION OF DIAMOND WHILE AT THE SAME TIME DISPOSING OF THESE MATERIALS AND ANY NOXIOUS BY-PRODUCTS

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Phone: (508) 371-2299
Title: ATMOSPHERIC WATER-VAPOR PROFILER

Topic#: 91-160 ID#: 91PAA-810
Office: PL/OLAA
Contract #: F19628-91-C-0101
PI: JOHN H. FLINT

Abstract: THE AIR FORCE HAS EXPRESSED AN INTEREST IN BEING ABLE TO MEASURE THE CONCENTRATION OF WATER VAPOR, AND OTHER GASES, IN THE ATMOSPHERE AT ALTITUDES BETWEEN 15 AND 90 KM. THE MEASUREMENT WOULD BE CONDUCTED DURING THE DESCENT PHASE OF A SMALL ROCKET FLIGHT. IN THE PHASE I OF THIS RESEARCH EFFORT, WE PROPOSE TO MAKE SEVERAL MEASUREMENTS THAT WILL ALLOW US TO DESIGN A WATER-VAPOR DETECTOR BASED ON A DIODE-LASER-PUMPED SOLID-STATE LASER. WE WILL USE EITHER A THULIUM LASER, WHICH IS CONTINUOUSLY TUNABLE FROM 1.85 μm TO OVER 2 μm , OR AN ERBIUM LASER, WHICH HAS SEVERAL EMISSION LINES BETWEEN 2.6 μm AND 2.9 μm . THE LASER WILL BE ALTERNATELY TUNED ON AND OFF A STRONG ABSORPTION LINE, AND BOTH THE SHIFTED FLUORESCENCE EXCITED BY THE LASER, AND THE BACKSCATTERED LIGHT AT THE LASER WAVELENGTH WILL BE COLLECTED. AT HIGH ALTITUDES, BOTH SIGNALS WILL BE DUE TO WATER-VAPOR FLUORESCENCE, AND THE H₂O CONCENTRATION WILL BE CALCULATED FROM THE INTENSITY. AT LOWER ALTITUDES, WHERE THE FLUORESCENCE IS QUENCHED, THE [H₂O] WILL BE CALCULATED FROM THE DIFFERENCE IN THE BACKSCATTERED INTENSITY WHEN THE LASER IS TUNED ON OR OFF THE ABSORPTION PEAK. MEASUREMENTS OF THE H₂O FLUORESCENCE QUANTUM YIELD AND RADIATIVE LIFETIME AS A FUNCTION OF PRESSURE, AND A DEMONSTRATION OF RAPID TUNING BETWEEN AN ABSORPTION PEAK AND MINIMUM WILL BE CONDUCTED. WE WILL ALSO EXAMINE APPROACHES BASED ON RAMAN SCATTERING AND FLUORESCENCE EXCITED BY ULTRA-VIOLET LIGHT. POTENTIAL APPLICATIONS INCLUDE SCIENTIFIC LASERS FOR SPECTROSCOPY, COMMERCIAL LASERS FOR PROCESS CONTROL, REMOTE SENSING OF AIR POLLUTANTS, AND BASIC INFORMATION USEFUL FOR THE MODELING OF THE CHEMISTRY OF THE UPPER ATMOSPHERE.

AIR FORCE ABSTRACTS OF SBIR PHASE I AWARDS

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Topic#: 91-090 ID#: 91WAA-061
Office: WL/AA
Contract #: F33615-91C-1770
PI: C.F. BUMAN & L.K.SHERMAN

Title: AIR-TO-AIR ANTI-RADIATION MISSILE (ARM) ELECTRONIC COUNTER-COUNTERMEASURE (ECCM)

Abstract: This program provides an approach to identify and evaluate Anti-Radiation Missile (ARM) Electronic Counter-Countermeasure (ECCM) techniques for developmental and planned Air Force radars to counter current and advanced hostile ARMs. The approach determine the vulnerability of Air Force airborne radars to projected threat ARMs, develops and evaluates radar ARM ECCM and Tactical ARM Countermeasure, and identifies advanced radar and sensor approaches to minimize the ARM's effectiveness. The technical approach consists of performing hostile ARM and candidate Air Force airborne radar characterization and radar vulnerability analysis to identify ARM ECCM requirements and advanced radar and sensor approaches to counter projected ARM threats. Trade off analyses will be performed to determine the effectiveness of candidate ARM ECCM which can be implemented within the radar's hardware and software configuration. Recommended ARM ECCM for Air Force airborne radars will be identified, and designs for advanced radar techniques and tactics to neutralize the projected and advanced ARMs will be developed.

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Topic#: 91-135 ID#: 91WFO-201
Office: WL/PO
Contract #: F33615-91C-2130
PI: DR DAVID V. ROSCOE

Title: ADVANCED SECONDARY GAS PATH METHODOLOGY

Abstract: An innovative approach is proposed to develop an inlet/fan compression system design methodology for those components for which the inlet and fan have a strong mutual interdependence and cannot be considered separately. The proposed Phase I/Phase II effort would be performed with SRA as the prime contractor and Teledyne CAE as a subcontractor. Under this program an existing state-of-the-art Navier-Stokes code would be extended via incorporation of an actuator model to represent fan blade forces. Solution of the Navier-Stokes equations for the duct flow with the actuator disk model would provide a solution for the duct flow including the effect of fan blade forces and inlet flow control via wall transpiration and suction. Under Phase I a geometry would be chosen, the actuator disk model would be incorporated into the existing code, a demonstration calculation run and an assessment would be made. Phase II would incorporate wall transpiration and suction, generalize the actuator disk model, possibly extend the computational procedure upstream of the inlet entrance plane and provide a user oriented workstation interface. In addition, the procedure would be used in the design of an inlet fan system for the Next Generation Cruise Missile and the design would be built and tested.

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Topic#: 91-195 ID#: 91OSR-262
Office: AFOSR
Contract #: F49620-91-0039
PI: RAMAN MEHRA SHAH MAHMOOD

Title: CLUTTER REJECTION SIGNAL PROCESSING

Abstract: Infrared sensors used for surveillance must be able to discriminate unresolved targets against a cluttered background which may contain clouds, sea or terrain. One of the important problems associated with this task is temporal processing in which the target movement relative to both background and foreground clutter is used to enhance detection probability. In this proposal, we present an integrated and powerful approach to this problem which has the potential to yield superior performance to current technology such as MTI. Current algorithms tend to be ad hoc, consisting of a cascade of processors which may work at cross purposes. A more suitable approach would be to combine motion detection and clutter reduction in a single step. We propose a probabilistic framework in which the image is modeled as a random field to be estimated in real time from noisy ambiguous measurements from multiple sensors. A Bayesian viewpoint is adopted, in which the prior knowledge is expressed as a probability distribution. Using a probabilistic description of the observation noise, the posterior distribution of the random field can be computed. These models are based on Markov random fields and the Gibbs distribution. Significantly, these assumptions lead to cooperative distribution algorithms which may be implemented on parallel processors. It is possible to model both piecewise continuous surfaces and the boundaries between smooth patches (targets, clouds, objects, e.g.). the parameters that appear in the reconstruction algorithms have a precise statistical interpretation which may be validated on physical grounds.

AIR FORCE ABSTRACTS OF SBIR PHASE I AWARDS

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Topic#: 91-109
Office: WL/KT
Contract #:
PI: JOHN M. HAMMER

ID#: 91WKT-018

Title: COCKPIT DESIGN FOR SUPER-MANEUVERABLE FIGHTER

Abstract: This proposal describes Search Technology's understanding of the challenges to providing controls and display support as part of the implementation of super maneuverability technology in advanced fighter aircraft. It describes what we believe to be the critical details of cockpit design criteria for fully exploiting super-maneuverable capabilities and achieving the technical objective of this research effort. A technical plan is offered that will identify pilot constrained control and display requirements for supporting and implementing super maneuverability and will develop design concepts that address the critical details of cockpit design technology for this application.

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Topic#: 91-142
Office: PL/OLAH
Contract #: F04701-91-C-0043
PI: ASIT K. ROY, PH.D.

ID#: 91PAH-679

Title: NEUTRALIZATION AND CHEMICAL DETOXIFICATION OF NITROGEN TETROXIDE SPILLS BY ACTIVE SILICEOUS SORBENTS

Abstract: THE OBJECTIVE OF THIS PROPOSED PROGRAM WILL BE TO SYNTHESIZE REACTIVE POROUS SILICEOUS SORBENTS CAPABLE OF COVERING THE SPILL OF LIQUID NITROGEN TETROXIDE, AND AT THE SAME TIME TO NEUTRALIZE/CHEMICALLY DESTROY IT. THE SORBENTS WILL CARRY ACTIVE FUNCTIONAL GROUPS SUCH AS ALIPHATIC AMINE, AROMATIC AMINE, HYDRAZIDE GROUPS, ETC. THE METHOD WILL BE INNOVATIVE IN THE SENSE THAT THE NEUTRALIZATION REACTION WILL MOST PROBABLY NOT BE VIGOROUS AND HYPERBOLIC, BECAUSE LOADINGS OF ACTIVE FUNCTIONAL GROUPS OR SORBENTS CAN BE EASILY CONTROLLED. SINCE POROUS SORBENTS WILL BE USED, THE LARGE SURFACE AREA WILL HELP IN COVERING THE SPILL AND THE VOLUME OF THE WASTE MATERIAL WILL BE MINIMAL. REACTIVE LIGANDS AND REAGENTS WILL BE BONDED TO SILICEOUS SORBENTS (CLAY, DIATOMACEOUS EARTH, POROUS SILICA, ETC.) BY SILANIZATION, POLYMERIZATION, AND ADSORPTIVE-CROSSLINKING REACTIONS. THE SYNTHESIZED SORBENTS WILL HAVE SUCH FUNCTIONAL GROUPS THAT WILL BE EASILY OXIDIZED AND/OR NITRATED BY N2O4. NEUTRALIZATION REACTIONS WILL PRODUCE NONFUMING SUBSTANCES. EACH SYNTHESIZED SORBENT WILL BE ANALYZED (ELEMENTAL AND FUNCTIONAL) AND TESTED FOR THEIR RESPECTIVE PROPERTIES. LAB-SCALE TESTING THE EFFICACY OF THE SORBENTS WITH N2O4 AND ANALYSIS OF WASTE MATERIAL (BY NAOH TITRATION, ETC.) WILL BE PERFORMED. THE PROPOSED ACTIVE POROUS SILICEOUS SORBENTS WILL NEUTRALIZE/CHEMICALLY DESTROY/SUPPRESS VAPOR EMISSIONS OF NITROGEN TETROXIDE WHICH IS USED AS AN OXIDIZER IN SPACE PROPULSION BY THE AIR FORCE. THE METHOD WILL BE EFFICIENT AND INNOVATIVE BECAUSE THE REMOVAL AND DISPOSAL OF THE WASTED MATERIAL WILL BE EASY. THE ACTIVE SORBENTS ALSO WILL BE USED BY MANUFACTURERS OF TOXIC CHEMICALS OR CHEMICAL PLANTS WHERE ANY TYPE OF NITROUS FUMES ARE GENERATED AS BY-PRODUCTS.

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Topic#: 91-022
Office: AEDC
Contract #: F40600-91-C0007
PI: GEORGE P. CHAMBERS

ID#: 91AED-018

Title: NOVEL HYDROGEN DETECTION SCHEME BASED ON CHANGES IN MAGNETIC SUSCEPTIBILITY

Abstract:

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Topic#: 91-084
Office: WL/AA
Contract #: F33615-91C-1755
PI: BRUCE M. HERBERT

ID#: 91WAA-032

AIR FORCE ABSTRACTS OF SBIR PHASE I AWARDS

Title: TECHNICAL PROPOSAL FOR THE DEVELOPMENT OF A TACTICAL MODEM FOR STEALTH COMMUNICATIONS

Abstract: Future tactical communication systems must employ modular modem architectures that support digital sampling rates up to 50 mhz, to process burst transmissions. They should be able to match the processing to the real received signals regardless of distortion introduced and have the ability to switch modulation format on the fly to counter an intelligent jamming environment. These requirements are in addition to the typical signal processing performed in modern digital communication systems such as Forward Error Correction (FEC) encoding and decoding, interleaving, encryption, burst detection and burst modulation/demodulation, etc. It is clear that these type of systems will levy stringent signal processing requirements on tactical communication systems of the future essentially dictating a system architecture which is capable of employing parallel signal processing. This proposal presents innovative approaches for rapidly developing a modem for stealth communications and construction a test bed which incorporates this modem for evaluating adaptive signal processing algorithms.

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Topic#: 91-158 ID#: 91PAA-805
Office: PL/OLAA
Contract #: F19628-91-C-0105
PI: GEORGE D. EMMITT

Title: LIDAR MAPPING OF CLOUD TOPS AND CLOUD TOP WINDS

Abstract: GROUND-BASED AND AIRBORNE PROGRAMS HAVE DEMONSTRATED THE POTENTIAL OF DOPPLER LIDARS TO MEASURE WINDS IN THE CLOUD-FREE REGIONS OF THE ATMOSPHERE. TO PROVIDE FULL TROPOSPHERIC WIND PROFILES FROM SPACE WOULD REQUIRE A VERY POWERFUL (10-20 J) AND A HEAVY LIDAR SYSTEM. ALTHOUGH A MORE MODEST SYSTEM WOULD BE LIMITED TO THE HIGHER BACKSCATTER REGIONS OF THE ATMOSPHERE (I.E., CLOUD TOPS, THIN CIRRUS LAYERS, THE PBL, DUST CLOUDS, ETC.) THE GLOBAL COVERAGE MAY STILL REPRESENT A SIGNIFICANT CONTRIBUTION TO IMPROVING WEATHER FORECAST AND DIAGNOSTIC SKILLS. USING OUR EXPERIENCE AND COMPUTER MODELS DEVELOPED IN A FEASIBILITY STUDY FOR A LARGE CO2 WIND SOUNDER, WE PROPOSE TO CONDUCT A PHASE I STUDY FOR A LOW POWER LIDAR SYSTEM TO BE USED TO MAP CLOUD TOPS AND MEASURE CLOUD TOP WINDS. THIS STUDY WILL RESULT IN: (1) SPECIFICATION OF PRELIMINARY SAMPLING REQUIREMENTS TO ACHIEVE VARIOUS LEVELS OF PERFORMANCE (LINE-OF-SIGHT ACCURACY, MEASUREMENT REPRESENTIVENESS); (2) A BASELINE DESIGN/CONFIGURATION (WAVELENGTH, POWER, PRF, SCAN ANGLE) OF A HIGH B SPACE-BASED DOPPLER LIDAR CLOUD TOP MAPPER/WIND MEASURING SYSTEM; AND (3) SPECIFICATION OF THE MISSION OBJECTIVES FOR A PHASE II AIRBORNE OBSERVATION PROGRAM NEEDED TO OPTIMIZE THE DESIGN OF THE HIGH B SENSOR. THE MOST LIKELY BENEFIT OF THE DEVELOPMENT OF A HIGH B SPACE-BASED DOPPLER LIDAR WIND SOUNDER WOULD BE IMPROVED WEATHER FORECASTING IN SUPPORT OF MILITARY OPERATIONS. DOD IS THE MOST PROBABLE AGENCY INTERESTED IN THIS CAPABILITY.

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Topic#: 91-085 ID#: 91WAA-033
Office: WL/AA
Contract #: F33615-91C-1753
PI: DR KAM SING TSO

Title: COMPLEXITY METRICS FOR AVIONICS SOFTWARE

Abstract: This research will integrate the most generally accepted software complexity metrics and extend them to avionics software. The extensions will address the additional features of multitasking, intertask communication, real-time constraints, and error recovery provisions that are present in Ada source code. It is hypothesized that this integration and these extensions will enable us to better measure the complexity of avionics software. In Phase I a tool, CMAS, will be developed which analyzes Ada source code for the metrics which are generally accepted within the research community. In Phase II, a full scale analysis of avionics software and other realtime Ada applications will be undertaken and carried to the design phase of the software lifecycle. The result of the research will be a versatile analysis tool coupled with a sound prediction methodology tailored to avionics software.

AIR FORCE ABSTRACTS OF SBIR PHASE I AWARDS

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Topic#: 91-151
Office: PL/OLAC
Contract #:
PI: ROBERT MORRIS

ID#: 91PAC-758

Title: SEMI-FLEXIBLE PHOTOVOLTAIC SOLAR ARRAY

Abstract: RECENT EFFORTS TO REDUCE THE MASS OF SOLAR ARRAY COMPONENTS HAVE CONCENTRATED ON TWO MAIN THEMES: IMPROVING SOLAR CELL EFFICIENCY, THEREBY REDUCING ARRAY AREA AND USING LIGHTER WEIGHT ARRAY SUBSTRATE MATERIALS. WITH THE CURRENT INTEREST IN LIGHTSATS FOR VARIOUS APPLICATIONS, A LOW MASS ARRAY SYSTEM IS DESIRABLE FOR SMALL POWER REQUIREMENTS. AT PRESENT, HIGH-EFFICIENCY SOLAR CELLS ARE TOO COSTLY FOR MANY MISSIONS. THE LIGHTWEIGHT ARRAY DESIGNS HAVE CONSISTED OF "FLEXIBLE" SUBSTRATES IN EITHER ROLLED (FRUSA AND HUBBLE ST), AND FLATPACK FOLD-OUT (SAFE AND APSA) CONFIGURATIONS. THE PRIMARY LIMITATIONS OF THESE DESIGNS FOR LOW-POWER APPLICATIONS IS THAT A LARGE STORAGE HOUSING AND DEPLOYMENT MECHANISM ARE REQUIRED. THESE LIMITATIONS MEAN THAT THESE ARRAY ARE ONLY LIGHTWEIGHT FOR HIGH POWER APPLICATIONS, >5KW. FOR SMALLER ARRAYS, THE LOWER MASS OF THE SUBSTRATE IS OVERWHELMED BY THE MECHANICAL HARDWARE'S MASS, WHICH IS GENERALLY NOT AS SCALABLE TO POWER AS THE BLANKET AREA. ALSO, BECAUSE OF STIFFENING RODS USED FOR LATERAL SUPPORT, QUICK RETRACTION IS VIRTUALLY IMPOSSIBLE, WHICH COULD HAVE SURVIVABILITY IMPLICATIONS. A MORE TRADITIONAL RIGID ARRAY IS FOLDED AND SELF-SUPPORTING FOR STORAGE, EASILY UNFOLDED, AND QUICKLY RETRACTED IF NECESSARY. UNFORTUNATELY, THE PANELS USED IN THESE DESIGNS HAVE SUBSTANTIAL MASS. A COMPROMISE BETWEEN THESE CONCEPTS, A SEMI-FLEXIBLE SOLAR ARRAY, WOULD PROVIDE A LIGHTER ARRAY FOR SMALLER SPACECRAFT. SUCCESSFUL COMPLETION OF THIS EFFORT WILL SUPPORT NUMEROUS GOVERNMENT LIGHTSAT PROGRAMS, INCLUDING BRILLIANT PEBBLES, TACSAT, AND NASA'S EARTH OBSERVING SYSTEM (EOS). FURTHERMORE, BECAUSE OF THE PLANNED RETRACTIBILITY OF THE SEMI-FLEXIBLE SOLAR ARRAY, THERE IS AN INHERENT SYSTEM SURVIVABILITY THAT COULD BE ENHANCED WITH THE ADDITION OF A SIMPLE OUTBOARD HEATSHIELD.

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Topic#: 91-106
Office: WL/FI
Contract #: F33615-91C-3001
PI: Dr. Michael Andrews

ID#: 91WFI-686

Title: Numerical Analysis on Massively Parallel Processing Computers

Abstract: Air Force missions require computers of immense sustained CPU/IO bandwidths, not currently available. These new architectures invoke greater demands on the compilation phase, but current compilers lack the capabilities to generate "parallel" code without considerable human effort. A meta-compiler is proposed for parallel machines. A major innovation is the effective capture of data/instruction pipelining and parallelism for the code generation, optimization, and firmware compaction phases. A development effort is proposed to embody these theoretic advances into the parallel processor compiler for CFD code. Extensions to the compiler technology are proposed that will effect compilation of very diverse machines, including systolic, parallel, and vector architectures. An exciting potential now exists to compile code for neural net machines. Phase I of the effort will determine if a massively parallel computer architecture can be used to significantly speed up the numerical solution of the Reynolds-averaged Navier-Stokes and Euler equations. Space Tech proposes to quantify the relative merits of SIMD and MIND architectures and, if appropriate, other architectures that would be advantageous for CFD solutions. Space Tech will also identify the optimum number and/or arrangement of Processors and compare maximum theoretical computer speeds with realistic speeds for practical problems. The Phase II effort will be to develop or modify a Reynolds-averaged Navier-Stokes or Euler code that would be optimized to run on an existing machine that utilizes the computer architecture determined in Phase I to show the greatest payoff.

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Topic#: 91-146
Office: PL/OLAH
Contract #: F04701-91-C-0039
PI: ROGER R. BENNETT

ID#: 91PAH-724

AIR FORCE ABSTRACTS OF SBIR PHASE I AWARDS

Title: INNOVATIVE APPROACHES FOR FORCE SUPPORT FROM SPACE

Abstract: INNOVATIVE USES OF TACTICAL SATELLITES (TACSAT) TO RELAY DATA AND COMMANDS TO/FROM UAV'S (RPV'S) ARE THE SUBJECT OF THIS PROPOSAL. TWO POTENTIAL SATELLITE DATA RELAY MISSIONS ADDRESSED IN THIS PROPOSAL ARE: (1) REAL-TIME UAV DATA AND COMMAND RELAY, AND (2) RELAY OF TACTICAL COMMUNICATIONS FROM SMALL FIELD UNITS TO END TERMINALS. RECENT ADVANCES IN SATELLITE TECHNOLOGY CAN REDUCE SATELLITE WEIGHT AND POWER, MAKING NEW AND MORE CAPABLE SYSTEMS SUCH AS THESE EFFECTIVE AND COST-EFFICIENT. PRESENT SATELLITE SYSTEMS MAY NOT BE AVAILABLE TO 'LOW-PRIORITY' TACTICAL USERS IN CRITICAL TIMES. ADDITIONAL COMMUNICATIONS DATA COULD BE PROVIDED TO THE FIELD BY A UAV-TACSAT RELAY SYSTEM. ALONG WITH THE IMAGE DATA, THE UAV COULD ALSO RELAY COMMUNICATIONS MESSAGES TO A USER THROUGH THE SATELLITE. SINCE THE UAV IS RELATIVELY CLOSE TO THE GROUND WHEN COMPARED TO A TYPICAL COMMUNICATIONS SATELLITE, THE POWER REQUIREMENTS (AND HENCE SIZE) OF THE FIELD TRANSMITTER WOULD BE SIGNIFICANTLY LESS (50-60 DB LESS) THAN THAT REQUIRED FOR THE NORMAL GROUND-SPACE COMMUNICATIONS LINK. THE OBJECTIVES OF THE PHASE I EFFORT WILL BE TO ANALYZE AND EVALUATE VARIOUS SYSTEM CONCEPTS TO DETERMINE THEIR FEASIBILITY AND SYSTEM EFFECTIVENESS. SYSTEM REQUIREMENTS AND CONOPS WILL BE DEFINED, AND TECHNOLOGY ISSUES WILL BE DETERMINED. THE RESULTS OF THIS PHASE I EFFORT WILL PROVIDE DATA ON REQUIREMENTS, CONCEPTS, AND TECHNOLOGY OF A SYSTEM THAT WILL PROVIDE BOTH ENHANCED UAV/RPV MISSION CAPABILITIES, AS WELL AS TACTICAL COMMUNICATIONS CAPABILITIES, LEADING TO FURTHER ANALYSIS AND DESIGN. THE CONCEPTS EXPLORED IN THIS STUDY CAN BE PART OF THE LARGER CONCEPT TO PROVIDE SUPPORT TO THE TACTICAL USERS WITH SATELLITE SYSTEMS (TACSATS).

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Topic#: 91-174
Office: BMO/MYSP
Contract #:
PI: MR ROBERT RISS
ID#: 91BMO-914

Title: CONVENTIONAL MISSION ALTERNATIVES FOR LAND-BASED ICBMS

Abstract: THE U.S. IS FACED WITH A GROWING NUMBER OF THIRD WORLD AND NON-SOVIET THREATS, SOME OF WHICH POSSESS OR MAY SOON POSSESS FORMIDABLE WEAPONS - BOTH OFFENSIVE AND DEFENSIVE. EXPERIENCE SHOWS THE NECESSITY OF MAINTAINING A GLOBAL CAPABILITY TO DELIVER QUICK SURGICAL STRIKES, AS EVIDENCED BY THE SUCCESSFUL RAID ON LIBYA. IN THIS NEW ENVIRONMENT, IT WOULD BE HIGHLY DESIRABLE TO HAVE AN ALTERNATIVE MEANS TO DELIVER FIREPOWER WHICH DOES NOT RISK U.S. CASUALTIES AND IS NOT DEPENDENT UPON THE AVAILABILITY OF FOREIGN BASES. ICBMS ARMED WITH CONVENTIONAL MUNITIONS PROVIDE AN ALTERNATIVE WHICH CARRIES WITH IT THE BENEFITS OF SHORT TIME OF FLIGHT, HOME BASING, AND A COMPLETE LACK OF BALLISTIC MISSILE DEFENSES TO OPPOSE THEM IN THE THEATERS OF INTEREST. THE UTILITY AND COST EFFECTIVENESS OF CONVENTIONALLY ARMED ICBMS MUST BE EVALUATED AND COMPARED WITH TRADITIONAL ALTERNATIVES WHOSE COSTS AND RISKS ARE ON THE RISE. THE PROPOSED EFFORT WILL IDENTIFY ALTERNATIVE MISSIONS AND CANDIDATE DESIGN CONCEPTS. ANALYTIC TOOLS WILL BE DEVELOPED WHICH ENABLE AN ASSESSMENT OF COST EFFECTIVENESS FOR A PARTICULAR MISSION TO BE TREATED AS A CASE STUDY. THE CASE STUDY PROPOSED IS A RE-EXAMINATION OF THE LIBYA RAID AND HOW IT MIGHT HAVE BEEN CONDUCTED WITH CONVENTIONAL WARHEADS ON ICBMS. PROVIDE BMO WITH THE RATIONALE AND STRATEGY TO CONVERT AND/OR DEVELOP CONVENTIONALLY ARMED ICBMS FOR USE IN SURGICAL STRIKE AND OTHER SPECIAL MILITARY OPERATIONS.

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Topic#: 91-022
Office: AEDC
Contract #: F40600-91-C0010
PI: STEVEN ADLER-GOLDEN
ID#: 91AED-019

Title: RAMAN HYDROGEN SENSOR (RHS) FOR PROCESS AIR DUCTING

Abstract:

AIR FORCE ABSTRACTS OF SBIR PHASE I AWARDS

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Topic#: 91-014 **ID#: 91MNP-157**
Office: WL/MNPB
Contract #:
PI: MS PATRICIA SEKULA-MOISE

Title: INP-BASED HBTS FOR EXTREMELY HIGH FREQ TRANSMISS

Abstract: Millimeter waves are an integral part of satellite communications, electronic warfare, and missile radar. Until recently, the prospects of amplifying significant levels of millimeter power using solid state devices have depended on IMPATT diodes which exhibit low efficiency and reliability. Spire proposes to develop an InP-based heterojunction bi-polar transistor (HBT) technology for the amplification of millimeter waves with high efficiency and reliability, specifically at frequencies of 140 and 220 GHz.

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Topic#: 91-028 **ID#: 91ESD-656**
Office: ESD
Contract #:
PI: STEPHEN J. HOGAN

Title: COMMERCIALIZATION OF NEW MOCVD REACTOR

Abstract: A DETAILED BUSINESS PLAN FOR THE COMMERCIALIZATION OF A NEW SINGLE WAFER METAL ORGANIC CHEMICAL VAPOR DEPOSITION (MOCVD) REACTOR SYSTEM BASED ON AN EXISTING REACTION CHAMBER DESIGN. A COMPLETE TOP LEVEL DESIGN WILL BE PRODUCED BASED MARKETING SPECIFICATIONS. DESIGN AND SETUP COSTS WILL BE ESTIMATED AND WILL INCLUDE: A) CHANGES THAT MAY BE NEEDED TO THE REACTION CHAMBER FOR COMMERCIALIZATION AND B) CHANGES TO PRESENT SPIRE SYSTEM TECHNOLOGY REQUIRED TO MAKE IT APPROPRIATE FOR THE SINGLE WAFER REACTOR MARKET. A REVENUE FORECAST, ESTIMATED DEVELOPMENT COSTS, AND PROJECTED SCHEDULES WILL BE USED TO CALCULATE RETURN ON INVESTMENT (ROI). A PROGRAM LAUNCH RECOMMENDATION WILL BE MADE BASED ON THE BUSINESS PLAN.

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Topic#: 91-188 **ID#: 91BMO-028**
Office: BMO/MYSP
Contract #:
PI: G. BICKEL

Title: FIBER-OPTIC CABLE CONNECTOR

Abstract: THE DEVELOPMENT OF HI-RELIABILITY, OPTICAL CABLE CONNECTORS FOR MISSILE-RELATED, LASER, ORDNANCE, FIRING SYSTEMS REQUIRES AN EXAMINATION OF THE PRIMARY FACTORS WHICH HAVE INHIBITED THAT DEVELOPMENT. WE PROPOSE TO SYSTEMATICALLY STUDY AND ANALYZE EACH OF THESE FACTORS UTILIZING THE 13 YEARS OF RELATED EXPERIENCE RESIDENT IN OUR TEAM. WE FURTHER PROPOSE TO DEVELOP SPECIFICATIONS FOR THE LASER FIRING UNIT, THE PROPAGATION MODES LAUNCHED INTO THE FIBER, THE FIBER BENDING LIMITATIONS, AND THE CONNECTORS. REQUIREMENTS FOR THE FIBER PARAMETERS WILL ALSO BE ESTABLISHED. SRA OPTIK WILL DEVELOP A PRELIMINARY DESIGN OF THE CONNECTOR, DETERMINE THE OVERALL CHARACTERISTIC OF THE LASER ORDNANCE FIRING SYSTEM, AND DEVELOP A DIAGNOSTIC METHOD OF DETERMINING MODES PROPAGATED IN THE FIBER. FIELDING OF RELIABLE MISSILE ORDNANCE LASER-FIBER FIRING UNITS, WHICH IS EMP AND EMI RESISTANT. COMMERCIAL EMPLOYMENT IN OTHER LASER APPLICATIONS REQUIRING LASER CONTROL APPLICATIONS.

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Topic#: 91-031 **ID#: 91ROM-009**
Office: ROMELAB
Contract #: F30602-91-C-0068
PI: LAURE L. PULLUM

Title: INSERTION OF SOFTWARE FAULT TOLERANCE TECHNOLOGY TOOLS INTO THE SLCSE

AIR FORCE ABSTRACTS OF SBIR PHASE I AWARDS

Abstract: OBJECTIVE IS TO INVESTIGATE TECHNIQUES/METHODS FOR SOFTWARE FAULT TOLERANCE, AND THE AVAILABILITY OF, REQUIREMENTS FOR, AND USE OF TOOLS TO AID IN INSERTION OF SOFTWARE FAULT TOLERANCE INTO MISSION CRITICAL SYSTEMS. RESEARCH WILL PROVIDE THE INFORMATION REQUIRED TO DEVELOP A PROTOTYPE TOOL SET THAT CONSISTS OF THE SRS-DEVELOPED AUTOMATED FAULT TOLERANCE EVALUATOR AND AT LEAST ONE OTHER AUTOMATED TOOL TO AID IN FAULT TOLERANT SOFTWARE SYSTEMS THROUGH A USER-FRIENDLY, GRAPHICS-INTERFACE MODELING ENVIRONMENT UTILIZING TEMPLATES REPRESENTING SOFTWARE FAULT TOLERANCE TECHNIQUES AND COMMON SOFTWARE FUNCTIONS YIELDING RAPID PROTOTYPING CAPABILITY. THIS TOOL SET WILL PROVIDE THE MEANS FOR USERS AT EACH STAGE OF THE SOFTWARE LIFE CYCLE TO INCORPORATE SOFTWARE FAULT TOLERANCE TECHNOLOGY IN MISSION CRITICAL SYSTEMS IN ORDER TO MOST EFFECTIVELY UTILIZE THAT HIGH RELIABILITY AND AVAILABILITY REQUIREMENTS ARE MET BY THE RESULTING SYSTEMS.

SRS TECHNOLOGIES

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Topic#: 91-128

ID#: 91WFO-832

Office: WL/PO

Contract #: F33615-91C-2133

PI: James D. Moore

Title: Computer Graphics for Bearing Dynamic Analysis

Abstract: The enormous amount of data produced by computer codes used by the aerospace industry to design and evaluate high speed rolling element bearings makes it difficult and time consuming to synthesize and evaluate analysis results. Some codes provide computer graphics for specific parameters which significantly improves the understanding and evaluation of results. However, because of the two-dimensional limitations of these graphics, it is sometimes difficult to visualize the true operating characteristics of the bearing. The objective of the proposed research is to provide computer software that will use the output from a bearing dynamic code to provide an animation of the bearing such that the interactions of the elements can be visualized. The Phase I effort will develop the pictorial representation of the bearing from the axial perspective. Further effort will expand the capability for providing different views and include thermal and stress profiles in the bearing components. The animation software will be designed for use on a personal computer. This capability will significantly improve the utilization of complex dynamic bearing analysis codes, by providing better visualization of bearing operating characteristics, leading to more efficient and cost effective high speed gas turbine rolling element bearing designs.

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Topic#: 91-154

ID#: 91PAC-790

Office: PL/OLAC

Contract #:

PI: PAUL A. GIEROW

Title: CONCENTRATOR TECHNOLOGY

Abstract: DEVELOPMENT OF SOLAR POWERED ROCKET PROPULSION SYSTEMS DEPENDS HEAVILY ON DEMONSTRATING THE TECHNOLOGY FOR LIGHTWEIGHT SPACE-DEPLOYABLE SOLAR CONCENTRATORS. LARGE PARABOLICALLY SHAPED THIN FILM REFLECTORS CAN BE PACKAGED WITH OTHER SOLAR POWERED PROPULSION ELEMENTS AND DEPLOYED IN LOW EARTH ORBIT. THIN FILM CASTING AND COATING TECHNIQUES FOR FABRICATING SEAMLESS AND GORELESS CONCENTRATORS HAS BEEN DEMONSTRATED. THESE FABRICATION PROCESSES USE NEWLY POLYAMIDE MATERIALS SUPPLIED BY LANGLEY RESEARCH CENTER (LARC). ALTERNATIVE CONCENTRATOR CONCEPTS, SUCH AS INTEGRAL TORUS/CONCENTRATORS, MADE POSSIBLE BY SPRAY CASTING FABRICATION TECHNIQUES WILL BE EVALUATED. THE PHASE I EFFORT WILL SELECT A SINGLE PRELIMINARY DESIGN THAT WILL BE USED TO FABRICATE A 7X9 METER OFF-AXIS PARABOLIC SOLAR CONCENTRATOR UNDER THE PHASE II EFFORT. THE MEMBRANE FABRICATION PROCEDURES WILL BE DEFINED IN PHASE I. EXISTING CASTING AND CURING EQUIPMENT WILL BE REVIEWED AND MODIFICATIONS NECESSARY TO CONSTRUCT THE 7X9 METER CONCENTRATOR WILL BE IDENTIFIED. THIS EFFORT CONTINUES TO SUPPORT THE SOLAR THERMAL PROPULSION PROGRAM THROUGH FURTHER TECHNOLOGY DEVELOPMENT OF FABRICATION TECHNIQUES FOR DOUBLY-CURVED MEMBRANE OFF-AXIS PARABOLOIDAL SOLAR CONCENTRATORS. THIS TECHNOLOGY INVOLVES SPIN OR SPRAY CASTING OF POLYAMIDE FILMS THAT CAN BE USED FOR CONCENTRATORS

AIR FORCE ABSTRACTS OF SBIR PHASE I AWARDS

HAVING LOW WEIGHT/AREA AND HIGH CONCENTRATION RATIOS. SOLAR THERMAL PROPULSION, SOLAR DYNAMIC SYSTEMS, LUNAR SOIL PROCESSING AND LARGE RF AND MICROWAVE ANTENNAS ARE TYPICAL APPLICATIONS THAT WOULD BENEFIT FROM POLYAMIDE CONCENTRATORS. ALSO REDUCED COST THIN FILM HELIOSTATS COULD BE USED IN PLACE OF A SECOND SURFACE GLASS MIRROR FOR TERRESTRIAL APPLICATIONS. THIS WOULD DECREASE THE COST OF THE HELIOSTAT RESULTING IN A MORE COST-EFFECTIVE POWER SOURCE FOR SOLAR FURNACES AND SOLAR DYNAMIC SYSTEMS.

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Topic#: 91-092 ID#: 91WAA-088
Office: WL/AA
Contract #: F33615-91C-1772
PI: ROGER PORSE

Title: HIGH TEMPERATURE SUPERCONDUCTING PHASE SHIFTER

Abstract: A 90 degree phase shifter capable of continuous operation at 4-8 GHz, 80K and power levels of 1-5 watts will be demonstrated in Phase I. We propose to develop the phase shifter using high temperature superconducting thallium thin films and demonstrate the power handling capability of the device. The reduced size and power dissipation of these devices have advantages for systems applications where volume, weight and power consumption are key consideration. Two prototype phase shifter designs will be fabricated from low loss Tl-Ca-Ba-Cu oxide films and tested as a function of input power, temperature and frequency. In Phase II we will develop a bank of low-loss, switched delay lines.

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Topic#: 91-098 ID#: 91WEL-008
Office: WL/EL
Contract #: F33615-91C-1733
PI: DR JONATHAN Z. SUN

Title: OPTICALLY DRIVEN MICROWAVE PULSE GENERATOR USING THIN FILM HIGH TC SUPERCONDUCTING Q-SWITCHED RESONATORS

Abstract: High Tc superconductors have made high-Q, high-power thin film resonators readily available. These resonators can be used to generate coherent microwave pulses with high peak power when operated in the Q-switching mode. We propose to use semiconducting and/or polymer photoconductors as optoelectronic switching elements to achieve the Q-switching process for thin film planar microwave resonators. It is expected that with currently available film quality and device technologies, a power gain of 10 cubed to 10 4 can be achieved with peak power level in excess of 10 Watts. Such devices will greatly reduce weight and power consumption when compared to the more conventional vacuum tube-based pulse generators.

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Topic#: 91-097 ID#: 91WEL-039
Office: WL/EL
Contract #: F33615-91C-1741
PI: PETER P. CHOW

Title: AUTOMATED MBE PROCESS WITH REAL TIME SENSOR CONTROL

Abstract: We propose an automated Molecular Beam Epitaxy (MBE) process for reproducible growth of semiconductor device structures. We will apply RHEED and thermal oscillation techniques to control the rate and composition of the layers and to ensure that the growth proceeds under optimum conditions. A mass spectrometer will be used to control dopant incorporation levels. Fluxes for optimum growth of the different layers are matched by feedback controlling an adjustable column V cracker source. Various sensor input will be used by a microprocessor to control other parameters as well. The MBE technique has been used for production of many high performance semiconductor devices. The proposed investigation will be performed in a MBE system that has incorporated significant advances in machine design to improve reliability and material yield. The improvements include large capacity tapered effusion cell, two zone cell heating, a microprocessor controlled cracker source, and long-life (> 1 Million cycles) shutters. This automated process can be used for production of a variety of compounds and can be applied to solid source as well as gas source MBE.

AIR FORCE ABSTRACTS OF SBIR PHASE I AWARDS

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Topic#: 91-114 ID#: 91WML-413
Office: WL/ML
Contract #: F33615-91C-5723
PI: James C. Jafolla, Ph.D.

Title: The Development of a Coatings Design Workstation

Abstract: The development of advanced surface treatments to counter the on-going evolution of active and passive EO threat systems requires the use of sophisticated computer models to optimize the design process. The Coatings Reflectance Engineering Evaluation Program (CREEP) was developed for this purpose. However, the CREEP code does not consider scattering from flaked pigments commonly used in coatings design, or the enhanced retro-reflectance surface scattering that is important for laser radar cross-section considerations. A Phase I program is proposed that will review the scientific literature for advanced single and surface scattering techniques and develop a plan for integrating these techniques into the CREEP methodology and hosting the code on a parallel processing workstation. The program will also develop first-order approximations and a measurement data base to be used in model validation studies. The coatings design workstation will be built and demonstrated in a Phase II program. The program will make use of unique in-house facilities for mono- and bi-static reflectance measurements and an extensive data base of optical properties. The program will also benefit from current instrument development programs that are being supported by Phase I and II SBIR funds.

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Topic#: 91-056 ID#: 91CES-211
Office: AFCESA
Contract #:
PI: BRUCE L. ROBERTS

Title: THE USE OF MICELLAR-ENHANCED ULTRAFILTRATION FOR THE RECOVERY AND CONCENTRATION OF TRICHLOROETHYLENE FROM GROUNDWATER

Abstract: ECONOMICAL METHODS OF REMOVING AND RECOVERING DISSOLVED ORGANICS FROM AQUEOUS PROCESS STREAMS ARE NECESSARY FOR US INDUSTRIAL COMPETITIVENESS. ALSO, FIRMS SPECIALIZING IN HAZARDOUS WASTE DISPOSAL AND POLLUTION CONTROL WILL BE A MAJOR AREA OF INDUSTRIAL GROWTH IN THE US. MICELLAR-ENHANCED UNTRAFILTRATION (MEUF) IS A NOVEL PROCESS WHICH CAN REMOVE DISSOLVED ORGANIC SOLVENTS FROM WATER. IN MEUF, A NONIONIC SURFACTANT, WHICH FORMS AGGREGATES CALLED MICELLES, IS ADDED TO THE PROCESS STREAM. ORGANIC SPECIES ASSOCIATE WITH THE MICELLES BY A PHENOMENON CALLED SOLUBILIZATION. THE SOLUTION IS THEN TREATED IN AN ULTRAFILTRATION DEVICE WITH MEMBRANE PORE SIZES SMALL ENOUGH TO BLOCK THE PASSAGE OF MICELLES AND THE SOLUBILIZED ORGANIC SOLVENT. THE RESULT IS AN EXTREMELY PURE PERMEATE, AND A VERY CONCENTRATED, LOW-VOLUME RETENTATE. THIS PROPOSAL SPECIFICALLY ADDRESSES REMOVAL OF TRICHLOROETHYLENE (TCE) FROM POLLUTED GROUNDWATER. IN THIS CASE, THE RETENTATE WILL BE STEAM STRIPPED. THE STRIPPER OVERHEADS CONTAINING THE TCE WILL BE CONDENSED AND THE TCE-FREE STRIPPER BOTTOMS (A CONCENTRATED SURFACTANT SOLUTION) WILL BE RECYCLED TO THE MEUF UNITS. MEUF MAY BE STAGED TO ACHIEVE GREATER REDUCTION IN THE RETENTATE VOLUME WHICH MUST BE STEAM STRIPPED, WHILE STILL ATTAINING 99+ % REMOVAL OF TCE FROM POLLUTED GROUNDWATER.

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Topic#: 91-025 ID#: 91ROM-124
Office: ROMELABS
Contract #: F30602-91-C-0095
PI: EDWIN R. ADDISON

Title: DOCUMENT MANAGEMENT TOOLKIT FOR SYSTEM INTEGRATION

Abstract: THIS PROPOSAL IS TO DEMONSTRATE A DOCUMENT MANAGEMENT SYSTEM FOR CONTRACTOR DELIVERABLES AS A TOOL WHICH ASSISTS IN PROVIDING AN INTEGRATED APPROACH TO SYSTEM MANAGEMENT. THE SYSTEM CONCEPT IS A DERIVATIVE OF WORK ACCOMPLISHED BY SYNCHRONETICS FOR THE WRDC MANUFACTURING TECHNOLOGY DIRECTORATE FOR AN ENGLISH TEXT SEARCH SYSTEM DEMONSTRATED ON SBIR CONTRACT F33615-89-C-5734. THE BASIC CONCEPT IS TO PROVIDE THE MEANS FOR USER TO DO A COMPUTER SEARCH, INFORMATION EXTRACTION TASK, OR "ELECTRONIC CUT AND PASTE"

AIR FORCE ABSTRACTS OF SBIR PHASE I AWARDS

OPERATIONS OVER DIGITALLY STORED CONTRACTOR DELIVERABLE DOCUMENTS. IN PARTICULAR DOCUMENTS GENERATED ACCORDING TO INTEGRATED COMPUTER AIDED MANUFACTURING (ICAM) STANDARDS AS SPECIFIED BY THE "ICAM DOCUMENTATION STANDARDS", AIR FORCE (WRDC) REPORT NO. IDS150120000C, WILL BE ADDRESSED. THE COMPUTER SEARCH ALGORITHM TO BE USED IS BASED ON A VERY ROBUST AND PORTABLE IMPLEMENTATION OF NATURAL LANGUAGE PROCESSING (NLP) TECHNOLOGY, A BRANCH OF ARTIFICIAL INTELLIGENCE (AI) THAT DEALS WITH THE COMPUTER UNDERSTANDING OF NATURAL (I.E. ENGLISH) LANGUAGES RATHER THAN FORMAL (I.E., COBOL) LANGUAGES. PHASE I IS FOR A DEMONSTRATION OF THE PROPOSED DOCUMENT MANAGEMENT SOFTWARE AND FOR THE DEVELOPMENT OF A DETAILED ARCHITECTURE CONCEPT FOR THE SECOND PHASE. DOCUMENTS WILL BE ENTERED USING LOW COST LABOR BY TELEMAR DATA SYSTEMS (A SERVICE THAT UTILIZED LABOR OUTSIDE THE U.S. COUPLED WITH SOFTWARE FOR DATA ENTRY). PHASE II WILL DEVELOP OF A DETAILED PROTOTYPE OF THE DOCUMENT MANAGEMENT SYSTEM.

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Topic#: 91-062 ID#: 91ARM-406
Office: ARMSTR
Contract #:
PI: MR TERRY M. MILLER

Title: Technology for Manpower, Personnel, Training and Safety Trade-Off Decisions

Abstract: This project will demonstrate the feasibility of and develop the conceptual design for an integrated Human Factors (HF)/Logistics Support Analysis (LSA)/Manpower, Personnel, Training, and Safety (MPTS) analysis process and workstation. The workstation will support the design process from conceptual development through the development of training and technical order data. The proposed architecture focuses upon the manpower by maintenance specialty implications of the reliability and maintainability (R&M) allocation process in the earliest stages of design. HF and MPTS analyses during detail design are to be supported by automating detailed task analysis to support human factors, safety analysis, and training and personnel requirements analysis. The last step in the proposed integration strategy is to develop those products such as instructional materials and technical orders, currently dependent upon detailed task analysis, by the automated task analysis facility developed to support HF and MPTS analysis.

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Topic#: 91-163 ID#: 91PXP-822
Office: PL/XPPP
Contract #:
PI: ARTHUR NELSON

Title: MICROWAVE/MILLIMETER-WAVE FIELD SENSOR

Abstract: THE ACCURATE MEASUREMENT OF ELECTROMAGNETIC FIELDS IS OFTEN COMPLICATED BY THE INTERACTION BETWEEN THE FIELD BEING MEASURED AND THE RECEIVING ANTENNA WITH ITS ASSOCIATED ELECTRONICS AND CABLING. WITH THE DEVELOPMENT OF HIGH FREQUENCY FIBER OPTIC ANALOG LINKS, OPTICAL CABLES HAVE BEEN USED TO ISOLATE THE MEASUREMENT ANTENNA. HOWEVER, PREVIOUS EFFORTS HAVE HAD THE DISADVANTAGE OF REQUIRING A RELATIVELY LARGE PHYSICAL VOLUME AT THE ANTENNA LOCATION, WHICH PERTURBS THE FIELD BEING MEASURED. IN ORDER TO OVERCOME THIS PROBLEM, TACAN HAS RECENTLY DEVELOPED AND TESTED A NEW APPROACH FOR HIGH FREQUENCY FIELD MEASUREMENTS USING REMOTE OPTICAL POWERING TO ELIMINATE BATTERY OPERATION OF THE ELECTRONICS AND ELECTRO-OPTICS. A SPECIAL ELECTRO-OPTIC INTERFACE HAS BEEN DESIGNED, CONSISTING OF PASSIVE ELECTRICAL COMPONENTS TO COMPLETE A BIAS TEE NETWORK AND PROVIDE IMPEDANCE MATCHING. THE TOTAL VOLUME FOR THE ELECTRO-OPTIC INTERFACE UNIT CAN BE LESS THAN 1 CM³. NO BATTERIES ARE REQUIRED, AND THEREFORE OPERATION IS CONTINUOUS WITHOUT INTERRUPTIONS FOR BATTERY REPLACEMENT. NEW TECHNIQUES ARE DESCRIBED TO EXTEND THE FREQUENCY RESPONSE TO 100 GHZ. THE ACCURATE MEASUREMENT OF ELECTROMAGNETIC FIELDS WOULD BENEFIT A WIDE VARIETY OF COMMERCIAL APPLICATIONS, INCLUDING ANTENNA DEVELOPMENT, MONITORING OF ELECTROMAGNETIC FIELDS FOR POTENTIAL HAZARDS, AND EMI AND RFI MEASUREMENTS. COMPLETELY ACCURATE AND NON-PERTURBING MEASUREMENT TECHNIQUES HAVE NOT BEEN AVAILABLE TO DATE AND WOULD BE INVALUABLE FOR SCIENTIFIC INVESTIGATIONS.

AIR FORCE ABSTRACTS OF SBIR PHASE I AWARDS

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Topic#: 91-190 ID#: 91OSR-338
Office: AFOSR
Contract #: F49620-91-C-0038
PI: MICHAEL M. SALOUR

Title: MULTIFUNCTIONAL NONMETALLIC POLYMERIC MATERIALS FOR CHEMICAL SENSOR APPLICATIONS
Abstract: We propose to investigate new types of materials and methods for sensor applications. The proposed investigation will explore and develop novel approaches for the application of polymeric materials to sensor technology. Of particular interest are materials that can perform several functions for a specific device. The focus of this work will be on chemical sensor technology, but our approach is sufficiently general that it may be adapted to other sensor technologies. We will investigate alternative device architectures as well as identify desired materials properties. We will also survey existing materials as candidates for specific chemical sensor devices and applications.

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Topic#: 91-104 ID#: 91WFI-692
Office: WL/FI
Contract #: F33615-91C-3602
PI: EDWARD T. SCHNEIDER

Title: ThermoChemically Activated Motion (TCAM) Valve Actuator
Abstract: A proposal is put forward to develop ElectroHydraulic Valve (EHV) actuators utilizing a new technology, ThermoChemically Activated Motion (TCAM). TCAM actuators promise many improvements in valve performance and reliability, and yet present cost and complexity levels similar to electric solenoids. Features include IO to 100 times the power density of electric solenoids, installation convenience similar to solenoids, absolute silence of operation, vibrationless, no RF generation, and low projected cost levels. Control options include On-Off (Step Function) operation, multiple discrete positioning and full proportional control of force, distance, and speed. Power is 12 to 50 VDC at 2 to 8 Amps. The power density of this technology is expected to win many applications in which actuator size is a problem. These units can replace small Hydraulic Cylinders in the same package size and eliminate pumps, valves and lines. The TCAM actuator is self contained, requires only electric service, and presents no serious safety hazards. The company has identified \$8 Billion in target markets for potential TCAM devices, which break down into Automotive actuators, Valve actuators, Robotic actuators, and Small Horsepower gasoline engines.

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Topic#: 91-131 ID#: 91WFO-809
Office: WL/PO
Contract #: F33615-91C-2131
PI: Michael Karpuk

Title: A COMPACT HEAT EXCHANGER/REACTOR FOR ENDOTHERMIC FUELS
Abstract: Aircraft designed for flight in the Mach 3-6 range must incorporate active cooling in the turboramjet propulsion system. The required cooling can be provided by an endothermic reaction of the fuel. Endothermic-fuel reactors must be small and light. Heat transfer to the low thermal-conductivity, ceramic, catalyst support is a major limitation to the reactor design. TDA Research proposes to fabricate and test a unique, high thermal-conductivity catalyst/metal structure. TDA Research has previously developed durable catalysts bonded to metal heat transfer surfaces for endothermic methanol dissociation. Data from the catalyst testing will be used to design a scaled-up endothermic reactor for fabrication and testing in Phase II.

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Topic#: 91-060 ID#: 91ARM-401
Office: ARMSTR
Contract #:
PI: MS GAIL BOWERS-IRONS

Title: The Development of a Small-Scale Waterfall Paint Stripping System
Abstract: Technical Research Associates, Inc. and Hill Air Force Base personnel have exchanged ideas and technologies in several Air Force SBIR Phase I and Phase II projects. In these projects, TRA established successful polyurethane and epoxy paint degradation. An Air Force Phase II, now in progress, is developing a bead blast paint and primer waste biodegradation system.

AIR FORCE ABSTRACTS OF SBIR PHASE I AWARDS

These projects have given TRA a firm understanding of Air Force needs and requirements. This proposed project would use this experience to develop a small-scale waterfall paint stripping biodegradation system. Under new EPA standards, less hazardous paint disposal techniques are needed. This procedure would remove both air and water pollution, would be less costly and could be efficiently scaled. A small-scale waterfall will be built and tested in the first Task. Rate and volume data as well as representative sludge characteristics will be acquired. Task II will test a proposed paint and solvent sludge removal and disposal system. An environmentally safe effluent will be produced. Task III will choose the preferred configuration and begin optimization. The cost effectiveness will be assessed with an economic evaluation. A small-scale prototype will be delivered at the end of the project.

TECHNOLOGY INTEGRATION & DEVELOPMENT

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Topic#: 91-103 ID#: 91WFI-689
Office: WL/FI
Contract #: F33615-91C-3204
PI: George F. Succi

Title: High Gain Acoustic Sensor Systems for Aircraft Noise Signature Detection

Abstract: Passive acoustic detection systems have demonstrated potential to detect and track low-flying aircraft. Signal-processing techniques have progressed to the point where detection and classification capabilities are quite extensive for certain aircraft targets. Other targets have proven to be more difficult to detect and classify, due in part to lower acoustic levels on broadband noise characteristics. In all cases, improved sensor performance is needed. A novel high-gain sensor concept is proposed. The sensor will allow gain to be determined by adjusting its length, which in principle, can be unlimited. The concept has the potential to be low cost and easy to deploy.

TEXAS RESEARCH INSTITUTE AUSTIN, INC.

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Topic#: 91-149 ID#: 91PAC-747
Office: PL/OLAC
Contract #:
PI: DRS A.V. BRAY/R.L. SMITH

Title: DEVELOPMENT OF AN ACCELERATED LIFE TEST FOR NICKEL HYDROGEN AND NICKEL-METAL HYDRIDE BATTERIES

Abstract: THE PROPOSED ACCELERATED LIFE TESTING OF NICKEL HYDROGEN (NI-H) AND NICKEL METAL HYDRIDE (NI-HYDRIDE) BATTERIES USES IMPEDANCE SPECTROSCOPIC METHODS AS A DIAGNOSTIC FOR DETECTION OF AGING AND LIFE LIMITING PROCESSES. IN ADDITION, A THEORETICAL MODEL FOR THERMAL AND DEPTH OF DISCHARGE (DOD) STRESSES AS A MEANS OF ACCELERATING AGING IN THESE BATTERIES IS PROPOSED. THE IMPEDANCE SPECTROSCOPIC APPROACH USES A SERIES OF SPECTRAL FEATURES AS THE PRIMARY BATTERY LIFE DEGRADATION INDICATORS, AND TRI/AUSTIN WILL MEASURE THESE IN PHASE I ON NI-H AND NI-HYDRIDE CELLS WHICH ARE AT VARIOUS STAGES OF AGING AT EAGLE-PICHER, JOPLIN, MO. THROUGH ADVANCED DETECTION TECHNIQUES AND THEORETICALLY BASED ACCELERATION MODELS IT IS PREDICTED THAT NI-H AND NI-HYDRIDE ACCELERATED BATTERY TESTS CAN BE SHORTENED TO 6 MONTHS TO A YEAR COMPARED TO CURRENT TECHNOLOGY WHICH REQUEST 5 YEARS OF TESTING. TRI/AUSTIN WILL USE ITS EXISTING CAPABILITIES IN IMPEDANCE SPECTROSCOPY AND ACCELERATED TEST DESIGN TO REACH A FEASIBILITY DETERMINATION IN THE PHASE I TIME FRAME. BENEFITS RESULTING FROM REDUCED TEST TIME FOR BATTERIES TRANSLATE DIRECTLY INTO COST SAVINGS, AND THE SUCCESS OF THE PROPOSED EFFORT SHOULD REDUCE TEST COSTS FOR NI-H AND NI-HYDRIDE BATTERIES FIVE FOLD. COMMERCIAL BATTERY TEST COSTS WOULD BE REDUCED IN THE SAME MANNER, AND THERE IS THE POTENTIAL FOR AN INDUSTRY-WIDE STANDARD TEST PROCEDURE APPLICABLE TO A WIDE VARIETY OF BATTERY DEVELOPMENT EFFORTS.

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Topic#: 91-082 ID#: 91ASD-825
Office: ASD
Contract #: F33657-91C-2153
PI: DR A. VINCE MRSTIK

Title: ADVANCED ECM/ECCM MODELING

AIR FORCE ABSTRACTS OF SBIR PHASE I AWARDS

Abstract: A two-phase program is described for developing a high fidelity, yet fast executing, radar simulator which models the detection, acquisition, tracking, and missile guidance of U.S. and foreign systems in an ECM/ECCM environment. The simulation includes all major ECM/ECCM tactics (including towed decoys and terrain bounce) as well as the significant environmental effects of multipath and clutter. The proposed program builds on existing time-proven simulations, including (1) SAMES, an improved derivative of the Surface to Air Missile Simulation (SAMSIM) which was used by ASD during the source selection of the Advanced Cruise Missile, (2) ENDGAME, a simulation of the engagement of a missile seeker and its target, and (3) SEEKER, a detailed model of the ground clutter as seen by an active or semi-actively guided missile. The TOYON personnel proposed to contribute to this project are uniquely qualified for this project. The three primary personnel have a total of over 80 years experience in radar systems and modeling. The principal investigator is the creator of SAMSIM.

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Topic#: 91-174 **ID#:** 91BMO-904
Office: BMO/MYSP
Contract #:
PI: BERNARD B. GRAGG

Title: A METHODOLOGY FOR OPTIMIZING MARV EFFECTIVENESS AGAINST CONSTRAINED DEFENSE

Abstract: THE MANEUVERING REENTRY VEHICLE (MARV) PRESENTS SERIOUS PROBLEMS TO A MISSILE DEFENSE SYSTEM. BECAUSE OF ITS MANEUVER CAPABILITY, IT CAN GENERALLY EVADE INTERCEPTORS, AT LEAST OVER A PORTION OF THE BATTLESPACE. BECAUSE OF ITS LARGE MANEUVER FOOTPRINT, IT FORCES THE DEFENSE TO SEARCH A LARGE VOLUME OF THE SKY TO COVER ALL POTENTIAL ATTACKS. IN A PREVIOUS STUDY, AN ANALYSIS PROCEDURE TO EVALUATE MARV EFFECTIVENESS AGAINST A DEFENSE INHERENTLY CONSTRAINED IN BOTH THE SEARCH/DETECTION AND EVASION/INTERCEPT PHASES OF THE ENGAGEMENT WAS DEVELOPED. THIS METHODOLOGY DETERMINES OPTIMAL STRATEGIES FOR BOTH OFFENSE AND DEFENSE. IN THE PHASE I STUDY PROPOSED HERE, THE SCOPE OF THIS METHODOLOGY WILL BE EXPANDED BY RELAXING SOME OF THE SIMPLIFYING RESTRICTIONS OF THE EARLIER STUDY, AND BY IMPROVING THE FIDELITY OF THE INTERCEPTION MODEL, A FUNDAMENTAL COMPONENT OF THE ANALYSIS PROCESS. THE VALIDITY AND FEASIBILITY OF THE ANALYSIS APPROACH WILL BE DEMONSTRATED THROUGH EXAMPLE CALCULATIONS. REQUIREMENTS FOR AN ADVANCED VERSION OF THE METHODOLOGY HAVING A BROADER RANGE OF APPLICATION, AND FOR A COMPUTER CODE TO IMPLEMENT THIS PROCESS, WILL BE DESIGNED. THEN, IN PHASE II OF THE STUDY, THE ADVANCED METHODOLOGY WOULD BE DEVELOPED AND THE CODE CREATED AND PROVIDED AS A DELIVERABLE. (1) A UNIQUE AND INNOVATIVE METHODOLOGY FOR EVALUATING MARV PENETRATION EFFECTIVENESS WHICH ACCOUNTS FOR THE MANY INTERLINKED CONSTRAINTS ON DEFENSE OPERATIONS, AND WHICH DETERMINES OPTIMUM STRATEGIES FOR BOTH OFFENSE AND DEFENSE AS AN INTEGRAL PART OF THE EVALUATION PROCESS. (2) SPECIFICATIONS FOR A COMPUTER CODE WHICH IMPLEMENTS THE OPTIMIZATION PROCESS FOR USE BY MARV ANALYSTS, DESIGNERS, AND PLANNERS.

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Topic#: 91-145 **ID#:** 91PAH-708
Office: PL/OLAH
Contract #: F29601-91-C-0094
PI: ROBERT H. TUFFIAS, PH.D.

Title: THERMAL ABSORBER FOR A SOLAR-HEATED HYDROGEN ROCKET ENGINE

Abstract: SOLAR-HEATED HYDROGEN CAN YIELD MORE THAN THREE TIMES THE SPECIFIC IMPULSE OF CHEMICAL REACTIONS FOR ROCKET PROPULSION. THE DEVELOPMENT OF A SOLAR-HEATED HYDROGEN ENGINE DEPENDS ON BREAKTHROUGHS IN HIGH TEMPERATURE MATERIALS. A KEY COMPONENT IS THE SOLAR ABSORBER, WHICH IS HEATED BY FOCUSED SOLAR RADIATION AND THEN TRANSFERS THE HEAT TO THE GASEOUS HYDROGEN PROPELLANT. BY DEVELOPING A POROUS ABSORBER THAT CAN ACHIEVE A PROPELLANT TEMPERATURE OF 3778 K, THE SPECIFIC IMPULSE OF A SOLAR-HEATED HYDROGEN ROCKET CAN BE INCREASED TO 10,385 SECONDS FROM THE PRESENT RHENIUM TUBE LIMIT OF 8,532 SECONDS AT 2778 K. IN THIS PHASE I PROGRAM, ULTRAMET PROPOSES TO DESIGN, FABRICATE, AND TEST A RETICULATE VITREOUS CARBON FOAM SOLAR ABSORBER/HEAT EXCHANGER THAT WILL RESIST TEMPERATURES UP TO 3500°C. THE CARBON FOAM STRUCTURE WILL BE PROTECTED AGAINST CARBON/HYDROGEN REACTIONS

AIR FORCE ABSTRACTS OF SBIR PHASE I AWARDS

BY MEANS OF A REFRACTORY CARBIDE COATING APPLIED BY CHEMICAL VAPOR INFILTRATION (CVI). THE PROPOSED SOLAR ABSORBER WOULD SIGNIFICANTLY INCREASE EITHER MISSION LIFE OR PAYLOAD FOR SPACE MISSIONS REQUIRING HIGH PERFORMANCE. THE AIR FORCE ASTRONAUTICS LABORATORY (EDWARDS AFB) HAS LONG SUPPORTED EFFORTS IN THIS AREA AND WOULD BE A PRIME BENEFICIARY OF SUCCESSFUL RESULTS FROM THE PROPOSED PROGRAM. BOTH NASA AND COMMERCIAL FIRMS INVOLVED IN LONG-TERM AND/OR DEEP-SPACE MISSIONS WOULD ALSO HAVE A STRONG INTEREST IN CARRYING THIS EFFORT TO FRUITION.

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Topic#: 91-181 ID#: 91BMO987
Office: BMO/MYSP
Contract #:
PI: ANDREW J. SHERMAN

Title: IMPROVED HEAT SHIELD FOR LONG BOOST-GLIDE TRAJECTORIES

Abstract: THE HIGH TOTAL HEAT FLUXES ASSOCIATED WITH HIGH L/D REENTRY VEHICLES AND BOOST-GLIDE TRAJECTORIES REQUIRE THE DEVELOPMENT OF IMPROVED HEATSHIELDS AND INSULATORS. IN THIS PHASE I PROGRAM, ULTRAMET PROPOSES TO DESIGN A REENTRY HEATSHIELD BASED ON A CERAMIC FOAM CORE COMPOSITE SANDWICH PANEL CONSTRUCTION, LOADED WITH CVI-BONDED CERAMIC MICROBALLOONS TO IMPROVE THE INSULATIVE K-FACTOR AT ELEVATED TEMPERATURES. USING A MULTILAYER-WALL 1-D TRANSIENT HEAT FLUX ANALYSIS PROGRAM, MODIFIED TO INCLUDE AEROTHERMAL HEAT LOADS DUE TO ATMOSPHERIC FRICTION IN A GIVEN TRAJECTORY, ULTRAMET WILL DESIGN A FUNCTIONALLY GRADIENT HEATSHIELD/INSULATOR BASED ON COUPON-LEVEL PROPERTY DETERMINATION. THIS PROGRAM WILL ENABLE THE PRODUCTION OF ADVANCED THERMAL PROTECTION SYSTEMS FOR REENTRY AND HYPERSONIC VEHICLES OF ALL TYPES. WEIGHT SAVINGS OF OVER 50% FROM CURRENT SYSTEMS WILL THEREBY BE MADE POSSIBLE, PROVIDING GREATLY EXPANDED MISSION CAPABILITY.

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Topic#: 91-108 ID#: 91WFI-687
Office: WL/FI
Contract #: F33615-91C-3002
PI: Dr. Anthony L. Laganeli

Title: TURBULENCE MODELING

Abstract: A research program is proposed to investigate the embodied physics in turbulence closure models in order to develop a single module for utilization into multi-zone Navier Stokes type codes. The investigation will focus on fundamental parallel shear flows with consideration to wall conditions that include roughness, mass transfer, pressure gradient, and low Reynolds number effects. Moreover, the development of a model that features universality will consider generalization of existing techniques based on low-speed turbulence models and physical evidence to provide near term prediction capability. The Unistry/SAIC approach features a building-block methodology based on the teams extensive experience in code development and application which requires a thorough knowledge of turbulence closure techniques. This approach identifies flow domains applicable to various closure models (with modifications) from which the logic to develop closure coefficients where length scales of turbulence can be assessed. Specific attention will be given to unit problems (roughness for example) as well as coupling of unit problems which has not been demonstrated in the literature. The teams understanding and use of the various techniques, as provided on the NASP, allows for an impartial assessment from a user point-of-view.

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Topic#: 91-115 ID#: 91WML-415
Office: WL/ML
Contract #: F33615-91C-5641
PI: P. R. Subramanian

Title: Development of Oxidation Protection Coatings for Nb/Nb5Si3 In-Situ Composites

Abstract: Recent studies at the Air Force Materials Directorate (WL/MLLM) have shown that Nb-Nb5Si3 based in-situ composites have the potential for providing an acceptable balance in low-temperature toughness and high-temperature strength/creep resistance, and therefore, are attractive candidates as high-temperature structural materials for advanced aerospace

AIR FORCE ABSTRACTS OF SBIR PHASE I AWARDS

applications. However, catastrophic oxidation and embrittlement of these materials limit their usefulness in engine applications. UES, therefore, is proposing an SBIR program to develop oxidation-protective coatings for the Nb-Nb5Si3 composite system, using physical vapor deposition, specifically, the sputter deposition process. The requisite role of the protective coatings is to provide (a) a reservoir for a protective, oxide scale formation on the surface, and (b) a reasonable subsurface diffusion barrier around the base alloy. The Phase I technical objectives are (a) to demonstrate the potential of the sputter deposition process for obtaining highly controlled, reproducible, defect-free, uniform coatings of MoSi2 and Mo(Ge,Si)2, and multilayer coatings of (Nb,Mo)5Si3/Mo5Si3/MoSi2 on a selected Nb-Nb5Si3 base alloy, and (b) to evaluate the effectiveness of the coatings in forming a protective surface oxide scale under static oxidation conditions.

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Topic#: 91-080 ID#: 91ASD-568
Office: ASD
Contract #: F33657-91C-2211
PI: Susan M. Evans

Title: Requirements for an Automated Human Factors, Manpower, Personnel and Training (HMPT) Planning Tool
Abstract: The phase I research will establish the functional and information requirements for an effective automated design analysis and crew performance assessment methodology for used in pre milestone I planning. The information structure will include process, task, dynamic crew performance, operator graphic and human factors parameters, and training requirements. Existing automated tools such as the IDEFO structured analysis methodology, the SAINT task network simulation model, and various operator graphic and human factors models will be evaluated, along with other proven methodologies such as IDEAL and the Air Forces Instructional Systems Development (ISD) process. Insights from designers and other potential users will identify special functional, information, and hardware requirements to be included in the methodology. The requirements will direct the implementation of an automated Human Factors, Manpower, Personnel, and training System in phase II. The resulting system will make a significant contribution to the complex problems of considering HMPT issues early in system planning. Inclusion of ISD and human operators models will represent a unique contribution, which also complements efforts underway in other Dod organizations.

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Topic#: 91-025 ID#: 91ESD-621
Office: ESD
Contract #:
PI: MARK D. DANKBERG

Title: COMMAND, CONTROL, AND COMMUNICATIONS (C3) SYSTEMS/SUBSYSTEMS
Abstract: THIS PROPOSAL DESCRIBES AN SBIR PHASE I PROGRAM TO INVESTIGATE TECHNOLOGIES FOR ACHIEVING 25 KHZ UHF DAMA INTEROPERABILITY (AS SPECIFIED IN JTC3A SPECIFICATION 9128) WITH MINIMAL HARDWARE. IN ADDITION, DURING THIS PHASE I PROGRAM, WE PLAN TO CONSIDER SEVERAL INNOVATIVE CONCEPTS FOR ENHANCEMENT OF 25 KHZ UHF OPERATION, WHILE RETAINING INTEROPERABILITY WITH THE CURRENT AND PLANNED 25 KHZ UHF DAMA EQUIPMENT.

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Topic#: 91-030 ID#: 91ESD-669
Office: ESD
Contract #:
PI: MARK D. DANKBERG

Title: ADVANCED TECHNOLOGY APPLICATION FOR SMALL/MANPACK UHF SATELLITE TERMINALS
Abstract:

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Topic#: 91-171 ID#: 91WSM-885
Office: WSM/XP
Contract #:
PI: MARK J. MILLER

Title: MINIATURIZED INTEGRATED GROUND PROCESSING SYSTEMS (GPS) AND INERTIAL NAVIGATION

AIR FORCE ABSTRACTS OF SBIR PHASE I AWARDS

INSTRUMENTATION

Abstract: OUR PROPOSAL DESCRIBES AN INNOVATIVE TECHNIQUE TO INTEGRATING A GPS RECEIVER AND AN INERTIAL REFERENCE UNIT (IRU) WITHIN A COMMON MODULE. THIS COMMON MODULE WOULD BE USED TO PROVIDE ONBOARD POSITION AND VELOCITY TRACKING CAPABILITIES OF TEST VEHICLES. THE ONBOARD VELOCITY AND POSITION ESTIMATES ARE DOWNLINKED TO A GROUND STATION VIA AN S-BAND TELEMETRY LINK. THE PROPOSAL ADDRESSES THE PROBLEMS AND ISSUES INVOLVED WITH ACHIEVING THE SYSTEM ACCURACY REQUIREMENTS IN THE PRESENCE OF SEVERE VEHICLE DYNAMICS AND SIGNAL OUTAGES. SOLUTIONS THAT WILL ENABLE THE ACCURACY REQUIREMENTS TO BE ACHIEVED ARE PRESENTED AND DISCUSSED. THE DESIGN OF THE S-BAND DOWNLINK IS CONSIDERED IN THE PRESENCE OF THE SEVERE SIGNAL FADES TYPICAL ON THIS TYPE OF CHANNEL. TWO FADE PROTECTION TECHNIQUES ARE DISCUSSED AND PRESENTED TO COMBAT THE EFFECTS OF THE S-BAND CHANNEL. INCLUDED WITHIN THE PROPOSAL ARE ENGINEERING DIAGRAMS, LINK BUDGETS, AND PERFORMANCE ESTIMATES TO EXPLAIN AND SUPPORT THE PROPOSED CONCEPTS. GPS BASED ACCURATE POSITION/VELOCITY TRACKING CAPABILITY FOR TEST RANGES. IMPROVED PERFORMANCE IN THE PRESENCE OF COMMON LINK IMPAIRMENTS. RECEIVERS EQUIPMENT MAKES USE OF EXISTING S-BAND TELEMETRY EQUIPMENT AND OF THE SHELF MODEMS.

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Topic#: 91-065 ID#: 91ARM-440
Office: ARMSTR
Contract #:
PI: MR JAMES E. WAGONER

Title: Noninvasive Physiological Monitors

Abstract: Miniaturization technology should be applied to develop a digital device for recording environmental impacts of aircraft flyovers in remote areas which are overflowed by aircraft operating in MTRs and in MOAs. Application Specific Integrated Circuits (ASICs) would incorporate a microprocessor into a chip to allow sophisticated software algorithms to continuously monitor and calculate distribution statistics for ambient noise levels; to discriminate aircraft flyovers from naturally occurring sounds; to timestamp and log times of occurrence of flyovers; and to either passively accept human response information or administer a brief questionnaire upon detection of aircraft. The device would be light and small enough to fit into a pocket, be sewn into a hat, or possibly worn as a wrist watch. The low power consumption of ASIC devices permits field operation for extended periods. The device would contain a miniature microphone, an A/D conversion circuit to permit digital representation of the acoustic environment, a microprocessor capable of executing low frequency Fast Fourier Transforms or digital processing in real or near-real time to provide the required signal processing, 512 Kbytes or more of low power memory, RS-232 data communication for the transfer of data for analysis, and a display for interactive communication with the wearer of the device.

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Topic#: 91-104 ID#: 91WFI-691
Office: WL/FI
Contract #: F33615-91C-3601
PI: H. M. SPIVACK

Title: ELECTORRHEOLOGICAL CONTROL VALVE PROPOSAL

Abstract: An innovative design for a control valve is proposed utilizing an electrorheological fluid as the working medium. Optimization of the fluid properties, including testing, is to be performed, particularly for application to an aircraft environment. A prototype valve is to be provided and tested in the operating condition to demonstrate the anticipated improvements in simplicity of design, reduced size, improved response time and low cost compared to conventional hydraulic valves.

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Topic#: 91-053 ID#: 91CES-156
Office: AFCESA
Contract #:
PI: KATHY H. SPIVEY

Title: QUANTITY-DISTANCE CRITERIA FOR EARTH-BERMED AIRCRAFT SHELTERS

AIR FORCE ABSTRACTS OF SBIR PHASE I AWARDS

Abstract: THE PROPOSED PROJECT INVOLVES A THOROUGH FEASIBILITY STUDY WHICH WILL RELY HEAVILY ON EXISTING TEST DATA, ANALYSES AND COMPUTER CODES ALREADY APPLICABLE TO THE MEASURE OF QUANTITY-DISTANCE RATIO, AND WHICH WILL LEAD DIRECTLY INTO DETAILED DESIGNS FOR FIELD TESTING FOR PHASE II. SPECIFICALLY, A LITERATURE SEARCH FOR RELATED TEST DATA, ANALYSIS METHODS, AND COMPUTER CODES WILL BE CONDUCTED; RELATED TEST DATA FOR BOTH FULL-SCALE AND MODEL TESTS, ENGINEERING ANALYSES, AND COMPUTER PROGRAMS WILL BE REVIEWED. NEW ANALYSES AND COMPUTER CODES WILL BE DEVELOPED OR MODIFIED TO PREDICT THE EFFECTS OF BERMING AIRCRAFT SHELTERS ON THE BLAST AND DEBRIS HAZARDS WHICH DETERMINE QUANTITY-DISTANCE CRITERIA. THESE ANALYTIC OR COMPUTER CODE PREDICITONS OF BLAST AND DEBRIS HAZARDS WILL BE COMPARED WITH EXISTING FULL-SCALE AND MODEL-SCALE TEST DATA, AND THEN DETAIL PLANNING OF MODEL-SCALE TESTS WILL BE CONDUCTED.

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Topic#: 91-175
Office: BMO/MYSP
Contract #:
PI: KURT GOLDEN

ID#: 91BMO946

Title: ADVANCED ANTENNA WINDOW TECHNOLOGY, SYNTHETIC-APERTURE-RADAR REENTRY APPLICATIONS
Abstract: THE USE OF SYNTHETIC-APERTURE-RADAR (SAR) SENSORS TO AID IN NAVIGATION ON THE NEW HIGH PERFORMANCE MANEUVERING LIFTING REENTRY VEHICLES (HP-MARV) DURING THE LONG LEVEL GLIDE PORTION OF THE TRAJECTORY HAS GOOD POTENTIAL. SAR SENSORS ARE AN INTERESTING ALTERNATIVE TO THE HIGH POWER SCANNED PENCIL BEAM TERMINAL FIX SENSORS OF THE PAST BECAUSE THE ANTENNA SUB-SYSTEM IS TYPICALLY A FIXED NON-SCANNED SIDE LOOKING ARRAY WHICH IS MORE EASILY IMPLEMENTED, AND THE AVERAGE TRANSIT POWER IS LOW. THE LIMITING FACTORS OF SAR SENSORS ARE COMPUTER RESOURCES AND LONG TIME COHERENT SIGNAL COLLECTION AND PROCESSING. THIS PROPOSED STUDY WILL INVESTIGATE THE VARIOUS ASPECTS OF APPLYING SAR TECHNOLOGY TO THE NEW HIGH PERFORMANCE MANEUVERING REENTRY VEHICLES SUCH AS HP-MARV. THE PHASE I RESEARCH WILL DETERMINE SAR FEASIBILITY, PERFORMANCE, AND TRADE-OFFS INCLUDING THE EFFECTS OF TRAJECTORY, AEROTHERMAL HEATING/ABLATION, PLASMA SHEATHING, UNCERTAINTIES IN MOTION COMPENSATION, SENSOR FREQUENCY, PRF, TRANSMITTER POWER, SAR SIGNAL PROCESSING, SAR IMAGE RESOLUTION, ANTENNA SIZE, AND ANTENNA WINDOW CONFIGURATION. IN ADDITION, THE STUDY WILL DEMONSTRATE ALL OF THE MODELING CAPABILITIES, DETERMINE THE SOFTWARE ARCHITECTURE, AND SOFTWARE SPECIFICATIONS TO COUPLE THE SAR ANALYSIS INTO AN END-TO-END REENTRY 6DOF SENSOR SIMULATION. THE RESULTS FROM THIS STUDY WOULD PROVIDE VALUABLE DATA AND ANALYSIS TOOLS TO VARIOUS DOD AGENCIES TO EVALUATE ADVANCED MANEUVERING HYPERSONIC VEHICLE CONCEPTS WITH RADAR SENSORS SUCH AS MARV, HP-MARV, AND NATIONAL-AERO-SPACE PLANS.

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Topic#: 91-072
Office: ASD
Contract #:
PI: Dennis M. Zallen

ID#: 91ASD-571

Title: Halon Replacements

Abstract: The proposed work will provide application data and performance descriptions of alternatives for Halon 1301 for aircraft fire protection and Halon 1211 for ground fire fighting in normally occupied/unoccupied areas. Research will consider physically and chemically active fire extinguishing agents which have low/zero ODP, GWP, and toxicities; in addition to rating high in the assessment against application parameters. The objectives will be accomplished first by assessing application criteria against the halon alternatives (commercial/research) and other proven agents. Federally funded data bases and experiments for potential agents for fire/explosion suppression will be analyzed. Studies will look for second generation halon replacements beyond HCFCs and will consider saturated halocarbons (perfluoro, photosensitive, hydrogen-containing compounds), fluorinated carbonyl compounds, unsaturated halocarbons (fluoro- and bromofluoro-alkenes), halogenated ethers (and related compounds with oxygen added between two carbon groups in an alkane), halons containing iodine, sulfur halides, phosphorous compounds (fire retardants), Group IVA element stable halides, and volatile alkali and heavy metal inhibitors. Another product of Phase

AIR FORCE ABSTRACTS OF SBIR PHASE I AWARDS

I will be frameworks of data-based agent specifications, which will be finalized in Phase II.

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Topic#: 91-191 ID#: 91OSR-368
Office: APOSR
Contract #: F49620-91-C-0043
PI: MAR^Y F. SWEENEY

Title: OPTIMIZATION OF RESONANT INTERBAND TUNNEL DEVICES

Abstract: Resonant Interband Tunnel Diodes (RITD's) are a new negative resistance device, with potential for very high speed, large peak to valley ratios, and the potential for customized I/V curves. These devices are believed to be capable of switching in ~ 2 ps., or of offering gain in the teraHz range. Potential applications include the generation, amplification, and detection of TereHz range signals, and very high speed logic. We propose to carry out a research effort composed of device modelling, and device physics. The device modelling will include the development of computer models, which could be developed further (under Phase II) into tools useable by other researchers. The device physics effort is intended to result in recommendations for high speed three terminal device for further development.

CROSS REFERENCE

AIR FORCE LABORATORIES AND RESEARCH CENTERS:

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NAVY 91-016

ITERATIONS, INC.

DARPA 91-036
SDIO 91-010

J.A. WOOLLAM COMPANY

ARMY 91-046
ARMY 91-243

JAMESON ROBOTICS

DARPA 91-113

JET PROCESS CORP.

ARMY 91-133
DARPA 91-095

JIREH SYSTEMS

NAVY 91-338

JOHN R. BAYLESS COMPANY

DARPA 91-111
DNA 91-015

JRS RESEARCH LABORATORIES, INC.

NAVY 91-106

JSP INDUSTRIES, INC.

DARPA 91-128

JWA DIVISION, EMADEL ENTERPRISES, INC.

DARPA 91-220

KARTA TECHNOLOGY, INC.

AF 91-065

KC RESEARCH CORP.

DARPA 91-030

KINETICS GEN. IND., INC.

DARPA 91-243

KNOWLEDGE BASED SYSTEMS, INC.

DARPA 91-043
DARPA 91-050
DARPA 91-223

KNOWLEDGE INDUSTRIES

DARPA 91-218

KNOWLEDGE SYSTEMS CONCEPTS, INC.

DARPA 91-041

KONSAL RESEARCH ASSOC.

DARPA 91-054

KTAADN, INC.

AF 91-178

KTECH CORP.

DARPA 91-005

KVH INDUSTRIES, INC.

NAVY 91-363

L & W RESEARCH, INC.

AF 91-116

L-CHEM, INC.

NAVY 91-081

LABTEK CORP.

ARMY 91-004

LANGUAGE SYSTEMS, INC.

ARMY 91-108

LANXIDE CORP.

DARPA 91-126
DARPA 91-150
DARPA 91-152

LASER PHOTONICS TECHNOLOGY, INC.

AF 91-190
SDIO 91-003

LASER PHOTONICS, INC.

AF 91-167

LASER POWER CORP.

NAVY 91-348

LASER POWER RESEARCH

NAVY 91-285
DARPA 91-061
DARPA 91-117

CROSS REFERENCE

LASER SCIENCE COMPANY

SDIO 91-013
SDIO 91-013
SDIO 91-014

LASER SCIENCE, INC.

SDIO 91-003

LASER SYSTEMS AND RESEARCH CORP.

SDIO 91-003

LASERGENICS CORP.

AF 91-005
AF 91-115
AF 91-134

LB&M ASSOC., INC.

ARMY 91-248

LENTEC CORP.

ARMY 91-241

LICA SYSTEMS, INC.

ARMY 91-034

LIFECCELL CORP.

ARMY 91-028

LIGHT SCIENCES, INC.

DARPA 91-128

LIGHTWAVE ELECTRONICS CORP.

DARPA 91-118
DARPA 91-225

LINARES MANAGEMENT ASSOC., INC.

SDIO 91-014

LINDSEY ASSOC.

NAVY 91-364

LJF CORP.

NAVY 91-263

LNK CORP.

NAVY 91-357

LOGIX CORP.

NAVY 91-138

LONE PEAK ENGINEERING, INC.

SDIO 91-003

LYNNE GILFILLAN ASSOC., INC.

DARPA 91-216

LYNNTECH, INC.

ARMY 91-028
AF 91-058

M. L. ENERGIA, INC.

ARMY 91-080
ARMY 91-117
NAVY 91-344
AF 91-057

MAC AULAY-BROWN, INC.

NAVY 91-347

MACH I, INC.

AF 91-013

MACHINE PERCEPTION INTERNATIONAL

ARMY 91-018

MAINSTREAM ENGINEERING CORP.

ARMY 91-070
ARMY 91-092
DARPA 91-221

MAK TECHNOLOGIES, INC.

ARMY 91-180
ARMY 91-254
DARPA 91-003
DARPA 91-142

MALIBU RESEARCH ASSOC.

NAVY 91-193
AF 91-011

MANDEX, INC.

ARMY 91-201
NAVY 91-286

MANHATTAN TURBINE CORP.

DARPA 91-149

MANSOUR ENGINEERING, INC.

NAVY 91-100

MARK RESOURCES, INC.

NAVY 91-196
DARPA 91-001

MARKO MATERIALS, INC.

SDIO 91-013

CROSS REFERENCE

MARLOW INDUSTRIES, INC.
ARMY 91-047

MARTIN SYSTEMS, INC.
AF 91-029
DARPA 91-151

MASSACHUSETTS TECHNOLOGICAL LAB
ARMY 91-121

MATERIALS AND ELECTROCHEMICAL RESEARCH

ARMY 91-018
ARMY 91-170
NAVY 91-168
NAVY 91-245
AF 91-075
DARPA 91-093

MATERIALS SCIENCES CORP.
ARMY 91-164

MATERIALS TECHNOLOGIES CORP.
NAVY 91-154
SDIO 91-011

MAYA DESIGN GROUP, INC.
ARMY 91-148

MAYFLOWER COMMUNICATIONS COMPANY, INC.

AF 91-156

MCMAHAN ELECTRO-OPTICS, INC.
SDIO 91-003

MEDICAL LASER RESEARCH & DEVELOPMENT
COR
DARPA 91-083

MEGADYNE CORP.
NAVY 91-247

MEI ASSOC., INC.
AF 91-025

MEMBRANE DEVELOPMENT SPECIALISTS, INC.
NAVY 91-354

MEMBRANE TECHNOLOGY AND RESEARCH, INC.

AF 91-060
AF 91-187

MENTOR TECHNOLOGIES, INC.
ARMY 91-009
ARMY 91-086
ARMY 91-111

MERIDIAN INDUSTRIES, INC.
DARPA 91-129

METAGENE CORP.
ARMY 91-027

METATECH CORP.
DARPA 91-087

METHODICS, INC.
NAVY 91-181

METRATEK, INC.
NAVY 91-144
NAVY 91-303

METROLASER
AF 91-009
AF 91-015
AF 91-101
SDIO 91-003

METRON, INC.
NAVY 91-111

MICRILOR, INC.
ARMY 91-002
DARPA 91-139

MICROCOM CORP.
NAVY 91-195
NAVY 91-327
NAVY 91-328

MICROSCIENCE, INC.
SDIO 91-015

MICROSENSOR SYSTEMS, INC.
ARMY 91-073

MICROTRONICS ASSOC., INC.
DARPA 91-060

MILLITECH CORP.
ARMY 91-134

CROSS REFERENCE

MISSION RESEARCH CORP.

ARMY 91-154
ARMY 91-157
ARMY 91-160
NAVY 91-186
NAVY 91-221
NAVY 91-270
AF 91-064
DARPA 91-023
DARPA 91-024
DARPA 91-087
DNA 91-005

MO-SCI CORP.

ARMY 91-067

MOIRESTRESS, INC.

ARMY 91-171

MOLECULAR TECHNOLOGIES, INC.

DARPA 91-062

MOLTECH CORP.

DARPA 91-033
DARPA 91-101

MONTEREY TECHNOLOGIES, INC.

ARMY 91-015
NAVY 91-220

MORGAN RESEARCH CORP.

DARPA 91-222

MORLOCK ENVIRONMENTAL,, INC.

DNA 91-001

MOTIVAIR CORP.

ARMY 91-045

MRAM, INC.

SDIO 91-011

MRJ, INC.

ARMY 91-021
DARPA 91-151
SDIO 91-012

MSNW, INC.

DARPA 91-070

MTL SYSTEMS, INC.

AF 91-093
AF 91-110

MULTILAYER OPTICS AND XRAY TECH, INC.

ARMY 91-143

MUSYN, INC.

NAVY 91-261

MVM ELECTRONICS, INC.

NAVY 91-173

NANOSTRUCTURES, INC.

DARPA 91-033

NAVMAR APPLIED SCIENCES CORP.

NAVY 91-198

NAVSYS CORP.

AF 91-156
AF 91-171
AF 91-173
DARPA 91-242

NAVSYS CORP. & 3C SYSTEMS CO.

NAVY 91-283

NAVSYS CORP/SC SYSTEM

NAVY 91-274

NDI ENGINEERING COMPANY

NAVY 91-206

NEILLEN TECHNOLOGIES CORP.

ARMY 91-149

NEOCERA, INC.

SDIO 91-015

NEOTRONICS CORP.

ARMY 91-020

NETROLOGIC, INC.

DARPA 91-113

NETWORK DYNAMICS, INC.

DARPA 91-181

NIELSEN ENGINEERING AND RESEARCH, INC.

AF 91-189
NAVY 91-161

NIMBLE COMPUTER CORP.

ARMY 91-060
SDIO 91-010

CROSS REFERENCE

NKF ENGINEERING, INC.
NAVY 91-099
NAVY 91-132

NOMAC ENERGY SYSTEMS, INC.
ARMY 91-191

NONVOLATILE ELECTRONICS, INC.
AF 91-102

NORTH AMERICAN WEATHER CONSULTANTS
AF 91-162

NORTH COAST INNOVATION, INC.
ARMY 91-166
NAVY 91-010

NORTH EAST SEMICONDUCTOR, INC.
SDIO 91-014

NORTH STAR RESEARCH CORP.
AF 91-169

NORTHEAST PHOTOSCIENCES
AF 91-025
SDIO 91-005

NORTHWEST RESEARCH ASSOC., INC.
NAVY 91-291

NOVA ELECTRONICS & SOFTWARE
ARMY 91-040
SDIO 91-003

NTI, INC.
ARMY 91-209

NUMERICAL TECHNOLOGY, INC.
DARPA 91-075

O. DONN GRACE, PHD, INC.
NAVY 91-324

OAKTREE AUTOMATION, INC.
NAVY 91-244

OCA APPLIED OPTICS, INC.
NAVY 91-352

OFFICE OF NICHOLAS N. RIVERA, PHD
NAVY 91-204

OMNIA RESEARCH CORP.
AF 91-006

OMNITEK, INC.
AF 91-060
NAVY 91-147

OMNIVIEW, INC.
AF 91-095
DARPA 91-195

ONYX SCIENCES CORP.
DARPA 91-084

OPHIDIAN PHARMACEUTICALS, INC.
ARMY 91-027

OPHIR CORP.
ARMY 91-012

OPTECH LABORATORY
ARMY 91-128

OPTICAL CONCEPTS RESEARCH
SDIO 91-011

OPTICAL E.T.C., INC.
ARMY 91-074
ARMY 91-082

OPTICAL SENSOR TECHNOLOGY
DARPA 91-161

OPTICS 1, INC.
NAVY 91-236
NAVY 91-346

OPTIMAL ANALYSIS COMPANY, INC.
DARPA 91-183

OPTIMETRICS, INC.
ARMY 91-105

OPTIMUM STRUCTURAL DESIGN, INC.
NAVY 91-100

OPTIPHASE, INC.
NAVY 91-110
NAVY 91-349

OPTIVISION, INC.
AF 91-046

CROSS REFERENCE

OPTO-ELECTRIC
DARPA 91-237

OPTO-KNOWLEDGE SYSTEMS, INC.
AF 91-001

OPTOELECTRIC
DARPA 91-065

OPTRA, INC.
ARMY 91-168
NAVY 91-211
AF 91-021

OPTRON SYSTEMS, INC.
AF 91-025
DARPA 91-080

OR CONCEPTS APPLIED
AF 91-082

ORA CORP.
SDIO 91-010

ORBITAL RESEARCH, INC.
DARPA 91-134

ORINCON CORP.
ARMY 91-058
NAVY 91-131
NAVY 91-135
NAVY 91-297
DARPA 91-068
DARPA 91-106
DARPA 91-109

ORINCON-HAWAII CORP.
NAVY 91-128
NAVY 91-155

ORTEL CORP.
AF 91-033

PACIFIC ADVANCED TECHNOLOGY
AF 91-147

PACIFIC REM ENGINEERING
ARMY 91-109

PACIFIC-SIERRA RESEARCH CORP.
AF 91-052
DNA 91-001
NAVY 91-197

PDA ENGINEERING
AF 91-073

PDF SOLUTIONS
DARPA 91-182
DARPA 91-198

PDI CORP.
NAVY 91-207
NAVY 91-356

PEN RESEARCH, INC.
DARPA 91-006

PENETRADAR CORP.
ARMY 91-043

PERCEPTRONICS, INC.
DARPA 91-030
DARPA 91-177

PERCEPTUAL IMAGES
ARMY 91-139

PHASE IV SYSTEMS, INC.
ARMY 91-235

PHASEX CORP.
ARMY 91-068
AF 91-186

PHOENIX DIGITAL CORP.
NAVY 91-119

PHONON CORP.
ARMY 91-138

PHOTOGLASS
AF 91-007

PHOTOMETRICS, INC.
AF 91-161

PHOTONIC SYSTEMS, INC.
NAVY 91-264

PHOTONICS RESEARCH, INC.
ARMY 91-242

PHOTONICS TECHNOLOGIES
NAVY 91-191
SDIO 91-011

CROSS REFERENCE

PHYSICAL OPTICS CORP.

ARMY 91-071
ARMY 91-144
ARMY 91-169
NAVY 91-102
NAVY 91-119
NAVY 91-349
AF 91-027
AF 91-038
AF 91-044
DARPA 91-144
DARPA 91-192
SDIO 91-011
SDIO 91-014

PHYSICAL RESEARCH, INC.

DARPA 91-112
DARPA 91-114

PHYSICAL SCIENCES, INC.

ARMY 91-057
ARMY 91-182
NAVY 91-167
NAVY 91-213
AF 91-057
AF 91-144
AF 91-181
AF 91-200
DARPA 91-057

PHYSICON, INC.

AF 91-116

PHYSICS MATHEMATICS AND COMPUTERS, INC.

NAVY 91-162

PIASECKI AIRCRAFT CORP.

NAVY 91-317

PLANAR SYSTEMS, INC.

ARMY 91-137

PLANNING SYSTEMS, INC.

ARMY 91-176

POSITECH, INC.

SDIO 91-010

POTOMAC PHOTONICS, INC.

AF 91-196
DARPA 91-112

PRADEEP K. GUPTA, INC.

AF 91-128

PRECISION COMBUSTION, INC.

ARMY 91-011

PRECISION MEASUREMENT COMPANY

AF 91-197

PRINCETON COMBUSTION RESEARCH LAB.

ARMY 91-035

PRINCETON SCIENTIFIC ENTERPRISES

ARMY 91-117

PRINCETON SCIENTIFIC INSTRUMENTS

ARMY 91-116

PRINCETON X-RAY LASER, INC.

SDIO 91-001

PROMETHEUS, INC.

NAVY 91-124
NAVY 91-202
DARPA 91-045

PROTOTYPE SIMULATIONS

DARPA 91-141

PSI TECHNOLOGY COMPANY

DARPA 91-074
DARPA 91-113

Q-DOT, INC.

AF 91-086
DARPA 91-114

QRDC, INC.

DARPA 91-094

QSOURCE, INC.

SDIO 91-003
SDIO 91-003

QUAD DESIGN TECHNOLOGY, INC.

DARPA 91-076

QUANTEX CORP.

NAVY 91-157
DARPA 91-080

QUANTIC INDUSTRIES, INC.

NAVY 91-135

CROSS REFERENCE

QUANTUM CONSULTANTS, INC.

ARMY 91-014

QUANTUM CONTROLS

DARPA 91-168

QUANTUM EPITAXIAL DESIGNS, INC.

SDIO 91-014

QUATR CORP.

DARPA 91-096

QUEST INTEGRATED, INC.

ARMY 91-130

ARMY 91-165

NAVY 91-257

AF 91-023

AF 91-024

AF 91-052

AF 91-079

DARPA 91-127

SDIO 91-013

RADCON RADAR CONTROL SYSTEMS

DARPA 91-138

RADIATION MONITORING DEVICES, INC.

ARMY 91-131

AF 91-042

RADIX SYSTEMS, INC.

NAVY 91-130

RADIX TECHNOLOGIES, INC.

ARMY 91-051

AF 91-173

DARPA 91-002

RANTECH COMPANY

SDIO 91-011

RASOR ASSOC., INC.

SDIO 91-004

RD INSTRUMENTS

NAVY 91-293

NAVY 91-294

RECOGNITION RESEARCH, INC.

ARMY 91-204

REDZONE ROBOTICS, INC.

ARMY 91-099

ARMY 91-102

REKENTHALER TECHNOLOGY ASSOC. CORP.

ARMY 91-203

NAVY 91-140

NAVY 91-291

DARPA 91-135

REMAXCO TECHNOLOGIES, INC.

NAVY 91-351

REMTECH, INC.

AF 91-049

RESEARCH APPLICATIONS, INC.

ARMY 91-007

RESEARCH INTERNATIONAL, INC.

NAVY 91-121

RESEARCH PARTNERSHIP

AF 91-024

RESEARCH SUPPORT INSTRUMENTS, INC.

AF 91-159

RESEARCH TECHNOLOGY ASSOC.

ARMY 91-251

RESSLER ASSOC., INC.

NAVY 91-008

RETICULAR SYSTEMS, INC.

ARMY 91-053

ARMY 91-185

ARMY 91-188

SDIO 91-010

REUSE, INC.

DARPA 91-212

REVEO, INC.

SDIO 91-014

RGS ASSOC., INC.

NAVY 91-150

ROBERT LEVI ASSOC.

NAVY 91-217

CROSS REFERENCE

ROBOTIC SYSTEMS TECHNOLOGY

DARPA 91-203

ROCKFORD TECHNOLOGY ASSOC., INC.

AF 91-150

ROOS INSTRUMENTS

DARPA 91-157

RTS LABORATORIES, INC.

SDIO 91-004

RUDOLF, PAUL G.

AF 91-059

S-TRON

ARMY 91-064

SABBAGH ASSOC., INC.

NAVY 91-350

SAN JUAN TECHNOLOGIES

SDIO 91-013

SAPHIKON, INC.

AF 91-037

SARCOS RESEARCH CORP.

ARMY 91-222

DARPA 91-005

SATCON TECHNOLOGY CORP.

ARMY 91-018

NAVY 91-249

NAVY 91-267

NAVY 91-317

NAVY 91-332

NAVY 91-359

SDIO 91-012

SAVANNAH RIVER ASSOC., INC.

NAVY 91-055

SAVI TECHNOLOGY, INC.

ARMY 91-167

SCHMIDT INSTRUMENTS, INC.

AF 91-057

DARPA 91-097

DARPA 91-174

SDIO 91-003

SCHWARTZ ELECTRO-OPTICS, INC.

ARMY 91-112

ARMY 91-173

ARMY 91-249

ARMY 91-252

AF 91-160

DARPA 91-061

DARPA 91-064

DARPA 91-227

DARPA 91-235

SCIENCE AND APPLIED TECHNOLOGY, INC.

AF 91-090

SCIENCE AND ENGINEERING ASSOC.

DNA 91-008

SCIENCE HORIZONS, INC.

DARPA 91-088

SCIENCE RESEARCH LABORATORY, INC.

ARMY 91-079

DARPA 91-063

DARPA 91-112

DARPA 91-227

DNA 91-016

SDIO 91-001

SDIO 91-003

SCIENTIFIC COMPUTING ASSOC., INC.

NAVY 91-005

DARPA 91-036

DARPA 91-036

SCIENTIFIC RESEARCH ASSOC., INC.

ARMY 91-141

AF 91-135

DARPA 91-079

SCIENTIFIC SYSTEMS COMPANY

ARMY 91-003

ARMY 91-129

AF 91-195

DARPA 91-148

SDIO 91-010

SCS TELECOM, INC.

ARMY 91-006

DARPA 91-163

SEAKAY MANAGEMENT CORP.

NAVY 91-125

NAVY 91-132

CROSS REFERENCE

SEAMORE, INC.
NAVY 91-102

SEARCH TECHNOLOGY, INC.
ARMY 91-188
AF 91-109

SECURE SOLUTIONS, INC.
NAVY 91-061

SENSOR PLUS, INC.
ARMY 91-212

SENSOR SYSTEMS GROUP, INC.
SDIO 91-003

SENTEL CORP.
NAVY 91-114

SEPARATION INDUSTRIES
AF 91-142

SEPARATION SYSTEMS TECHNOLOGY, INC.
ARMY 91-001

SETS TECHNOLOGY, INC.
ARMY 91-021

SFA, INC.
AF 91-022

SI, DIVISION OF SPECTRUM 39
ARMY 91-008

SIERRA MONOLITHICS, INC.
SDIO 91-015

SIGMA GAMMA LAMBDA, INC.
NAVY 91-130

SIGNAL CORP.
NAVY 91-033

SIGNAL ENGINEERING, INC.
NAVY 91-287
AF 91-084

SIGNAL PROCESSING TECHNOLOGY, LTD.
DARPA 91-145

SILHOUETTE TECHNOLOGY, INC.
NAVY 91-199

SILICON DESIGNS, INC.
NAVY 91-248

SILICON ENGINES, INC.
SDIO 91-010

SILICON FILMS CORP.
SDIO 91-014

SIMEX SYSTEMS & SOFTWARE CORP.
ARMY 91-062

SIMPEX TECHNOLOGIES, INC.
ARMY 91-161

SIMPSON WEATHER ASSOC., INC.
AF 91-158

SIMULA, INC.
ARMY 91-018

SIPPICAN, INC.
NAVY 91-009

SKW CORP.
DARPA 91-177
SDIO 91-003

SOFTWARE ENGINEERING & TECHNICAL ANALYSIS
DARPA 91-213

SOFTWARE PRODUCTIVITY SOLUTIONS, INC.
ARMY 91-059
DARPA 91-212

SOHAR, INC.
AF 91-085

SONALYSTS, INC.
NAVY 91-124
NAVY 91-125
NAVY 91-131

SONOSCAN, INC.
SDIO 91-013

SOUTHWEST SCIENCES, INC.
DARPA 91-025

SPACE AND AERONAUTICAL SCIENCES, INC.
AF 91-151

CROSS REFERENCE

SPACE APPLICATIONS CORP.

ARMY 91-061
NAVY 91-303

SPACE POWER, INC.

SDIO 91-014

SPACE TECH CORP.

AF 91-106

SPACEBORNE, INC.

DARPA 91-206

SPARKTECH

NAVY 91-214

SPARTA, INC.

AF 91-146
AF 91-174
DARPA 91-006
DARPA 91-013
DARPA 91-048
NAVY 91-003
NAVY 91-004
NAVY 91-074
NAVY 91-241
NAVY 91-308

SPECTRA RESEARCH, INC.

ARMY 91-194
DARPA 91-001

SPECTRAL SCIENCES, INC.

ARMY 91-132
AF 91-022

SPECTRUM PHOTONICS

DARPA 91-063

SPIRE CORP.

ARMY 91-026
ARMY 91-063
NAVY 91-209
NAVY 91-361
AF 91-014
AF 91-028
DARPA 91-060
DARPA 91-062
DARPA 91-081
DARPA 91-097
SDIO 91-014
SDIO 91-014
SDIO 91-014
SDIO 91-014

SQM TECHNOLOGY, INC.

DARPA 91-004

SRA OPTIK

AF 91-188

SRS TECHNOLOGIES

AF 91-031
AF 91-128
AF 91-154

STANLEY ASSOC.

NAVY 91-136

STEINBRECHER CORP.

ARMY 91-013

STERIS CORP.

ARMY 91-219

STOTTLER HENKE ASSOC., INC.

ARMY 91-021
ARMY 91-198

STR CORP.

DARPA 91-075

STRATEGIC FRAMEWORKS, INC.

DARPA 91-183

STRESAU LABORATORY, INC.

NAVY 91-282

STRUCTURED SYSTEMS & SOFTWARE, INC.

DARPA 91-010

CROSS REFERENCE

SUMMITEC CORP.

NAVY 91-281

SUNBURST RECOVERY, INC.

DARPA 91-016

SUPERCONDUCTIVE COMPONENTS, INC.

DARPA 91-076

SUPERCONDUCTIVE ELECTRONICS, INC.

DARPA 91-098

SUPERCONDUCTOR TECHNOLOGIES, INC.

AF 91-092

AF 91-098

SDIO 91-003

SDIO 91-015

SDIO 91-015

SUPERCONIX, INC.

SDIO 91-015

SUPERIOR VACUUM TECHNOLOGY, INC.

AF 91-097

DARPA 91-060

SURFACE OPTICS CORP.

AF 91-114

SURFACES RESEARCH & APPLICATIONS

ARMY 91-100

SURFACTANT ASSOC., INC.

AF 91-056

SURVICE ENGINEERING COMPANY

ARMY 91-022

SYMBIOTECH, INC.

ARMY 91-225

SYMBIOTICS, INC.

NAVY 91-296

SYMETRIX CORP.

DARPA 91-077

SYNCHRONETICS, INC.

AF 91-025

SYNETICS CORP.

NAVY 91-035

NAVY 91-119

NAVY 91-122

NAVY 91-300

SYNEX, INC.

NAVY 91-046

SYSTEMS & PROCESSES ENGINEERING CORP.

ARMY 91-031

ARMY 91-083

ARMY 91-206

NAVY 91-176

DARPA 91-001

DARPA 91-131

SYSTEMS CONTROL TECHNOLOGY, INC.

ARMY 91-021

NAVY 91-089

NAVY 91-237

NAVY 91-355

DNA 91-010

SDIO 91-012

SYSTEMS ENGINEERING ASSOC. CORP.

NAVY 91-126

SYSTEMS EVALUATION LABORATORY IN FLIGHT

SDIO 91-003

SYSTEMS EXPLORATION, INC.

AF 91-062

SYSTEMS SOFTWARE ENGINEERING CORP.

NAVY 91-219

SYSTEMS TECHNOLOGY, INC.

ARMY 91-018

NAVY 91-091

TACAN CORP.

ARMY 91-156

AF 91-163

AF 91-190

TANNER RESEARCH, INC.

NAVY 91-252

DARPA 91-206

DARPA 91-233

TAU CORP.

DARPA 91-078

CROSS REFERENCE

TC SPECIALTY PRODUCTS CO.
ARMY 91-183

TCAM TECHNOLOGY, INC.
AF 91-104

TDA RESEARCH, INC.
ARMY 91-007
NAVY 91-101
AF 91-131

TECHNETICS CORP.
ARMY 91-018

TECHNICAL CERAMICS LABORATORIES, INC.
NAVY 91-177

TECHNICAL EVALUATION RESEARCH, INC.
ARMY 91-054

TECHNICAL IMAGING SERVICES, INC.
SDIO 91-011

TECHNICAL RESEARCH ASSOC., INC.
AF 91-060
DARPA 91-068

TECHNISCAN, INC.
NAVY 91-006

TECHNO-SCIENCES, INC.
ARMY 91-032

TECHNOCHEM COMPANY
NAVY 91-190
NAVY 91-343

TECHNOLOGY INTEGRATION & DEVELOPMENT
AF 91-103

TECHNOLOGY INTEGRATION, INC.
DARPA 91-113

TECHNOLOGY INTERNATIONAL, INC.
ARMY 91-055
NAVY 91-358

TECHNOLOGY MODELING ASSOC., INC.
DARPA 91-027

TECHQUEST, INC.
ARMY 91-212

TECSEC, INC.
NAVY 91-057

TERA RESEARCH, INC.
ARMY 91-205
NAVY 91-309

TERRA TEK, INC.
DNA 91-011
DNA 91-020

TETRA CORP.
ARMY 91-159
DNA 91-015
SDIO 91-002
SDIO 91-005

TEXAS RESEARCH INSTITUTE AUSTIN, INC.
ARMY 91-127
AF 91-149

THERMACORE, INC.
ARMY 91-193
SDIO 91-001

THERMAL SPRAY TECHNOLOGIES, INC.
ARMY 91-177

THIN FILM CONCEPTS, INC.
SDIO 91-015

TIBURON SYSTEMS, INC.
NAVY 91-039
NAVY 91-134
NAVY 91-141

TOP LEVEL, INC.
DARPA 91-036

TORREY SCIENCE & TECHNOLOGY CORP.
DARPA 91-233

TOYON RESEARCH CORP.
ARMY 91-233
NAVY 91-240
AF 91-082
AF 91-174

TPL, INC.
ARMY 91-038
ARMY 91-039
ARMY 91-136
NAVY 91-104

CROSS REFERENCE

TRANS-SCIENCE CORP.
DARPA 91-099

TRANSDUCER RESEARCH, INC.
ARMY 91-073

TRELLIS SOFTWARE & CONTROLS, INC.
DARPA 91-050

TRIANGLE RESEARCH & DEVELOPMENT CO.
NAVY 91-243
NAVY 91-307
NAVY 91-322

TRIDENT INTERNATIONAL, INC.
NAVY 91-235

TRIDENT SYSTEMS, INC.
ARMY 91-113
NAVY 91-086
NAVY 91-136

TRS CERAMICS, INC.
DARPA 91-077

TRYMER COMPANY
SDIO 91-005

TTL TECHNIQUES
DARPA 91-028

ULTRAMET
AF 91-145
AF 91-181
SDIO 91-002
SDIO 91-007

UNIAX CORP.
SDIO 91-014

UNIQUE ELECTRONICS, INC.
DARPA 91-204

UNISTRY ASSOC.
AF 91-108
DNA 91-001

UNITED SIGNALS & SYSTEMS, INC.
ARMY 91-076

UNIVERSAL ENERGY SYSTEMS, INC.
NAVY 91-142
AF 91-115
SDIO 91-014

UNIVERSITY RESEARCH ENGINEERS & ASSOCS.
DARPA 91-054

UNDXPROS, INC.
NAVY 91-279

UTEK, INC.
DARPA 91-185

UTILITY DEVELOPMENT CORP.
ARMY 91-088

VACTRONIC LAB EQUIPMENT, INC.
DNA 91-014

VECTOR RESEARCH, INC.
AF 91-080

VENDELIN ENGINEERING
DARPA 91-156

VENTURE SCIENTIFIC, INC.
ARMY 91-010

VERITAY TECHNOLOGY, INC.
ARMY 91-007
ARMY 91-118
ARMY 91-119
ARMY 91-211
NAVY 91-109

VERSATRON CORP.
NAVY 91-156
NAVY 91-242

VESTAR, INC.
NAVY 91-313

VIASAT, INC.
ARMY 91-115
ARMY 91-245
NAVY 91-017
NAVY 91-120
NAVY 91-294
AF 91-025
AF 91-030
AF 91-171

CROSS REFERENCE

VIRTUAL IMAGE LABS, INC.
DNA 91-001

VISTA RESEARCH, INC.
NAVY 91-165

WAGONER, JAMES E. TECHNICAL CONSULTANTS
AF 91-065

WEST COAST RESEARCH CORP.
AF 91-104

WILFRED BAKER ENGINEERING, INC.
AF 91-053

WINTEC, INC.
NAVY 91-073

WIZDOM SYSTEMS, INC.
DARPA 91-052

XACTON CORP.
SDIO 91-003
SDIO 91-003

XEMET, INC.
DARPA 91-056

XERAD, INC.
SDIO 91-002

XINOTECH RESEARCH, INC.
DARPA 91-208
DARPA 91-209

XONTECH, INC.
ARMY 91-235
AF 91-175

XYBION ELECTRONIC SYSTEMS CORP.
NAVY 91-012

YARDNEY TECHNICAL PRODUCTS, INC.
NAVY 91-007

YELLOWSTONE ENVIRONMENTAL SCIENCE, INC.
DARPA 91-111

ZALLEN INTERNATIONAL ASSOC.
AF 91-072

ZEREN RESEARCH, INC.
ARMY 91-037

ZYTRON LTD
AF 91-191