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# The Department of Defense

## DoD DEPARTMENTS/AGENCIES:



Department of the Army



Department of the Navy



Department of the Air Force



Advanced Research Projects Agency



Defense Nuclear Agency



Strategic Defense Initiative Organization

## DEFENSE SMALL BUSINESS INNOVATION RESEARCH PROGRAM (SBIR)

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FY 1992 SBIR  
PHASE II AWARD ABSTRACTS

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## PREFACE

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During Fiscal Year (FY) 1992 the Military Services, the Defense Advanced Research Project Agency (DARPA)<sup>1</sup>, the Defense Nuclear Agency (DNA), and the Strategic Defense Initiative Organization (SDIO) selected 434 proposals for funding in Phase II of the Small Business Innovation Research (SBIR) Program. These proposals were selected from those submitted by small research and development (R&D) firms awarded Phase I contracts from previous fiscal year solicitations.

In order to make information available on the technical content of the Phase II projects supported by the Department of Defense (DoD) SBIR Program, this report presents the abstracts of those proposals which have resulted in contract awards. Further, the name and address of each firm performing the work is given for those who may desire additional information about the project. 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 SBIR firm directly.

### FY 1992 Phase II Program:

FY 1992 Phase II awards were made to firms that had Phase I awards from several past solicitations, but mainly from solicitations FY90.1, FY90.2, FY91.1, and FY91.2. The topic number accompanying each abstract displays the solicitation year of the Phase I. Presentation of the technical abstracts which describe the nature of the funded FY 1992 Phase II SBIR projects is the main purpose of this report. Proprietary information is not provided in these abstracts, therefore technical details may be missing. For this reason, the report supplies the names of individuals (the principal investigator, PI) in the small business firms who may be contacted should more information be needed on a specific project.

	<u>Proposals Received</u>	<u>Phase II Awards</u>
Army	430	171
Navy	150	52
Air Force	327	109
DARPA <sup>1</sup>	130	41
DNA	19	12
SDIO	160	49

Phase II abstracts presented in this report are in alphabetical order by DoD Component.

<sup>1</sup> As of March 15, 1993, DARPA changed its name to Advanced Research Projects Agency (ARPA). However, DARPA is used in this publication because the solicitation topics and awards were made before the name changed to ARPA.

## INTRODUCTION

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On July 22, 1982 the President signed the "Small Business Innovation Development Act of 1982" (Public Law 97-219). This law is designed to give small high technology firms a greater share of the Federal R&D contract awards. The Act mandates that all Federal Agencies establish an SBIR program if their fiscal year extramural budget for R&D exceed of \$100 million. Beginning in FY 1983, DoD began its SBIR Program by setting aside a percentage of its extramural R&D budget for this program. The percentage, set by Congress, began at .1 percent, and has increased over the years to the funding level of 1.25 percent for FY92. The "Small Business Research and Development Enhancement Act of 1992" (P.L. 102-564), signed October 28, 1992, extends the SBIR program through the fiscal year 2000 and expands the funding level beginning in FY93.

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

The SBIR Program consists of three distinct phases. Under Phase I, DoD Components make awards to small businesses responding to advertised solicitation topics. Typically, a Phase I award is for one half to one man-year effort over a period generally not to exceed 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. All DoD topics address specific R&D needs to improve our defense posture. 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. The successful completion of Phase I is a prerequisite 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. In addition, 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 generally not to exceed 24 months, also subject to negotiation. The number of Phase II awards will depend upon the success rate of the Phase I effort and the availability of funds. Phase II is the principal research or research and development effort, and will require a more comprehensive proposal which outlines the intended effort in detail.

Phase III is expected to involve private-sector investment and support for any necessary development that will bring an innovation to the marketplace. Also, under Phase III, DoD may award follow-on contracts, not funded by the SBIR Program, for products or processes meeting DoD mission needs.

## ARMY SBIR PHASE II AWARDS

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ADAPTIVE SENSORS, INC.  
216 Pico Boulevard, Suite 8  
Santa Monica, CA 90405  
Phone: (213) 396-5997

Topic#: 90-244 ID#: 90-EW-052  
Office: CECOM  
Contract #: DAAB07-92-C-J312  
PI: Dr. Harold M. Finn

Title: Adaptive Array Technology for Transportable Long Wavelength Ground-Based Bistatic Radar Systems

Abstract: The Phase II program subject includes the design, development, simulation and field testing of the conversion to a fully adaptive beam space receiver system of the Army's planned development of a bistatic weapons location radar system which includes an elevation and azimuth beam cluster on receive. The fully adaptive beam space signal processor conversion introduces the capability for the effective adaptive nulling of multiple side lobe barrage noise jammers without the need of additional sensing channels. In addition, the beam space adaptive processor provides the needed degrees of freedom for the effective nulling of a main beam jammer so that the coverage loss is minimized for the artillery shell traversing the beamcluster on its outward trajectory. The significant target azimuth and elevation errors resulting, for example, from the nulling of a near mainbeam jammer are also eliminated with a Maximum Likelihood Estimator (MLE) compensating procedure which is an integral part of the beam space adaptive signal processor. The proposed Phase II program will progress towards a feasibility demonstration of a fielded bistatic radar operating in a jamming environment and incorporating some of the major techniques under development during the Phase I program. The program goal is to provide the Army, in a timely manner, and completely compatible with the Army's planned baseline design, the fully adaptive-in-the-beam space signal and data processing subsystem design, including implementation concepts, an simulation testbed, and laboratory and field testing procedures.

ADVANCED FUEL RESEARCH, INC.  
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East Hartford, CT 06138  
Phone: (203) 528-9806

Topic#: 90-079 ID#: 90TEC-004  
Office: TECOM  
Contract #: DAAD01-91-0016  
PI: Peter R. Solomon

Title: Dust Measurement System Using Light and Beta Particle Scattering

Abstract: The Army has a requirement for the development of a real-time in-situ system to measure dust levels around and in moving vehicle undergoing dust testing. The sensor unit must be small enough to mount near the area of interest on the vehicle without greatly disturbing the ambient airflow, which in turn would effect the dust concentrations. An instrument is required that will meet the Army's specifications for size, performance, and accuracy. Also the unit must allow for measurements to be taken at several locations on the vehicle, during tests that last up to 10 hours from initiation to completion. Existing systems which utilize light scattering to determine dust characteristics are limited with respect to physical size, particle loadings, particle sizes, and severe environments. The innovation demonstrated in Phase I of this project was that for dust of sizes and compositions of particles encountered in Army tests, a relationship between the wavelength of incident light and a specific scattering angle exists such that the measurement of scattered light is directly proportional to the mass of dust in the light beam (i.e. grams/m<sup>3</sup>), independent of the particle size distribution. This suggests that a single-wavelength, single-angle measurement system, which requires a simple geometry, can be used to directly measure dust concentration. The Phase I program has resulted in the specifications for a low cost, compact sensing unit that satisfies the Army's requirements for in-situ dust measurements. For thesis Phase II project, we propose to complete the research that will allow us to design, build, test, calibrate and field test a prototype dust measurement system for Army applications.

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Topic#: 90-369 ID#: 90MTL-055  
Office: MTL  
Contract #: DAAL04-92-C-0018  
PI: Stephen C. Bates

Title: High Temperature Oxygen Index Apparatus

Abstract: Improvements in polymers and composites have led to proliferating military and commercial applications where fire hazard rating is important. The Oxygen Index (OI) provides one major relative ranking of a material's fire resistance. Initially used at room temperature, OI tests by Macaione for the Army, and others, have shown that OI values can change dramatically versus temperature. A commercial instrument performs measurements to 400 degrees centigrade, but data up to 800 degrees centigrade is needed by the Army for its advanced materials. The innovation of this program is the development of a single device that employs radiant sample heating and Fourier Transform Infrared (FTIR) Spectroscopy to perform high temperature OI testing together with other complementary tests (e.g., smoke point, density, corrosivity, toxicity, vaporization rate, etc.) that

## ARMY SBIR PHASE II AWARDS

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measure the important fire hazard characteristics of materials. Phase I research demonstrated the feasibility of a high temperature OI apparatus using radiant heating, a simpler, more flexible, and cheaper heating technique. This method of heating also allows tests of surfaces while eliminating edge burning effects. Phase II work will complete the research and deliver to the Army a high temperature OI-FTIR apparatus that will perform the above series of fire tests. By providing these capabilities the Phase II prototype will be an extremely valuable addition to the Army Materials Technology Laboratory and commercial materials and fire testing industries.

### ADVANCED MOTION CONTROL

P.O. Box 379  
Princeton, WI 54968  
Phone: (414) 295-3500

Topic#: 90-055 ID#: 90MIC-005  
Office: MICOM  
Contract #: DAAH01-92-C-R375  
PI: George H. Holling

Title: Electro-mechanical (EM) Actuator Driver

Abstract: The project will continue development with state of the art miniature servo amplifier. Three implementations will be performed and compared: surface mount technology (SMT) projected 0.8 cubic inches; hybrid technology expected volume 0.55 cubic inches; and "smart power" integration expected volume 0.4 cubic inches. The development will focus on the application of liquid cooling technology to achieve ultra high power densities. The devices will incorporate innovative minimum component count circuit technology, which has been successfully developed and tested during phase one of this project. The project will attempt to integrate the servo amplifier into the actuator. This will significantly reduce the required number of interconnects, and improve the systems reliability, noise and radiated energy output. Finally, integrated feedback sensors and an intelligent peripheral.

### ADVANCED TECHNOLOGY MATERIALS, INC.

7 Commerce Drive  
Danbury, CT 06810  
Phone: (203) 794-1100

Topic#: 90-314 ID#: 90ETD-012  
Office: ETDL  
Contract #: DAAL01-92-C-0236  
PI: Peter S. Kirlin, PhD

Title: MOCVD of HTSC: Process Development for Uniform, Large Area Growth

Abstract: Lack of low cost, large area high temperature superconducting (HTSC) films remains a barrier to the production and deployment of HTSC components and subsystems. The performance of HTSC components will be critical to next generation: electronic warfare, radar, smart weapons, and communications systems. Based on work done in the growth of compound semiconductors, metal organic chemical vapor deposition (MOCVD) has emerged as the preeminent deposition method for the growth of uniform films over large areas. In Phase I, a combined modeling/empirical approach was used to produce state-of-the-art TI-based HTSC precursor films. Less than 5% variation was observed over 2 inch diameter substrates. In Phase II, the model will be extended to design, build, and test a reactor capable of producing high quality films on 3 inch diameter substrates. Process conditions will be identified that are highly tolerant of small fluctuations in the process parameters to ensure a level of process reproducibility typical of the electronics industry. Ten TlBaCaCuO HTSC films on three inch substrates with uniformity better than 5% will be delivered to the Army at the conclusion of the program.

### ADVANCED TECHNOLOGY MATERIALS, INC.

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Topic#: 90-427 ID#: 91SDC-018  
Office: SDC  
Contract #: DASG60-92-C-0104  
PI: Charles P. Beetz, Jr.

Title: Contacts for Diamond Semiconductor Devices

Abstract: High temperature, radiation-hardened power semiconductors are very quickly reaching their limitations. Indeed, for some applications, devices are nonexistent despite a growing need within the DoD and throughout industry for higher power semiconductor devices. Military applications for high performance power semiconductors include transport, weapons, and communications. Commercial applications range from automobiles, to power generation, to mining and drilling operations. Reliability at sustained high temperatures and radiation levels is critical. Diamond possesses the physical and electronic properties to fill the gap in high temperature, radiation hardened power semiconductor technology. Key are stable ohmic and Schottky contacts. Wide bandgap materials, diamond (5.5 eV), pose special problems and demand ingenious solutions. In Phase I we proposed and demonstrated a novel contact formation technique using low energy silicon implantation into diamond.

## ARMY SBIR PHASE II AWARDS

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Transition metals were alloyed at relatively low temperatures to form a thin layer of silicides which lowered the Schottky barrier height between the diamond and the contacting metal by over a factor of two. In Phase II, we will optimize the contact technology through utilization of shallow co-implants and to demonstrate its utility in the fabrication of a high power photoconductive switch for microwave generation.

AERODYNE RESEARCH, INC.  
45 Manning Road  
Billerica, MA 01821  
Phone: (508) 663-9500

Topic#: 89-035 ID#: 89MIC-006  
Office: MICOM  
Contract #: DAAH01-92-C-R218  
PI: John A. Conant

Title: Automatic Target Model Degradation

Abstract: The growing need and capability for sensor simulation creates an ever-growing burden to create simulator input data in a timely and accurate manner. The Phase I program recently completed provided the Army with working software to automatically reduce the level-of-detail (LOD) of model geometries and radiances. The proposed Phase II program will enhance that software, and will address other aspects of the simulator data problem. These other aspects include the design of advanced geometry data structures, the translation between different geometric and image formats, the extension of the LOD solution to background scene elements, and the generation of specific data needed for MICOM programs. All software developed will be ported to an IRIS Unix-based workstation, and will be delivered to MICOM.

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Topic#: 90-141 ID#: 90AVS-141  
Office: AVSCOM  
Contract #: DAAJ02-92-C-0039  
PI: R. C. Miake-Lye

Title: A Cold Flow Test Facility for IR Suppressors

Abstract: An approach has been developed to accurately simulate the hot exhaust from a helicopter turboshaft engine using nominally ambient temperature flows for testing, development, and evaluation of IR suppressor devices at very low cost. This simulation makes use of a "Stagnation Temperature Similarity Principle" that allows a quantitative correspondence to be made between high temperature and ambient temperature flows. The theoretical basis for this simulation is described and experimental evidence of its utility for mixer/ejector flows - the class of flows encompassing IR suppressors - is reviewed. This similarity, as well as the other important similarities needed for accurate flow simulation, is exercised in the conceptual design of three Cold Flow Test Stand (CFTS) facility options. Each of these options has distinct advantages for IR suppressor evaluation and their relative merits are presented and discussed. The options include a full-scale cold flow, a sub-scale cold flow, and a sub-scale water flow facility. The equipment needed to produce the flow, as well as to calibrate and measure the important flow parameters, is described so that the capabilities of each facility can be compared to the needs of IR suppressor evaluation programs. The second phase of this Cold Flow Test Stand development effort will be directed at assembling and verifying the operation of a working sub-scale IR suppressor test facility. Phase II is a two year, two part effort to develop the sub-scale water and air simulation facilities designed conceptually in Phase I and to implement the proposed measurement systems so that the accuracy of the simulation can be quantitatively demonstrated. The 1/5th scale air simulation and IR imaging will be developed in the first year and the flow field data from the test facility will be compared to measurements made on a corresponding full-scale suppressor used on a working engine at AATD. In the second year, the water facility and Laser Induced Fluorescence (LIF) flow visualization will be developed, allowing general flow features to be directly observed in 1/5th scale model flows and used to further analyze and compare to data collected in the first

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Topic#: 91-015 ID#: 91HEL-301  
Office: HEL  
Contract #: DAAA15-92-C-0078  
PI: Dr. Jean MacMillan

Title: Human-Computer Interface for Machine-Aided Target Acquisition

Abstract: The human operator plays a critical role in screening detections even for state-of-the-art automated target-recognition (ATR) systems. Therefore, the human-ATR interface is a key element in ATR system design. The goal of this Phase II SBIR is to develop guidelines for the display of information from a multiple-sensor ATR system to support a human operator in

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identifying targets. We propose to empirically validate these display guidelines through laboratory experiments that measure target-identification performance using alternative human-ATR interface designs. We hypothesize that the best design for the human-ATR interface will depend on factors such as the quality of the information available, the difficulty of identifying individual targets, the time available for the target identification task, and the performance levels of the ATR system. We propose a design for an experiment paradigm that captures these key factors in the laboratory so that we can test ATR-interface designs across a broad range of target-identification difficulty and ATR performance levels. The proposal presents a series of hypotheses about the relationship between the ATR operator's information use, the task difficulty, and the level of ATR performance, and describes a plan for testing these hypotheses.

### ALTERNATIVE SYSTEM CONCEPTS

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Pelham, NH 03076  
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Topic#: 90-317 ID#: 90ETD-015  
Office: ETDL  
Contract #: DAAL01-92-C-0239  
PI: Carl A. Karrfalt

Title: BIST for OTS and ASIC VLSI Designs with VHDL (Automatic Built-in Test Insertion for Microelectronic Devices)  
Abstract: During Phase I, high-level synthesis was researched and the most promising methods selected for Phase II development of a design tool, named VBIT (VHDL Built-in Test). A new design paradigm divides abstract design space in two dimensions, beginning with the basic design and, perpendicular to each level of abstraction, adding test engineering steps. The new tool set will permit designers to navigate through the environment depicted by the design-for-testability diagram, making design automation tools easier to understand and use. Testability is the number two priority for improvement to Army electronics design (manufacturing is first). Surface mount packaging, and the increasing density and complexity of VLSI devices, demand more attention to design-for-test. VBIT will automatically add test circuitry to existing system and board level designs using both customizable and non-customizable devices. Analog synthesis will be considered based on high level synthesis and MHDL (MIMIC Hardware Description Language). VBIT will comply with industry standard IEEE 1076-1987 VHSIC Hardware Description Language (VHDL) and IEEE 1149.1-1990 Boundary-Scan Architecture (originally JTAG). A major commercial vendor of VHDL design automation tools is well on the way to a Phase III exclusive marketing arrangement with rights to license the product. Prototypes of test cases will be designed, fabricated, and tested. Additional funding will be sought for the formal validation and product testing of VBIT.

### AMHERST SYSTEMS, INC.

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Buffalo, NY 14221  
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Topic#: 90-243 ID#: 90-EW-051  
Office: CECOM  
Contract #: DAAB07-92-C-J607  
PI: David A. Macaluso

Title: Digital Interface Between Multispectral Force Laydown and Multispectral Environment Generator  
Abstract: A method of conveniently adapting existing scenario laydowns to a form compatible with an advanced multispectral simulator will allow facilities such as the CECOM Center for EW/RSTA to quickly and economically configure high-resolution test scenarios. Numerous "blessed" multispectral laydowns exist that can be implemented into simulator testing methodologies with a multispectral interface. An advanced simulator will be used to create complex emitters, that may be automatically associated with the laydown of interest. The simulator will also incorporate a method for rapidly editing light paths through the laydown of interest. The Phase II effort involves the design, development and delivery of an advanced simulator with a multispectral interface. The simulator will be incorporated into the existing MSEG, and will be designed to readily incorporate future MSEG enhancements.

### ANALYTIC POWER CORP.

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Boston, MA 02111  
Phone: (617) 542-6352

Topic#: 91-011 ID#: 91ARO-328  
Office: ARO  
Contract #: DAAL03-92-C-0041  
PI: David P. Bloomfield

Title: Mobile Electric Power

Abstract: Analytic Power proposes to develop a six pound, 350 watt, portable fuel cell power supply for the U.S. Army Research Office. Our Phase I work has demonstrated the feasibility of the power supply. In the first three months of the program we built a single cell which exceeded the cell performance requirement, and we constructed a 5 cell substack which

## ARMY SBIR PHASE II AWARDS

demonstrated the weight requirement. The five cell substack is currently under test. The material cost of the proposed approach is about \$2600 each. This is not based on speculative "long term, high quantity production" but on the cost of actual parts purchased in Phase I. The cost is about three times the cost of a gel type lead acid battery - which would weigh over 300 lb. The proposed program is focused at environmental and performance testing of twenty fuel cell power supplies, fifteen of which will be delivered to the Army 18 months after contract award. These prototype units will be tested at the Army's Natick Lab. Analytic Power will explore manufacturing methods which will further reduce fuel cell cost and permit their delivery in high quantities. We will also explore the production of an irreversible sodium borohydride hydrogen source.

ANTECH SERVICES  
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Chatsworth, CA 91311  
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Topic#: 90-296 ID#: 90TF-C-020  
Office: TECOM  
Contract #: DAAD01-91-C-0040  
PI: Karl Bernstein

Title: Depleted Uranium Detection/Location System

Abstract: Pieces of depleted uranium (DU) metal, sometimes oxidized, are present in the soil at the Yuma Proving Ground. Material that is not removed may become dispersed ultimately, and could cause undesired health and economic consequences inside or outside of the Government site. Current trends in decontamination suggest the possibility of removal and disposal of vast amounts of soil to preclude realization of the potential hazards. This is a very expensive process. ANTECH Services, Inc. has shown in the Phase I program that pieces of DU can be detected under as much as two feet of soil, depending on the uranium mass and the measurement time. Detection of pieces of DU, or DU contaminated soil, allows effective DU cleanup of the site with removal of much less soil than would be required in the absence of effective instrumentation. The Phase II proposal covers the first year of Phase II development of an automated DU detection system, U-Spot, and describes the following year's effort.

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Huntsville, AL 35814  
Phone: (205) 922-8600

Topic#: 90-260 ID#: 90MIC-012  
Office: MICOM  
Contract #: DAAH01-92-C-R390  
PI: Larry Z. Kennedy

Title: Model Based Synthetic Discriminate Function for Pattern Recognition

Abstract: The Phase I SBIR research under MICOM contract DAAH01-91-C-R136 demonstrated the feasibility of achieving the requirements for creating a model based filter with current imagery. A CAD tank model was utilized to construct arbitrary aspects and scales sizes which could be encoded into a multiplexed filter. In addition, a technique was developed for "painting" the CAD model with current imagery before generating the many different aspects required for the filter from the CAD model. These elements are to make the multiplexed filter, target acquisition technique practical. Development of the techniques with regard to CAD model modification, improvement of image accuracy, and operational issues for field uses are proposed.

APPLIED TECHNOLOGY ASSOC.  
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Albuquerque, NM 87119  
Phone: (505) 247-8371

Topic#: 90-339 ID#: 90HDL-023  
Office: HDL  
Contract #: DAAL02-92-C-0020  
PI: Mr. Darren Laughlin

Title: Low Cost Angular Rate Sensor

Abstract: The Army requires an autonomous navigation system that can be widely used by troops or vehicles in battlefield conditions to relay their position and movement. A central component of the system is a low-cost, accurate, rugged angular rate sensor. Applied Technology Associate, Inc., (ATA) demonstrated a proof-of-concept model of such a sensor during Phase I of SBIR Topic A90-339. Under Phase II, development of the sensor will be extended to fabrication, test, and analysis of prototype and pre-production models. The final preproduction model will be known as the magnetohydrodynamic effect rate gyroscope (MERG) and is anticipated to be a formidable contender in the medium-to-high performance gyroscope marketplace because of its many advantages for measuring angular motion including reliability; low production cost; low sensitivity to cross-axis and linear accelerations and to temperature; no lag time in start-up; low power consumption; broad frequency bandwidth; and large dynamic range.

ARMY SBIR PHASE II AWARDS

ASTRON CORP.  
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Herndon, VA 22070  
Phone: (703) 471-0600

Topic#: 90-033 ID#: 90-SW-012  
Office: CECOM  
Contract #: DAAB10-90-C-7046  
PI: Joseph R. Jahoda

Title: Electronic Warfare HG Antenna Size Reduction

Abstract: There is a major Army requirement for reducing the physical size of tactical HF Antennas (for use on a variety of carriers from tracked vehicles to drones) for Electronic Warfare applications without degrading currently accepted performance and still maintaining the same gain, frequency, and power handling capabilities. The approaches that are potentially capable of achieving this are: Superconductivity and dielectric, ferrite loading and several innovative slow wave structures.

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Santa Clara, CA 95054  
Phone: (408) 748-0867

Topic#: 90-390 ID#: 90-AVS-390  
Office: AVSCOM  
Contract #: DAAJ02-92-C-0050  
PI: Dr. I. C. Chang

Title: Compensation Techniques for Amplitude Modulated Fiber Optic Sensor

Abstract: Fiber optic sensors offer the advantages of increased sensitivity, geometric versatility, remote sensing, immunity to RFI, high safety and reliability and potential for multiplexing and low cost. Previous work sponsored by the AVSCOM has used the amplitude modulated (AM) fiber optic sensor approach to develop an oil pressure transducer for helicopter applications. A major deficiency of the AM sensor is its limited accuracy caused by the environmentally induced variations of the fiber-optic components such as connectors and cables. The dual wavelength referencing technique used in the design appears inadequate since the environmentally induced loss variations are wavelength dependent. In Phase I an experimental investigation was performed on the temperature variation of fiber and connector losses. By utilizing an acousto-optic tunable filter (AOTF), measurements were performed at the various wavelengths. A phenomenological theory fitting the experiment results was developed. It suggests a design method and modified wavelength referencing algorithm for significantly improving the system accuracy. The objective in Phase II is to apply the Phase I results in the hardware development of the AM fiber optic sensor with reducing environmental sensitivity. The proposed breadboard also includes the use of an AOTF to demonstrate the wavelength division multiplexing of separate sensors.

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Topic#: 90-438 ID#: 90SDC-027  
Office: SDC  
Contract #: DASG60-92-C-0169  
PI: Dr. I. C. Chang

Title: Surveillance and Early Detection for Anti-Satellite (ASAT)

Abstract: The Aurora Phase I program developed the innovative concepts and designs for a new type of rapid scan Acousto-Optic Tunable Filter (AOTF). The AOTF combines in a single device the functions of spectral filtering, amplitude and wavelength modulation and imaging. An IR AOTF was fabricated and tested verifying the design theory and demonstrated the unique capabilities of the novel device. A dual mode (passive IR/Active radar) approach exploiting the AOTF was proposed and studied in Phase I as the technical basis for Surveillance and Early Detection Sensors (SEDS). It is proposed in Phase II to design, technical basis for Surveillance and Early Detection Sensors (SEDS). It is proposed in Phase II to design, fabricate, test and demonstrate a spectral agile imaging sensor (SAIS) in the 2 to 5 micron wavelength region. A Beam Rider Radar (BRR) concept based on the AOTF was also analyzed in Phase I. The SAIS can be used to provide passive target acquisition in the IR range and then to cue a BRR for actively tracking targets a very high angular accuracy while simultaneously providing the normal target Doppler and range data derived from conventional target tracking radars. The Aurora Associates Phase II program proposes to design, fabricate, test and demonstrate an AOTF based BRR in a series of target simulation experiments. The Phase II program proposes to demonstrate and evaluate both advance AOTF based applications, each having US Army Strategic Defense (USASDC) applications in terms of contributing to the resolution of several technical deficiencies. The technical base developed in this program is expected to be useful in several advance USASDC programs in the area of target surveillance, discrimination, and ENDO and EXO missile seeker development. Aurora Associates offers an option to the Phase II proposal in the medical area having potential for immediate use in Army medical labs and having near term commercial applications. The option exploits the AOTF technology and components developed in the Phase II program to design, fabricate, test and demonstrate a multi-parameter optical flow cytometer (MOFC) for cancer and AIDS detection.

ARMY SBIR PHASE II AWARDS

AURORA OPTICS, INC.  
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Blue Bell, PA 19422  
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Topic#: 90-144 ID#: 90AVS-144  
Office: AVSCOM  
Contract #: DAAJ02-92-C-0049  
PI: Nellie L. Cabato

Title: Particulate Sensor for Turboshaft Gas Turbine Engines

Abstract: In Phase I Aurora analyzed five candidate particle sensing technologies for potential application to turboshaft engine inlets, and selected the beam scattering method, with various enhancements, utilizing fiber optics for light transmission. This method was then modelled with an experimentally. In tests with various sizes of dusts, particle densities, and air speeds, the method was found easily capable of detecting the dust under all conditions. In addition, several properties of the optical signals were shown to be correlated with variables in the dust flow. In Phase II Aurora proposes to develop this method into a fully-testable prototype particle sensor. The model will be tested and calibrated with dusts and air flows covering the full range of conditions appropriate to Army aviation. Software will be developed for the opto-electronic interface to unambiguously calculate accurate dust data under all conditions. The sensor system will then be extensively tested, both on an inlet test rig (subcontracted) and in MIL-SPEC environmental conditions, with the goal being provisional qualification for flight testing. Assuming a vehicle can be made available by the Army, the program will conclude with a flight test on an Army helicopter.

AURORA OPTICS, INC.  
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Blue Bell, PA 19422  
Phone: (215) 646-0690

Topic#: 90-149 ID#: 90AVS-149  
Office: AVSCOM  
Contract #: DAAJ02-92-C-0021  
PI: Laurence N. Wesson

Title: Fiber Optic Components for Turboshaft Engine Control Systems

Abstract: In Phase I Aurora Optics analyzed in depth the state of the art in fiber optic technology and determined that sensors, cables, connectors, and opto-electronics are, or soon will be, fully capable of implementation in turboshaft engine control systems. Based on this information and an in depth analysis of current engine systems operational and environmental requirements, a complete high-performance baseline sensor system was designed. In Phase II Aurora proposes to design, make-or-buy, assemble, calibrate, and test a complete seven-sensor system, including engine inlet pressure, compressor discharge pressure, engine inlet temperature, turbine inlet temperature, rotary position, shaft speed, and shaft torque sensor, cables, and electro-optic interface. Following environmental testing, the system will be installed in an engine test cell at a selected engine company and tested for performance during a representative range of engine operating conditions. Assuming satisfactory results, and with suitable arrangements by the Army, the system will finally be installed and flight tested on a selected Army flight vehicle.

BELMONT INSTRUMENT CORP.  
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Billerica, MA 01821  
Phone: (508) 663-0212

Topic#: 91-028 ID#: 91MED-345  
Office: MEDICAL  
Contract #: 91C1109  
PI: David Cassidy

Title: Portable Fluid Infusion/Warming Device for Hemorrhagic Shock

Abstract: A major cause of combat death is rapid hemorrhage. We propose development of a compact portable system for rapid infusion and warming of crystalloid fluid or blood substitute for volume replacement in hemorrhagic shock. The system will be capable of infusion rates exceeding 1 liter per minute and will utilize unique power conversion technology for heating the infusate fluid in a much more compact and light weight package than has previously been available. The system will be designed to operate from battery power and to function immediately without a "warm up" period. In Phase I we demonstrated feasibility by developing and testing a prototype system using our high frequency magnetically coupled heat exchanger incorporated into a simple infusion system. Using the prototype we achieved rapid response time, thermal efficiency of 95%, and relative uniformity of infusate heating while minimizing system weight. In Phase II a complete infusion/warming system will be developed with closed loop flow and temperature control, computer based system control and alarms, user interface, including keypad and display, filtration, air detection, and integral power source. In addition to its military applications, the system will have applications to trauma in the civilian sector.

## ARMY SBIR PHASE II AWARDS

CCI, COMMAND CONTROL, INC.  
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Atlanta, GA 30350  
Phone: (404) 992-8430

Topic#: 90-239 ID#: 90-C3-062  
Office: CECOM  
Contract #: DAAB07-92-C-B004  
PI: Stephen K. Fitzpatrick

Title: Tactical Multimedia Information Communications System (MMICS)

Abstract: The multimedia industry is currently in its infancy. Although the concept of multimedia is not new, it has only been in recent years that computing technology has progressed to the point that multimedia applications are feasible. However, support for multimedia development is still lacking in the area of communications. The bandwidth and communications handling requirements for distributed multimedia application currently exceed commercially available network technologies. The Phase I project identified the tactical requirements for multimedia and produced a design for the tactical Multimedia Information Communications Systems (MMICS). The innovation for this design lies in the Communications Subsystem, which implements communications protocols and a dynamic bandwidth allocation technique for multimedia communications. The network interface is adaptable to a number of existing digital networks. Phase II work will involve the prototyping of a MMICS terminal and the implementation for the Communications Subsystem. Also, several distributed multimedia applications, including teleconferencing, will be developed for tactical functions. The system capabilities include the following integrated media: motion video, audio, text, graphics, and still imagery. The applications will be demonstrated with three terminals on the Army's MSE network.

CERACON, INC.  
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Sacramento, CA 95834  
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Topic#: 90-302 ID#: 90BRL-005  
Office: BRL  
Contract #: 92C-0068  
PI: Ramas V. Raman

Title: A Novel Manufacturing Process Route for Forming High-Density Ceramic Armor Materials

Abstract: Research at Army Ballistic Research Laboratory (BRL) has identified the need for a lower cost upscalable combustion synthesis/dynamic compaction processing to fabricate lighter and higher performance vehicle armor. Under a BRL sponsored Phase I SBIR project Ceracon Inc. has successfully demonstrated the feasibility of fabricating 98% dense TiC specimens of size 4 inches in diameter and 1 inch thick using Combustion Synthesis/Ceracon process. The optimum processing parameters and preliminary work on thermal management to control crack prevention in titanium carbide has been established. The titanium carbide material fabricated in this manner has been tested and characterized. Microhardness, compressive strength, and modulus, as well as phase purity, and grain size distribution have been measured and analyzed and found to be equal to current higher cost hot pressed material. Initial cost analysis indicates a projected cost savings of 50% over current processing approach. The goal of the Phase II effort will be to further develop the CS/Ceracon process to fabricate crack-free prototype quantities of TiC and qualify via more extensive characterization, mechanical testing, and field testing. A cost analysis for manufacturing this material using data developed in Phase II will also be provided. Phase III will involve setting up a manufacturing system at Ceracon to meet BRL's need for ceramic armor materials.

CFD RESEARCH CORP.  
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Phone: (205) 536-6576

Topic#: 91-010 ID#: 91BRL-301  
Office: BRL  
Contract #: 92C-0042  
PI: Dr. Andrzej Przekwas

Title: Development of a Scientific Visualization Tool

Abstract: The overall objective of the project is to develop graphical tools for visualization and comparison of scientific data. The objective of Phase II is to further develop and demonstrate the phase I tools which support the visualization, analysis, and comparison of scientific data sets from sources such as experiments and/or numerical simulations. The specific objectives are as follows: 1. Develop an image data set comparison tool which allows the user to achieve reliable and accurate image comparisons. 2. Develop integrated software for animation of simulated, experimental, or comparison result image data sets. 3. Develop graphical methods which mimic the physical techniques used for experimental flow visualization, and in particular the techniques used for compressible and chemically reactive flows. 4. Demonstrate the application of these tools on selected experiments and numerical simulations. Suggested simulations include focusing of weak shock waves and shock reflections from a wedge. Clear experimental image data exists for both cases.

ARMY SBIR PHASE II AWARDS

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Topic#: 90-388 ID#: 90AVS-388  
Office: AVSCOM  
Contract #: DAAJ02-92-C-0031  
PI: Clifford E. Smith

Title: Dual Airblast Fuel Injector for Small Gas Turbine Combustors

Abstract: The novel dual-lip airblast fuel atomizer for small, high temperature rise gas turbine combustors is proposed in this project. The two major advantages of the dual-lip concept, as compared to conventional simplex-piloted airblast nozzles, are: 1) reduced plugging/fouling of the nozzle by maintaining minimum fuel passages of 0.018 inch and 2) larger combustor turndown fuel-air ratios by optimizing spray distribution and aerodynamic flow patterns within the combustor front-end. In Phase I, the atomization potential of the dual-lip airblast concept at start-up flow conditions was demonstrated. In Phase II, single injector tests will be performed at Fuel Systems-Extron to identify the most promising configuration in terms of ignition, lean blowout, and flow patterns. Combustor fuel injectors will then be designed, fabricated, and tested in advanced reverse-flow annular combustor rig provided by subcontractor Allison Gas Turbine Division. A new, integrated flowpath combustor will be fabricated using existing tooling to reduce fabrication costs. The dual-lip airblast nozzle will be tested at various operating conditions (e.g. SLTO, idle, ignition, etc.) to fully demonstrate the potential of the concept.

CHI SYSTEMS, INC.

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Spring House, PA 19477  
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Topic#: 90-360 ID#: 90HEL-006  
Office: HEL  
Contract #: DAAA15-92-C-0026  
PI: James H. Hicinbothom

Title: Intelligent Interface Construction (IICON) Workbench Development - Phase II

Abstract: The Intelligent Interface Construction (IICON) Workbench is a tool for constructing direct-manipulation graphical user interfaces (DM-GUIs). Four DM-GUI construction needs were identified: (1) better "industrial strength" development tools to rapidly and easily construct interfaces from scratch and re-use existing interface pieces (e.g., widget instance hierarchies); (2) more interface pieces for Army logistics planning domain (e.g., road movement graph, data-driven objects); (3) computer-human interface testing/evaluation tools for evaluation based on recognized standards; and (4) integration of requirements specification efforts through CASE tools (e.g., exchange requirements and design data with planning aid architects). NASA's Transportable Applications Environment was selected as off-the-shelf technology to form the core of the IICON Workbench. Four types of views will be provided: (1) visual display views portraying visual/spatial layout of interface (used by most surveyed tools); (2) tree-structured relational views depicting a-kind-of, composed-of, and represented-by relationships; (3) object definition views to present the designer with form-based access to the underlying objects in the interface; (4) Interface control structure views to portray the dialogue between human and computer as a display-state transition network for identifying problems in flow of control through the interface.

COMPUTATIONAL MECHANICS CORP.

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Topic#: 90-002 ID#: 90ARD-036  
Office: ARDEC  
Contract #: DAAA22-92-C-0123  
PI: G.S. Iannelli

Title: A Finite Element CFD Code for Generic Gun Bore Evacuator and Flareback Control

Abstract: The Phase I project has verified the feasibility of a computational fluid dynamics analysis capability for design optimization of bore evacuator systems. In Phase II our objective is to develop a user-friendly design code for ballistics linked 3-D evacuator flows that account for blowdown, headwing, cab pressures, dissipative and hot propellant gas effects. The user will be able to select geometric and operational configurations for interactive evaluation on the IRIS-CONVEX or Cray platforms, hence estimate optimum candidate for laboratory testing without the long lead time and expense of exploratory field tests. For example, finding optimum performance, in the sense of minimizing propellant gas/air combustible mixtures, is possible in the conceptual model framework. Flow pattern variations examined by visualization graphics, say for port geometries that can initiate swirl, may yield a gas dynamical solution, without the need to use the finite rate chemistry code option to be used in flareback research work.

ARMY SBIR PHASE II AWARDS

CREATIVE OPTICS, INC.  
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Topic#: 87-226 ID#: 87BRL-003  
Office: BRL  
Contract #: 92C-0069  
PI: Dr. John F. Ebersole

Title: Innovative Concept for Target/Threat Analysis

Abstract: Field tests of smart weapons often require the use of targets to stand in place of actual threat systems. Cost and complexity are issues because targets are often used in tracking or live fire missions. Thus, to minimize test cost while maintaining test validity, a target should be just good enough to fool the smart weapon system under test. Project managers responsible for test and evaluation of future sensor systems need to quantitatively determine how closely, and under what circumstances, a target represents the corresponding threat for a given smart weapon system. This type of analysis also extends to research and development programs of simulation of future threat systems. Creative Optics, Inc. is proposing an approach for analyzing target/threat equivalence. Our methodology will be demonstrated against the SADARM smart munition sensor algorithm. Our proposed research will provide a broad spectrum of innovative target/threat analysis tools to help guide an analyst through validation and design of targets, as well as giving the analyst a basis for ascertaining the robustness of a target against future changes in technology, tactics, and environments.

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Topic#: 90-111 ID#: 90ETD-007  
Office: ETDL  
Contract #: DAAL01-92-C-0237  
PI: Maurice Landstrass

Title: Diamond Superlattice Devices

Abstract: We propose extending the successful Phase I work demonstrating superlattice growth for the purpose of fabricating IMPATT diodes and power optically triggered switches. Single crystal diamond doping superlattices offer the most promising near term design solution for the fabrication of higher power, compact microwave components. Diamond superlattices will perform many of the device functions of the III-V compound system while having the added ability to operate at higher power and temperatures. *Diamond superlattice potentials of 5.0V are ten times that of the III-V compound semiconductor system.* One of the major limitations of present diamond technology is the lack of shallow dopant species, especially n-type donor dopants. We propose to fabricate a new class of avalanche devices from doping superlattices that will take advantage of the excellent transport properties of both electrons and holes in diamond and be compatible with diamond doping technology. The proposed devices create the required carriers by avalanche multiplication and as a consequence will have operating characteristics similar to GaAs or Si with the added benefit of higher power levels. *Diamond IMPATTs will allow much more power to be available in smaller systems while diamond power switches will enable an entirely new imaging radar capability.*

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Topic#: 89-051 ID#: 93TEC-003  
Office: TECOM  
Contract #: DABT-63-92-C-0011  
PI: Brian T. Mitchell

Title: Real-time Data Collection and Analysis Tools for Testing Parallel & Geographically Distributed Systems

Abstract: This proposal outlines a 24 month project to develop a testing/truthing tool for collecting and analyzing real-time information from parallel and geographically distributed systems. This toolset features the use of commercially available acquisition hardware for collecting real-time data, communications hardware and software for storing, truthing, and retrieving collected test data at the central site, measurement and display algorithms for analyzing and visualizing collected data, and report writing applications for producing quality test documents based on the resulting quantitative and graphic outputs of the toolset. The toolset will be developed for use on an IBM PC or compatible computer, with the completed version of the developed tool deliverable to the government at the end of the project for thorough test and evaluation.

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Topic#: 90-116 ID#: 90HEL-017  
Office: TACOM  
Contract #: 92-C-R062  
PI: Charles J. Jacobus

ARMY SBIR PHASE II AWARDS

Title: A Compact Robotics Command Center Phase II: Implementing a Hardened Compact Unit

Abstract: New generations of military mobile robotics vehicles will be driven by man-portable command systems. In the Phase I effort under this project we implemented a prototype of such a unit which provided display and capture of up to four video input channels, provided 4 color LCD screen a larger status display LCD screen, and provided driver input through two joysticks. The proposed work will extend this work through the implementation of a next generation brassboard--a hardened compact robotics command center. The proposed unit will be designed and built to provide more advanced video capture, display, and interfacing features than are currently implemented in the product of the Phase I effort.

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Topic#: 90-211 ID#: 92BRI-114  
Office: BRDEC  
Contract #: DAAK70-91-C-0046  
PI: Benuel J. Kelsall

Title: Broadband Thin Film Radar Camouflage Screen

Abstract: Two large sized 10'x10' radar camouflage screens will be designed, fabricated, laboratory tested and delivered for field testing. The field evaluation of these screens will include more realistic conditions and geometries such as off normal performance when draped over an actual component that is to be concealed. The design methodology of Phase I will be employed.

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Topic#: 90-326 ID#: 90HDL-011  
Office: HDL  
Contract #: DAAI02-92-C-0022  
PI: William J. Biter

Title: Microstructural Engineered Thin Film Material

Abstract: Damaskos, Inc. proposes to continue development and commercialization of an advanced thin film shielding system which appears capable of meeting both the magnetic field and low frequency performance for EMP requirements while being able to retrofit existing structures. During the Phase I program, Damaskos, Inc. successfully demonstrated a composite material formed by depositing alternating layers of conducting and magnetic films without affecting their basic properties. This process produces a composite film with attenuation superior to either material separately. The composite material is deposited onto a flexible substrate using thin film processes. These sheets can be interconnected by soldering, insuring a good contact for both electrical magnetic fields. The flexible substrate minimizes problems with cracking due to building settling, etc. The Phase II program will address production problems associated with the material from the standpoint of cost and performance so at the end of the Phase II a viable product will result even at low initial production volumes. Larger production volume and the resulting lower cost will result in a broader market, including its use in TEMPEST applications and shielding to meet FCC requirements for commercial and consumer devices.

DEDICATED ELECTRONICS, INC.  
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Chester, NH 03036  
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Topic#: 91-020 ID#: 91CRR-321  
Office: CRREL  
Contract #: DACA33-91-C-0030  
PI: Dennis P. Glynn III

Title: Development of a Portable-Thickness Measuring Instrument

Abstract: A portable instrument capable of non-obtrusively measuring the thickness of a layer of ice over a body of water will be developed. The instrument will be manually placed on the ice and will be able to measure ice in several locations in a short time. The measurement principle has been proven with a sorting breadboard model of the instrument. The objectives of this effort will be to refine the measurement approach and to fabricate a calibrated prototype of the final system.

DELTA INFORMATION SYSTEMS, INC.  
BUILDING 3 STE 120, 300 WELSH ROAD  
HORSHAM, PA 19044  
Phone: (215) 657-5270

Topic#: 91-019 ID#: 91AIR-301  
Office: AIRMICS  
Contract #: DAKF11-92-C-0615  
PI: RICHARD A. SCHAPHORST

## ARMY SBIR PHASE II AWARDS

### Title: ISDN Applications in the Army Environment

Abstract: This document is a technical proposal to develop a multipoint, multimedia terminal that operates over basic rate ISDN networks. The terminal is expected to simulate face-to-face meetings. To do so, it is expected to display a head-and-shoulders motion image of the current speaker. Plus, it is expected to permit users to share, discuss, view, annotate, and edit easily a variety of documents. These documents are expected to include text, graphics, and photographic imagery. This might also include output from programs like spreadsheets and wordprocessors. An objective of this project is to use IBM personal computers or compatible as the baseline systems. In addition, the development of custom hardware and software is to be minimized. As much off-the-shelf hardware and software is to be used as is possible.

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Philadelphia, PA 19104  
Phone: (215) 386-4884

Topic#: 90-259 ID#: 90MIC-024  
Office: MICOM  
Contract #: DAAH01-92-C-R260  
PI: Mr. Michael G. Crilly

### Title: "Development of Dual Mission Warhead"

Abstract: Currently fielded anti-armor and anti-air missiles are designed to effectively perform one mission. Thus, typical anti-armor and anti-air warheads are optimized to yield the performance and lethality to defeat a narrowly defined class of threats. Unfortunately, application of either warhead outside of this "envelope" results in an ineffective engagement or a less than optimum overkill. Recent advances in shaped-charge and EFP warhead technology suggest the possibility of an anti-armor/anti-air warhead or Dual Mission Charge (DMC). Various shaped charge and EFP warheads have been designed and tested to demonstrate the ability to significantly alter or "tailor" the characteristics of an otherwise axisymmetric penetrator using novel initiation schemes. This technology is unique in that one warhead design forms several penetrators to satisfy diverse performance requirements. The application of DMC designs to anti-armor and anti-air missions offer a unique opportunity to consolidate several systems into one multi-mission missile. The proposed program will develop and demonstrate this concept.

E-TEK DYNAMICS, INC.  
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Title: Optical Modulator

Topic#: 90-234 ID#: 90FW-043  
Office: CE:COM  
Contract #: DAAB07-92-C-J602  
PI: J.J. Pan

Abstract: A wideband electro-optical modulator (EOM) is needed in the countermeasure system. In Phase I, E-Tek has successfully designed, fabricated and tested the wideband Induced Field Effect EOM (IFE-EOM). This innovative IFE-EOM provides a wide bandwidth, a more than 25 dB on/off ratio and a less than 1 ms agility time. Based on the experimental results of Phase I, two new innovative IFE-EOM and PFE-EOM are proposed for Phase II fabrication and demonstration. With the innovative designing, material selecting and electrode/waveguide fabricating technique, the IFE- and PFE-EOM will provide 1-5  $\mu\text{m}$  wideband optical spectrum, more than 100 W throughput power, 20-2000 Hz modulation rate, less than 1 ms agility time and less than 0.4 dB/cm insertion loss.

ECODYNAMICS RESEARCH ASSOC., INC.  
P.O. Box 8172  
Albuquerque, NM 87198  
Phone: (505) 843-7445

Topic#: 90-158 ID#: 90AVS-158  
Office: AVSCOM  
Contract #:  
PI: Dr. Patrick J. Roache

### Title: Dynamic Stall Control

Abstract: Computational algorithms and code will be completed for calculating unsteady compressible 3-D viscous flow and retreating-blade dynamic stall on modern high-performance helicopter rotors. Present code features include the approximate factorization (AF) algorithm, a moving boundary fitted coordinate system, solution adaptive grid generation, K-omega turbulence model including rotational/curvature and unsteady effects, and will be adaptable to fully coupled aeroelasticity calculations. Phase II funding will produce a user-friendly and efficient code to model the dynamic stall problem with useful engineering accuracy. The capability to accurately calculate the unsteady flow and retreating-blade dynamic stall for realistic and innovative rotor blade shapes will contribute significantly to the ability to design high-performance helicopter rotor blades with reduced vibrations and greater maneuverability.

ARMY SBIR PHASE II AWARDS

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Topic#: 91-027  
Office: MEDICAL  
Contract #: 91C1103  
PI: G. Allen Beard

ID#: 91MED-360

Title: Ultrasensitive detection of toxins using immunoassay amplification

Abstract: We have developed a sensitive assay system for detection of c. botulinal toxin and antibodies to it which appears to duplicate or exceed the sensitivity of the 'mouse test' which is the current standard for measurement of this toxin. This was accomplished in collaboration with USAMRIID at Fort Detrick, using a coagulation-based immunoassay amplification system known as ELISA-ELCA. This assay is based on the use of a solid-phase coagulation assay and preparation of antibody conjugates with a snake venom enzyme (Russell's viper venom factor X activator, or RVV-XA) which is a potent activator of coagulation. For this effort in Phase II, we propose that the work be extended to completion of development of 'kits' for laboratory use, including optimization of the conditions for stabilization and assay reproducibility using these assay kits. In addition, we propose that the assay technology be extended to measurement of antibody to botulinal toxin, especially with a view to assessing the relative affinity of different antibody preparations and comparing this information with the neutralization titers of these same antisera. Finally, we propose that modification of the assay technology be developed to simplify the kits for field use in a calorimetric format, and that the same assay be converted to a biosensor format based on binding of fluorescent fibrin to optical fibers.

ELECTRO MAGNETIC APPLICATIONS, INC.  
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Topic#: 90-327  
Office: HDL  
Contract #: DAALO2-92-C-0059  
PI:

ID#: 90HDL-012

Title: Experimental and Analytical Determination of the Properties of the Impulse Radiating Antenna (IRA)

Abstract: A Phase II investigation is proposed to further enhance understanding of the Impulse Radiating Antenna. A prototype model of the IRA will be built, optimized, and tested. In addition, the numerical models used in the Phase I effort will be further refined.

ELECTROIMPACT, INC.  
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Topic#: 90-143  
Office: AVSCOM  
Contract #: DAAJ02-92-C-0038  
PI: John Hartmann

ID#: 90AVS-143

Title: Conformal Magnetic Repair System

Abstract: Advanced composites introduce new challenges for field repair. The ideal conditions for composite repair are to employ hard tooling with consolidation pressure and temperature conditions similar to an autoclave. Neither tooling or autoclaves are available in the field. The Conformal Magnetic Repair System (CMRS) is a flexible magnetic repair system which allows field repair of all types of composite materials. The CMRS uses a matrix of permanent magnets and resistance heaters on either side of the repair area to apply heat and pressure to a damaged area. The CMRS is compact and requires minimal support equipment, providing the Army with a portable field repair system for logistical support. In Phase I the CMRS was demonstrated to be able to perform repairs on both thermostats and thermoplastic materials. Both of these materials are characteristic of materials used on the AH-64 Apache helicopter. Phase II has been broken into two primary tasks. In Part I, the CMRS will be extensively tested. If the results achieved in Part I meet with the Army's approval, the project will continue with Part II. In Part II, a field ready prototype will be developed and field tests will be performed. At the conclusion of Phase II, the field ready CMRS will be delivered to the Army complete with software and a data base of qualification tests.

ELECTRONICS DEVELOPMENT CORP.  
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Topic#: 90-126  
Office: HDL  
Contract #: DAA102-92-C-0034  
PI: Robert N. Johnson

ID#: 90HDL-005

Title: Acceleration Sensing Module for Munition Safety Systems

Abstract: The proposed Phase II program continues the development of a miniature, low-cost acceleration sensing and integrating

## ARMY SBIR PHASE II AWARDS

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module for use in missile safety and arming systems. The design goals include a size not to exceed 0.03 inc. and a cost of \$15 each in quantities of 100. The basic system architecture includes an acceleration transducer and a signal processor. Factory programmable gain, calibration, and threshold settings allow a small family of sensor to cover a wide range of munition launch environments. Two sub-phases are proposed. Phase II-A is based on available military-grade components and will include environmental and functional tests of a full system. Phase II-B includes fully integrated electronics, (ASIC) and fabrication and testing of a design qualification lot.

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Topic#: 90-163 ID#: 90CFR-007  
Office: CERL  
Contract #: DACA88-92-C-0008  
PI: Jerome P. Harper

Title: Development and Testing of Pipe Detector Network for Ventilation Effectiveness

Abstract: EnTechnology has successfully completed Phase I of its development of a PIPE Detector Network for ventilation effectiveness measurement. The prototype detector has four 12-bit data measurement capabilities. It is designed to be part of a two-way RF (radio frequency) linked environmental instrumentation monitoring network. However, it can be a stand-alone instrument (with the addition of a display or meter), a personal dosimeter, or part of an building energy management system. Three of the four channels are designated for specific measurements (i.e., temperature, relative humidity, and air movement), the fourth is unspecified and can be used for other physical (e.g., differential pressure) or chemical (e.g., tracer gas) measurements. Phase I consisted of two parts: the initial six months research and development effort that demonstrated the technical feasibility of the concept and a extension of the research involving the development and alpha-testing of a 5-unit PIPE detector network. The proposed Phase II effort centers on the development of a 10-unit PIPE detector network for beta-testing by independent researchers, and the development of a manufacturing prototype PIPE detector for submission to the FCC for certification. Specific Phase II objectives are the completion of the development and testing of both serial and PC-bus versions of a new modular transceiver for the RF base station and development of application-specific sensor options for HVAC operation, building air flow, radiation, indoor air quality, and ergonomic evaluations. However, the major objective is the development of an FCC certified PIPE detector network. A complete engineering and FCC certification report, software and instrumentation manuals, and a 10-unit PIPE detector network are the deliverables for the PIPE II development program.

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Topic#: 90-021 ID#: 90BRD-004  
Office: BRDFC  
Contract #: DAAK70-92-C-0048  
PI: Oved S.F. Zucker

Title: Long Pulse Solid State High Power Microwave Source

Abstract: Under a Phase I SBIR contract with Ft. Belvoir, ECR has structured a development program, including a Phase III Advanced Technology Demonstration (ATD), for a High Power Microwave system for countermine applications, which based on the use of light activated silicon switches (LASS). The advantages of the LASS HPM source include: a) the use of high energy and power density components, b) high reliability due to the conservative operating parameters for the switches and c) the ability to generate HPM using power supplies of only a few kV. The technical goals of the Phase III program have been specified through extensive modelling and analysis, and sufficient confidence in their achievement has been established. The ATD design involves the sequential firing of adjacent LASS sources at a high repetition rate to achieve high peak and average powers. The SBIR Phase II program will address the four key technological milestones identified as necessary to proceed to the ATD program, i.e. peak power capability, high burst rate capability, average power and thermal and electrical stressing of the components. The successful completion of a Phase II program will validate the LASS concept as the most credible technology for use in HPM countermine applications.

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Topic#: 90-468 ID#: 90ARD-028  
Office: ARDEC  
Contract #: DAAA21-92-C-0026  
PI: John Perry

Title: Digital X-Ray Image Viewing and Analysis System

## ARMY SBIR PHASE II AWARDS

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**Abstract:** The goal of the Phase II program is to complete the development of the "Image Viewing and Analysis System (IVAS)" that commenced in the Phase I effort. IVAS is being developed to satisfy the requirement of having an off-line inspection system that is intuitively functional, reliable, extremely interactive and cost-effective. The general features of IVAS include the following: 1) Duplicates, displays and enhances X-ray imagery and inspection data. 2) Provides general analysis and measurement tools to aid in the inspection of these X-ray images and in the prediction of new and unexpected defects. 3) Built with hardware, software, interfaces, etc., that are low-cost, reliable and readily available. 4) The system has use both in the Department of Defense and commercially. IVAS will be built in such a fashion to allow the inspection analyst to collect and characterize defects in different component devices. IVAS will also let the analyst generate image data sets. These data sets will be use to evaluate new techniques for classifying defects.

ENZYME TECHNOLOGY RESEARCH GROUP, INC.  
710 West Main Street  
Durham, NC 27701  
Phone: (919) 683-3133

Topic#: 91-029 ID#: 91MFJ-357  
Office: MEDICAL  
Contract #: 91C1111  
PI: Junguo Zhao, Ph.D.

Title: Phase Separated Enzyme Inhibitor Electrode for Mercury Compounds

**Abstract:** Mercury is a highly toxic metal that occurs in both organic and inorganic forms. Because of its widespread industrial use, the whole population is exposed to mercury compounds everyday. To reduce the risk of chronic exposure, a fast, easy-to-use, sensitive method to detect mercury is needed. Successful Phase I work demonstrated the feasibility of a new technique for the selective detection of low levels of various forms of mercury. In Phase II we will develop a portable device, based on the enzyme inhibition by mercury and the phase separation of organic and inorganic mercury, for the selective determination of mercury, either in its organic or inorganic form, or in total. The expected result is the design and fabrication of a prototype, inexpensive mercury-sensing electrode and a hand-held instrument for the readout of the electrical signal produced by the sensing electrode as well as a body of research on the principle of development of sensors for quantitative measurement of toxic substances in environmental samples. The three researchers submitting this proposal have collaborated successfully to develop enzyme-based sensor technology which will be a crucial component for this research and development. Practical phase-separated enzyme inhibitor electrodes will have great commercial potential by providing simple, inexpensive monitoring of the environment for trace amounts of toxic metals.

EXPERTSOFT  
6160 Cornerstone Court East  
San Diego, CA 92121  
Phone: (213) 693-3108

Topic#: 90-037 ID#: 90-NV-018  
Office: CECOM  
Contract #: DAAB07-92-C-K502  
PI: Dr. Rubin Johnson

Title: Assumption Truth Maintenance in Automatic Target Recognition (ATR) Algorithm Design

**Abstract:** Assumption analysis and tracking plays a fundamental role in model-based Automatic Target Recognition (ATR) design and evaluation. Simply put, an Assumption Truth Maintenance System (ATMS) provides a mechanism for tracking assumptions and logical propositions, and recognizing contradictions. We propose to implement an ATMS variant, a Belief Maintenance System (BMS) as an evidence accumulation module available to model-based pattern recognition algorithms. The BMS will allow evidence accumulation within a single algorithm as well as evidence combination for complementary algorithms operating in parallel. The BMS will take the form of a software library to be used in the Center for Night Vision's MAXIMIZE system. The proposed Phase II system will expand the capabilities of the Phase I demonstrator and be integrated into MAXIMIZE.

FIBERTEK, INC.  
510-A Herndon Parkway  
Herndon, VA 22070  
Phone: (703) 471-7671

Topic#: 90-038 ID#: 90-NV-019  
Office: CECOM  
Contract #: DAAB07-92-C-K760  
PI: Dr. Horacio R. Verdun

Title: New Chromium-Activated Crystals for Diode-Pumped Lasers Operating in the Near Infrared

**Abstract:** The recent development of high-power diode laser arrays, and the demonstration of high efficiency diode-laser pumped chromium, neodymium, yttrium, thulium, thulium-holmium and erbium lasers, covering the spectral region from 800 nm to 3 um, demands the search for new laser hosts with potential for improved performance. Among the many crystal hosts, there are those with structures and compositions possessing the desirable characteristics for long upper state lifetime, effective

ARMY SBIR PHASE II AWARDS

cross-relaxation and energy transfer process, and the production of large electric dipole oscillator strengths required for the efficient operation of these lasers. It is proposed here to conduct the development of the growth conditions and the optimization for the dopant concentrations for doped crystals of unique compositions in order to achieve efficient operation in room-temperature high energy diode-laser pumped solid state lasers.

FLAM & RUSSELL, INC.  
P.O. Box 999, 506 Prudential Road  
Horsham, PA 19044  
Phone: (215) 674-5100

Topic#: 90-442 ID#: 90SDC-030  
Office: SDC  
Contract #: DASG60-92-C-0154  
PI: John F. Aubin

Title: AN/FPQ Radar Automated Phase Tracking Receiver Upgrade

Abstract: Many government facilities such as the Kwajalein Missile Range (KMR) depend on tracing radars such as the AN/FPQ-19 to provide angle tracking and range data during missile tests. These types of radars are still the primary instruments used for test support, although the state of the art has advanced since those radars were fielded. A Severe limitation present in the An/FPQ-19 and some of the other radars in this class is that the mission capable; bandwidth is limited to a fraction of the radar functional bandwidth. The An/FPQ-19, for example, cannot switch between beacons separated by more than 50 MHz during a mission, as the beacon be automatically adjusted to accommodate a larger frequency shift. Manual adjustments are currently required to accommodate frequency shifts larger than 50 MHz. In addition, the calibration procedure is cumbersome. A Phase I proposal has been completed that defines the methodology for upgrading the radar to allow beacon tracking operation during a mission anywhere within the full functional bandwidth (5.4-5.9 GHz) of the radar. Also, a fully automatic calibration procedure has been devised. This Phase II proposal (submitted as a result of the Phase I contract) describes a plan to develop and install an operational upgrade to the An/FPQ-19 at KMR during the Phase II program.

FLIGHT TECHNOLOGY INTERNATIONAL  
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Charlottesville, VA 22901  
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Topic#: 90-170 ID#: 90WES-002  
Office: WES  
Contract #: DACA39-92-C-0084  
PI: M. Van Wilson

Title: Identification and Evaluation of Natural Fibers for Camouflage Netting Material

Abstract: The Army has expressed a need for a camouflage material that is effective against electronic, as well as visual surveillance, and that is manufactured from materials available domestically and classified as non-strategic. The final Phase I report submitted detailed the results of a study of candidate materials and manufacturing methods directed toward the goal of creating such a material. This proposal for a Phase II continuation of the development program will deal with the actual manufacturing of a prototype camouflage material in sufficient size and quantities for field and laboratory testing by the Army, with the design and modification of the machinery needed for volume production. Manufacturing details and production cost will also be established during the process, with the intent being to deliver to the Army a totally new concept in camouflage and concealment to deal with the advanced surveillance methods in use by many potentially hostile nations.

FLOW, INC.  
6127 S. W. Corbett  
Portland, OR 97201  
Phone: (503) 721-7820

Topic#: 90-421 ID#: 90MED-017  
Office: MEDICAL  
Contract #: 91C1015  
PI: Michael T. Makler, M.D.

Title: Method for Evaluation of Drug Resistance for Plasmodium Falciparum

Abstract: The detection of drug resistant forms of Plasmodium falciparum has traditionally required a 24-48 hr culture period with analysis conducted by microscopically measuring the level of parasitemia for each test point. It is our intent to modify this procedure to allow earlier detection of the drug resistant form of the parasite and to permit this detection to be made with significant reduction in man-power requirements. The assay is based on detection of metabolic products of the parasite during its growth phase. These metabolic products will be measured by standard technique. Thus the assay for drug resistance will be dependent on an alteration of the metabolism of parasite rather than direct measurement of parasite multiplication.

## ARMY SBIR PHASE II AWARDS

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FLUENT, INC. Topic#: 90-395 ID#: 90AVS-395  
Centerra Resource Park, 10 Cavendish Court Office: AVSCOM  
Lebanon, NH 03766 Contract #: DAAJ02-92-C-0053  
Phone: (603) 643-2600 PI: Jayathi Y. Murthy  
Title: Advanced Computational Fluid Dynamics Code Development for Centrifugal Compressors  
Abstract: The objective of this project is to develop an advanced computational fluid dynamics code for simulating flows in highly loaded centrifugal compressors. In Phase I, we demonstrated the feasibility of using our unstructured, tetrahedral mesh code, RAMPANT, for analyzing compressor flows. In Phase II, we propose to incorporate a sliding mesh capability that will allow the coupled computation of compressor and diffuser flows. We will also validate the code by computing the turbulent rotating flow in two high pressure-ratio centrifugal compressors and their diffuser systems.

FOSTER-MILLER, INC. Topic#: 90-033 ID#: 90-SW-015  
350 Second Avenue Office: CECOM  
Waltham, MA 02254 Contract #: DAAB10-90-C-7048  
Phone: (617) 890-3200 PI: Charles A. Carey  
Title: HTSC Small Antenna and Matching Network  
Abstract: High temperature superconductors (HTSC) already available show a 4 to 6 order of magnitude reduction of resistance relative to copper in the HF frequency range. The proposed effort take advantage of this recently developed technology to produce slow wave helical delay lines with greatly reduced size compared with what can already be achieved with copper. Delay lines with 300 to 800 nsec per 0.3M (one foot) are the immediate objective. (These delay lines will be used in this program to demonstrate how a reasonable size 50 sec delay line, as well as a tapped delay line for signal processing.) These devices are useful for small HF beamformers, small digital phase shifters, and real time super resolution processing. It is anticipated that the incorporation of HTSC into HF systems will result in truly portable DF systems with small antennas, reduced size matching components, improved signal processing, as well as better adjacent channel and large signal interference rejection. HTSC appears to be an enabling technology which will lead to greatly improved HF Antenna systems.

FOSTER-MILLER, INC. Topic#: 90-394 ID#: 90AVS-394  
350 Second Avenue Office: AVSCOM  
Waltham, MA 02154 Contract #: DAAJ02-92-C-0036  
Phone: (617) 890-3200 PI: Daniel E. Bullock  
Title: Embedded Fiber Optic Sensor for Composite Flexbeams  
Abstract: The Phase I program has proven the technical feasibility of embedding a fiber optic Bragg grating strain sensor through the thickness of a graphite epoxy laminate. This is the first time, to our knowledge, that direct through thickness strain measurements have been made in a composite laminate. The sensor, which was embedded using the Foster-Miller ultrasonic fiber insertion technique, successfully measured through thickness strains in tests using the NASA Edge Delamination test specimen configuration and demonstrated the ability to detect crack propagation well in advance of the crack front. In the proposed Phase II program Foster-Miller will fabricate scaled Blackhawk tail rotor flexbeams with through thickness embedded fiber optic Bragg grating sensors. These components will be tested in fatigue combining centrifugal loading with flapping and pitch to simulate actual flexbeam loading conditions. Team members, UTRC and Sikorsky Aircraft, will assist in specimen design, testing and interpretation of the data. Successful completion of this Phase II effort will demonstrate the practicality of applying this technology to full-scale production components and provide detailed recommendations for Phase III commercialization.

FOSTER-MILLER, INC. Topic#: 90-430 ID#: 91SDC-019  
350 Second Avenue Office: SDC  
Waltham, MA 02154 Contract #: DASG60-92-C-0126  
Phone: (617) 890-3200 PI: Dr. Lawrence H. Domash  
Title: Low Power Optical Bistability with Controllable Threshold  
Abstract: Lower power, high speed optically bistable elements are sought as a fundamental enabling technology for optical computers, optical neural networks and fiber optic communications networks switching. To date the most promising technology

## ARMY SBIR PHASE II AWARDS

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has been multiple quantum well (MQW) semiconductor devices, but their fabrication by molecular beam epitaxy is a slow, complex and expensive technology ill adapted for transfer to volume manufacturing. In Phase I research we demonstrated experimentally that a much simpler, lower cost family of semiconductor devices, based on the Franz-Keldysh effect in bulk films fabricated by the new lift-off techniques developed at the Georgia Institute of Technology, appears capable of achieving bistability performance comparable to MQW. In Phase I, a single-pixel hybrid Franz-Keldysh bistability was demonstrated with a contrast ratio of 92:1 at 1mW/cm<sup>2</sup>, insertion loss of 62% and response time faster than 1 ms (limited by external circuitry). In Phase II research, in which collaboration between Georgia Tech and Foster-Miller will continue, a 20 by 20 array of all-optical GaAs bistable elements of <100 um diameter size will be demonstrated. The expected device specifications are: >100:1 contrast ratio, <50% insertion loss and switching response shorter than 1 um at 1 mW/cm<sup>2</sup>. By the end of Phase II, a pre-manufacturing prototype compatible with low power diode lasers is expected to be available. Franz-Keldysh bistable elements appear to be an attractive, low cost alternative to MQW capable of comparable performance but requiring a much shorter research and development cycle.

FUTURE GROUP  
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Phone: ( ) -

Topic#: 90-411 ID#: 90ETL-008  
Office: TOP  
Contract #: DACA-92-C-0030  
PI: JOHN STOVER

Title: Sensors and Technology for Minefield Detection from Space

Abstract: Phase I examined the alternative technologies available for landmine/minefield detection from space. We concluded that an optical system, based on a Light-Sat platform, is capable of detecting and delineating anti-armor minefields from space. We also concluded that a tactical satellite in low earth orbit could provide other information of importance directly to a battlefield commander. In Phase II, we propose to expand that knowledge by developing performance criteria for a tactical Light-Sat capable of anti-armor minefield detection and delineation, and other tactical roles. Four key objectives of Phase II are: 1. Data collection on simulated minefields to provide a detailed picture of the minefield signature variance as a function of time of day seasonal variation, and topographic variation. 2. Mission analysis to optimize the satellite design for the needs of other tactical users. (How can this system be leveraged to provide other tactical information required by a battlefield commander?) 3. Engineering analysis, including a proof of concept demonstration. This will provide the basis for satellite design specifications. 4. Development of design performance specifications for a satellite capable of meeting the above needs of the tactical user. This will provide the basis for a decision on whether the program should transition to hardware.

G S ENGINEERING AND MACHINE CO.  
P.O. Box 7743, 866 Oriole Way  
Incline Village, NV 89450  
Phone: (702) 831-3917

Topic#: 90-210 ID#: 92BRD-112  
Office: BRDEC  
Contract #: DAAK70-92-C-0089  
PI: Gregory S. Stevenson

Title: Kerosene Base Fuels in Small Baseline Engines

Abstract: This proposal outlines an SBIR Phase II project for the development of a low cost pumpless fuel injection system to convert small gasoline engines to operate on kerosene based fuels.

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Topic#: 90-183 ID#: 90MED-028  
Office: MEDICAL  
Contract #: 90C0092  
PI: Patrice Yarbough, Ph.D.

Title: Assay Development of Diagnostic Tests for Hepatitis E.

Abstract: We have previously identified two cDNA clones which encode epitopes specifically recognized by antibodies from human and cynomolgus macaques infected with enterically transmitted non-A, non-B hepatitis virus (HEV). Using the two HEV cDNA clones as probes, we have isolated two additional cDNA clones that contain inserts encoding long open reading frames. Since it is likely that the two newly isolated cDNA clones contain multiple immunogenic sequences, we propose to express both cDNA clones in *E. coli* or in yeast as fusion proteins. We will then use the purified recombinant proteins to develop a new HEV antibody test based on an enzyme-linked immunosorbent assay (ELISA). We will also develop two confirmatory tests for detecting HEV in human fecal specimens. One confirmatory test will be use of ELISA to capture the HEV viral antigens in

## ARMY SBIR PHASE II AWARDS

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clinical samples, and the other test will be based on polymerase chain reactions (PCR) to detect specific nucleotide sequences of HEV.

### GENISYS RESEARCH AND DEVELOPMENT

201 Mill Street  
Rome, NY 13440  
Phone: (315) 339-5502

Topic#: 90-025 ID#: 90-C3-004  
Office: CECOM  
Contract #: DAAB07-92-C-B005  
PI: Joseph C. Breda

Title: Innovative Techniques for Overcoming Cochannel Interference in HF Modems

Abstract: Co-channel interference remains a persistent and pervasive annoyance for most HF band communications. The Phase I program, Co-channel Interference Suppression Using Multirate Orthogonal Sampling (MOS), demonstrated a quasi-linear, non-uniform sampled data system approach for separating co-channel signals. The degree of success has provided a promising enabling technology for addressing the co-channel problem in HF data modems. The Phase II effort will apply the results of the technical feasibility study to the development and validation for co-channel suppression technique for specific data modulation formats including FSK, PSK, and QAM. The HF modem "applique" to be developed will be integrated/interfaced with Army JF radios and modems and tested using "live" transmissions. Measures of effectiveness of the equipment, categorized by interference severity and type will be reported. A baseband variation of the Phase I MOS technique will be evaluated. This baseband approach facilitates interfacing MOS suppression to existing radios. Due to the pervasiveness and deleterious effects of co-channel interference in Army communication, the benefits to be derived are substantial. Successful demonstration will enable the immediate manufacturing of low-cost HF modem "add-ons" which will permit better utilization of the HF resources. Additionally, Phase III commercialization of a co-channel interference capable data modem will be addressed.

### GEOSYSTEMS ENGINEERING, INC.

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Lenexa, KS 66214  
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Topic#: 90-416 ID#: 90WES-004  
Office: WES  
Contract #: DACA3992-C-0024  
PI: Glen Ferguson, Ph.D, P.E.

Title: In-Situ Test Device to Determine Lateral Earth Pressure

Abstract: Lateral in situ soil stress being fundamental to many soil mechanics and foundation engineering, is an entered parameter in many computer programs generating these solutions for purposes of analysis and design. Yet seldom, if ever, is the in situ lateral stress actually known, nor has it been measured. The problem has been the lack of an instrument with which to accurately and efficiently perform such measurements. The successful development of such a method or methods therefore may be expected not only to provide these essential data that now must be estimated or guessed at--it may also lead to new concepts in analysis and design of soil and foundation structures, and almost certainly will lead to modifications and improvements on the old ones. The Phase I study reviewed the current technology on in situ lateral earth pressure measurement and identified the stepped blade as having the greatest potential for achieving the stated goals of the project solicitation. Problems relating to measurement of in situ lateral earth pressures relate to the sensitivity of soil stress to the introduction of a measuring device. The self-boring pressuremeter addresses these sensitively by attempting to minimize displacement while the dilatometer applies empirical relationships to account for influence on soil stress resulting from insertion of the device. The stepped blade provides a direct measure of the influence on solid stress, eliminating the need for empirical relationships that may not be appropriate for a specific soil. Also, in addition to providing a means of measuring lateral earth pressure, results obtained with the stepped blade can provide a basis for estimating other soil parameters, providing a better means to understand soil behavior in situ.

### GRADIENT LENS CORP.

207 Tremont Street  
Rochester, NY 14608  
Phone: (716) 235-2620

Topic#: 90-014 ID#: 90ARD-013  
Office: ARDEC  
Contract #: DAAA21-92-C-0050  
PI: C. Benjamin Wooley

Title: Enhanced Laser Eye Protection Using Axial Index of Refraction Gradients and Diffractive Optical Elements

Abstract: With the advent of laser designator, laser weapons, and guided laser systems, has come the problem of intense laser radiation sources on the battlefield. This has provided a laser threat to the soldiers' eyes. IN order to eliminate this threat, it is necessary to put various types of protectors in the optical systems through which soldiers view the battlefield. Because these

## ARMY SBIR PHASE II AWARDS

laser systems can be at many different wavelengths, are tunable, and can be any place in the field of view, it is important that a versatile system be used to block these threats. Modifications to existing optical systems which use three new optical technologies have been completed in a Phase I effort. These technologies are gradient index optics, diffractive optics and spheres. Utilization of these new technologies, allows the design of optical systems with no more elements than the original system while providing a higher concentration of power at the blocking plane. The Phase II effort will culminate in the fabrication of brassboard Laser Eye Protection systems which are based on existing Department of the Army requirements.

### HAWAII BIOTECHNOLOGY GROUP, INC.

99-193 Aie Heights Drive

Aiea, HI 96701

Phone: (808) 486-5381

Title: Urease-Linked Immunoassay Reagent Stability Studies

Abstract: The U.S. Army requires urease conjugates and other immunoreagents for rapid immunoassays in the Threshold Immuno-Ligand Assay (ILA) format. All these immunoreagents must be stable to storage at 60 degrees Celsius for up to five years. During Phase II, rapid model system Threshold ILA format immunoassays will be developed. High activity urease-monooclonal antibody (mAb)-anti-fluorescein conjugates and biotin- or fluorescein-labeled binding proteins necessary for these immunoassays, will be prepared. Microwell format-based immunoassays for independently monitoring the activities of these individual component immunoreagents, will also be developed. During Phase I of this project, we identified additives and conditions for stabilizing lyophilized polyclonal antibody and mAb-urease-anti-palytoxin conjugates to storage at 60 degrees Celsius for 60 days. Initially during Phase II, these promising studies will be extended. A series of short and long term stability studies will then be designed and executed, applying this technology to each component immunoreagent of the above model system Threshold ILA format immunoassays. At each time point, the activity of individual component immunoreagents will be independently determined using the microwell format-based immunoassays. Component immunoreagents that retain full activity in these systems will be tested in combination in the appropriate Threshold ILA format immunoassays. This strategy should identify additives and conditions for successfully stabilizing all the immunoreagents prepared during this study, to the U.S. Army's specifications.

Topic#: 90-256

ID#: 90CRD055

Office: CRDEC

Contract #: DAAA15-93-C-0002

PI: Dr. T. J. G. Raybould

### HITTITE MICROWAVE CORP.

21 Cabot Road

Woburn, MA 01801

Phone: (617) 933-7267

Title: GPS Frequency Translator Integrated Circuits

Abstract: For monitoring trajectory of artillery-fired munitions, the positioning data accessible from GPS satellites may be used effectively anywhere on earth in tactical situations. The critical component of the GPS-based tracking system is the ruggedized, miniature frequency translator to relay the GPS data to the ground. Recent advances in the microwave monolithic integrated circuits (MMIC) technology provides an opportunity to realize the translator design concept. In Phase I of this SBIR program, Hittite, in cooperation with HDI, has established the baseline approach for the translator design and identified MMIC functions required for the translator. The proposed translator is a double-conversion device with amplifiers and filters distributed between the two RF (input and output) rejection requirement of filters and a synthesizer design approach was selected. The translator architecture contains seven MMIC chips replacing 20 discrete microwave components. New chips to be designed in Phase II include 2 converters, 1 VCO, 1 amplifier, and 2 phase-locking loop circuits for local oscillators. The proposed packaging approach shows that the active translator package can be accommodated within the space of 2.5 in<sup>3</sup>, most of which will be occupied by the filters. In addition to the Phase II baseline program described above, Hittite proposes options for (1) assembly and testing of the complete translator package, and (2) MMIC implementation of three band-pass filters.

Topic#: 90-329

ID#: 90HDI014

Office: HDI

Contract #: DAAL02-92-C-0031

PI: Peter J. Katzin

### IAP RESEARCH, INC.

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Phone: (513) 296-1806

Title: Enhancement of Shaped Charge Jet Breakup Performance With Axial magnetic Fields

Topic#: 89-025

ID#: 89BRI001

Office: BRI

Contract #: 92C0007

PI: DUANE C. NEWMAN

## ARMY SBIR PHASE II AWARDS

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Abstract: Increased shaped charge penetration performance will be required to defeat advanced armor. In the Phase I effort, we investigated the feasibility of using 20 T axial magnetic fields to delay jet breakup. We observed local delays in jet breakup of 10-15  $\mu$ s for applied fields between 8-20 T. We are proposing a Phase II to perform a more in depth experimental study of shaped charge interaction with pulsed magnetic fields. The objective of the Phase II effort will be to establish the technical baseline for delaying jet breakup and improving penetration performance with pulsed magnetic fields. We will conduct a series of experiments to establish parametric relationships for breakup performance. We will perform hydrocode and electromagnetic fields on jet performance.

### IMAGING AND SENSING TECHNOLOGY CORP.

Westinghouse Circle  
Horseheads, NY 14845  
Phone: (607) 796-3202

Topic#: 90-040 ID#: 90-AS-026  
Office: CI-COM  
Contract #: DAAB07-92-C-3263  
PI: Dr. Martin Green

Title: Integrated Audio-Visual Headset Display Terminal For Maintenance Personnel

Abstract: The Phase I study has shown that cost effective means exist to build an Integrated Audio-Video Headset Terminal (IAVHDT) for US Army maintenance and logistics applications using commercially available components. The head mounted display is the critical component of the system. It should support at least 640 x 480 pixel VGA resolution graphics. At this resolution the display can capture the level of detail needed to show clearly the line drawings of small equipment parts in Army technical manuals. It was also determined that the addition of color will eventually be desirable to convey all the information contained in many complex diagrams.

### IMPLANT SCIENCES CORP.

107 Audubon Road - 5 Corporate Place  
Wakefield, MA 01880  
Phone: (617) 246-0700

Topic#: 90-479 ID#: 90-ARO-013  
Office: ARO  
Contract #: DAAI 03-92-C-0044  
PI: Stephen N. Bunker

Title: Ion Implantation of Ceramic Surface Layers

Abstract: Refractory coatings are important for protecting vulnerable substrates from extreme environments. However, adhesion of coatings during extremes of thermal cycling and corrosion limit the applications. Inconsistencies between properties, such as chemical stability and low friction versus adhesion, make the successful design of useful coatings quite difficult. A method is proposed to use a new type of ion implantation technology to implant a ceramic surface into an arbitrary substrate and to make thick layers. Adhesion should be excellent, even for oxides, and normal concerns about thermal expansion matching, impurities, and chemical compatibility should not apply. Components of a military diesel engine will be coated with zirconia ceramic and tested under actual operating conditions.

### INDUSTRIAL QUALITY, INC.

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Gaithersburg, MD 20879  
Phone: (301) 948-2460

Topic#: 90-008 ID#: 90-ARD-007  
Office: ARDEC  
Contract #: DAAA21-92-C-0092  
PI: Edwin S. Gaynor

Title: Radiographic Image Prediction and Computer Modeling

Abstract: A Radioscopic Image Simulation System (RISS) is proposed. RISS will lead to a natural coupling of Nondestructive Inspectability and Design of Army munitions. RISS specifically emulates emulated radioscopic images from Computer Aided Designs (CAD). RISS will be configured as a component module to be integrated into PATRAN, a ubiquitous scientific analysis package widely used in finite element studies. As a PATRAN module, RISS will be applicable to any CAD drawing in International Graphics Exchange System (IGES) format. The planned RISS code includes calculations of spectrally dependent source, object and detector parameters. Noise and unsharpness will also be simulated in the code. The planned RISS user performs the Quality Assurance (QA) function. RISS offers the QA flexibility over inspection geometry as well as physical features such as source kilovoltage and detector type. RISS images will be made available to the processing algorithms of the Army's Automatic Fuze Inspection by Radiography System (AFIRS). AFIRS can thus be trained with these images to distinguish good from misassembled artillery fuzes without the necessity of time-consuming and costly inspections. The planned RISS user performs the Quality Assurance (QA) function in any production facility where goals of Design for Inspectability, Radiograph Preview, Automatic Inspection Machine Training and QA Training are sought.

## ARMY SBIR PHASE II AWARDS

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Topic #: 87-135 ID#: 87ARD001  
Office: ARDEC  
Contract #: DAAA21-92 C-0021  
PI: Harold Berger

Title: A Large Area X-Ray Video Tube for Nondestructive Testing

Abstract: An improved x-ray sensitive video type tube has been designed for critical nondestructive inspection applications such as artillery shells, rocket motors and welded assemblies. This advance results from the continuation of an earlier successful Phase I program. Additional research supported with internal funds provided a new basis for the design of the tube electron optics and sensor-target including a new photoconductive target material better suited to detecting x-rays over a wide energy range. The new tube can be used advantageously in the sector type structure as recommended originally and is also suited to large area formats up to sizes as large as 25 inches. Intrinsic spatial resolution of the video tube is expected to be about 10 lp/mm with a dynamic image range 11-12 bits. The output signal can be fed to a digital image acquisition and processing system for achieving contrast enhancement. Limiting spatial resolution will be determined by the penumbra derived from the source focal spot, geometrical magnification and the digital matrix selected for the large area format. In this program we will test demountable x-ray systems over a wide x-ray energy range to demonstrate the superior characteristics of this novel x-ray detector.

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Vienna, VA 22182  
Phone: (703) 448-1116

Topic #: 90-036 ID#: 90SW407  
Office: CECOM  
Contract #: DAAB10-90C-7087  
PI: John E. Don Carlos

Title: Analysis and Evaluation of Advanced Direction Finding (DF) Approaches

Abstract: High resolution direction finding algorithms can produce good angle of arrival estimates even using a relatively compact DF system such as are desirable for mobile and portable application in the field army. These algorithms require very good calibration of the receive antenna array in terms of both amplitude and phase. The center for signals warfare (C2SW) is developing a testbed for evaluation of evolving DF systems, antennas, and algorithms. An objective of this project is to evaluate the effects of the testbed environment over a wide range of frequencies and signal arrival angles to a high degree of sensitivity and resolution. Field army DF systems will often operate in unprepared and less than ideal positions. Another objective of this project is to design a calibration workstation which can be deployed with the DF system to evaluate the suitability of alternative DF locations and to rapidly calibrate the effects of the environment on the system. Emphasis is on automated operation requiring minimal skills on the part of the operators.

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Phone: (708) 887-1911

Topic #: 89-031 ID#: 89BRD-116  
Office: BRDEC  
Contract #: DAAK70-92-C-0041  
PI: Martin J. Volk

Title: Improved Ultrasonic Inspection System Using Multibit Digital Signal Correlators

Abstract: In both military and civilian applications, a major and pressing problem in nondestructive evaluation (NDE) of materials using ultrasound is the detection of critical defect echoes of low signal-to noise ratio (SNR). The loss of the signal by scattering and absorption imposes a limit on the detection capability of ultrasound systems. This problem often arises in testing composites, ceramics, cast components, adhesive bonds, welds or any thick section of materials. An effective and practically feasible method for obtaining high SNR is the application of a correlation receiving system. Information Systems Technology, Inc. successfully realized all Phase I research and development objectives, and a working prototype of an *Ultrasound Multibit Digital Correlator (UMDC)* has been developed. The overall objective of Phase II is to improve and optimize the developed prototype into a versatile, high performance, compact and cost effective system for laboratory testing or field applications. Specific objectives for Phase II will be: (i) to increase the speed of data acquisition to 80 MHz, (ii) to increase the accuracy of correlation, (iii) to improve the design of the ultrasound pulser for use with ultrasound transducers ranging from 200 MHz, (iv) to improve the echo selectivity of the system for tuning out undesired clutter echoes, (v) to design a microcontroller for front panel and computer interface, (vi) to implement an IEEE488 bus interface for industry standard data communications, (vii) to design the system with Field Programmable Gate Arrays for size reduction, and (viii) to develop UMDC driver software for computer interface. Certain design elements of the above objectives are potentially patentable.

## ARMY SBIR PHASE II AWARDS

INFORMATION TECHNOLOGY & APP. CORP.  
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Reston, VA 22091  
Phone: (703) 391-8822

Topic#: 90-022 ID#: 90-NV-001  
Office: CECOM  
Contract #: DAAB07-92-C-K503  
PI: Dr. Roderick J. Pejsar

Title: Tactical Forces C3IEW Space Surveillance Countermeasures

Abstract: It is well accepted that anyone, including adversaries, can gain access to commercial space-based surveillance system information. This puts ground forces at risk of detection and collection. ITAC has designed a system to combat this threat, called the Surveillance Countermeasures Applications Manager (SCAM). This Phase II SBIR proposes to quickly build and deliver SCAM in field deplorable form. SCAM is comprised of a Threat Prediction Subsystem (TPS) and a Threat Reduction Subsystem (TRS). TPS will display ground forces on a map background and indicate which forces are at risk of being seen by surveillance systems. TRS will provide a prioritized list of CCD type actions a battlefield commander can take to reduce this risk. Use of SCAM begins by selecting a prestored Order of Battle and region of the world for it to be overlaid on. Once the collection systems (such as SPOT Image, LANDSAT, and Soviet Systems) are selected, the system shows the forces threatened and then the list of CCD actions. Scenarios can be changed and rerun.

INNOVATION ASSOC., INC.  
P.O. Box 1306  
Ann Arbor, MI 48106  
Phone: (313) 995-9338

Topic#: 90-087 ID#: 90SDC-045  
Office: SDC  
Contract #: DASG69-92-C-0143  
PI: Charles Lysogorski

Title: Highly Versatile, Holographic Imaging System for Plume Particulates (HISPP)

Abstract: Many government facilities such as the Kwajaleing Missile Range (KMR) depend on tracking radars such as the AN/FPQ-19 to provide angle tracking and range data during missile tests. These types of radars are still the primary instruments used for test support, although the state of the art has advanced since these radars were fielded. A severe limitation present in the AN/FPQ-19 and some of the other radars in this class is that the "mission capable" bandwidth is limited to a fraction of the radar functional bandwidth. The AN/FPQ-19, for example cannot be automatically adjusted to accommodate a larger frequency shifter. Manual adjustment are currently required to accommodate frequency shifts larger than 50 MHz. In addition, the calibration procedure is cumbersome. A Phase I proposal has been completed that defines the methodology for upgrading the radar to allow beacon tracking operation during a mission anywhere within the full functional bandwidth (5.4-5.9 GHz) of the radar. Also, a fully automatic calibration procedure has been devised. This Phase II proposal (submitted as a result of the Phase I contract) describes a plan to develop and install an operational upgrade to the AN/FPQ-a9 at KMR during the Phase II program.

INSTITUTE OF MEDICAL CYBERNETICS, INC.  
3993 Huntingdon Pike, s.104  
Huntingdon Valley, PA 19006  
Phone: (301) 983-2507

Topic#: 90-154 ID#: 90AVS-154  
Office: AVSCOM  
Contract #:  
PI: Yan Yufik

Title: A Technique to Assess the Cognitive Complexity of Man-Machine Interface

Abstract: Phase II of the study proposes R&D work to improve operator safety and performance efficiency in complex man-machine systems, to be conducted in conjunction with the A3I Program at NASA Ames Research Center. The study will develop methods for near-optimal design of conventional and multifunction displays, employing novel techniques for measuring cognitive complexity of operator-interface interaction. Phase I of this study has proposed these techniques, and demonstrated their computational feasibility in experimental software. In Phase II, these techniques will be developed further to demonstrate their practical application. Phase II will perform an in-depth analysis of the limitations and boundaries of applicability of the proposed interface optimization methods, and will apply the best effort to produce robust algorithms for interactive assessment of interface complexity. The study will include to NASA Ames, and development of a full-scale commercial prototype tool for interface optimization.

INTEGRATED PARALLEL TECHNOLOGY, INC.  
5994 W. Las Positas Blvd., Suite 209  
Pleasanton, CA 94588

Topic#: 90-398 ID#: 90AVS-398  
Office: AVSCOM  
Contract #: DAAJ02-92-C-0042

ARMY SBIR PHASE II AWARDS

Phone: (510) 734-8854

PI: Michael J. Robb

Title: Portable Self-Powered Heating Tool

Abstract: Current methodologies for repair and maintenance of fueled aircraft, utilizing heat-to-shrink materials from the Aircraft Combat Maintenance/Battle Damage Repair (ACM/BDR) kits, require that the aircraft be located at a facility that has the capability to supply forced air and electric power. In the future battlefield environment, battle damage repair will have to be performed in remote locations away from available air and power sources. A portable heating tool, with its own air and power source, is proposed which can deliver heated air to cure adhesives and shrink heat shrinkable material on fueled aircraft. The proposed tool shows applicability not only for remote area of battle damage in a portable capacity but also as an adjunct to repair and maintenance of aircraft at installations where electrical hookups are available. Integrated Parallel Technology's Phase I effort has demonstrated the feasibility of the proposed concept through the development of a prototype heating tool. The Phase II effort described will result in the generation of two heating tools for delivery to the military. These deliverable units will provide the opportunity to evaluate the ability of the tool to perform battle damage repair in remote areas and to operate successfully from multiple power sources.

INTEGRATED SENSORS, INC.

Topic#: 90-380

ID#: 90AVS-380

P.O. Box 814

Office: AVSCOM

New Hartford, NY 13413

Contract #: DAAJ02-92-C-0033

Phone: (315) 798-1377

PI: J. Brandstadt

Title: The Association of Dissimilar Sensors

Abstract: This program extends the functionality of the algorithm (Association of Dissimilar Sensors - AODS) conceived under the SBIR Phase I (A90-390) contract (DAAJ02-91-C0023). Initial algorithm simulation results suggest that significant improvements in the association of target reports from multiple sensors on a helicopter pop-up scenario (< 10 sec) can be achieved. Significant features include: 1) Operates on a short data collection time-line. 2) Hypothesizes all possible source locations. 3) Associates sensor reports to postulated sources. 4) Requires no initialization. 5) Generates an accurate source estimate as a by-product. 6) Handles spatial extent, target motion, sensor jitter, registration, quantization, thermal noise, and asynchronous data reports. The Phase II program will accomplish the following: 1) Fully develop the algorithm including the target clustering function. 2) Process recorded multisensor test data by the algorithm in a performance demonstration. 3) Optimize the algorithm for hosting on an operational avionics processor.

INTELLIGENT TEXT PROCESSING, INC.

Topic#: 90-359

ID#: 90HEL-005

1310 Montana Ave, Suite 201

Office: HEL

Santa Monica, CA 90403

Contract #: DAAA15-92-C-0025

Phone: (213) 576-4910

PI: Kathleen Dahlgren

Title: Improving Document Retrieval with Natural Language Understanding Techniques

Abstract: Machine intelligence now enables machines to understand natural language (i.e., human language) in human-like ways. Intelligent Text Processing, Inc. (ITP) has built a prototype of a system which understands English well enough to mimic the behavior of a human librarian. The system finds text in response to queries stated in English. ITP's librarian is far faster and more accurate than a human could be. In a recent competition among fifteen text retrieval systems from research laboratories nationwide, the ITP system proved to be one of the three most precise. The information explosion provides a huge market for precise, timely text retrieval. The proposed Phase II research will prototype a large-scale precise text retrieval system which leverages the best of both statistical and intelligent techniques. Phase II research will expand ITP's knowledge base, formal semantic module, and reasoning module, and will prototype precise retrieval in three content domains: human factors engineering, finance, and intelligence. A user-friendly, flexible window interface to the text retrieval system will be built. The Phase II product will work across all public affairs domains on the major platforms used in the marketplace.

INTERSCIENCE, INC.

Topic#: 90-290

ID#: 90TF-C-015

105 Jordan Road

Office: TE:COM

Troy, NY 12180

Contract #: DAAD01-91-C-0038

Phone: (518) 283-7500

PI: Mr. Michael Ampela

Title: High Resolution Optical Skyscreen System for Improved Projectile Sensing

## ARMY SBIR PHASE II AWARDS

**Abstract:** The U.S. Army at Yuma Proving Ground has the need for a skyscreen in the form of a vertical window to detect stable and unstable projectiles passing through a 40' by 40' area. With the development of smaller and faster projectiles the ability to remotely sense the passing of such projectiles against a variety of varying background conditions becomes an increasingly more challenging problem. Currently, there is no reliable detection system which can satisfy the Army's requirements for a high speed projectile sensing and triggering system. The implementation of a High Resolution Optical Skyscreen System (HIROSS) for improved projectile sensing is proposed. The general objective is to provide a reliable trigger pulse with 10 microsecond resolution. HIROSS is based on the integration of a multi-element linear photodetector array, fully automated data acquisition system, and real-time sensitivity and discrimination over present systems. For the Phase I effort, a fully integrated HIROSS prototype unit was designed, built, and demonstrated to have the potential for meeting the Army requirements. Using the same architecture developed in phase I with improved components and fabrication techniques, HIROSS can acquire 250,000 frames per second while electronically separating projectile signals from background clutter in real-time.

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Topic#: 90-333 ID#: 90HDL-018  
Office: HDL  
Contract #: DAAL02-92-C-0047  
PI: Dr. Eduardo Saravia

Title: High Sensitivity Wideband Analog Fiber Optic Link

**Abstract:** For signal transmissions, optical fibers offer the advantages of immunity from HPM, EMP and EMI effects, resistance to snooping, have very low loss, small in diameter and light in weight. Although the technology for digital transmission over fiber optic links is now well established, the ability to handle analog signals with arbitrary modulation in photopic systems is not as well developed. With the expected completion of the Army's new criteria HEMP simulator, there is now the need for a high sensitivity, wide band, miniature transmitter and data link that can be used to isolate the electric and magnetic sensor outputs from the electromagnetic environment produced over the simulators test volume. Under a 1990 DoD/SBIR Phase I contract, the feasibility of developing such a data link that can meet all of the Army's requirements was demonstrated through bench test of an operational prototype system. The design is based on the direct modulation of a diode laser and optical output transmitted through a single mode fiber optic cable to be detected by a PIN photodiode at the output of the cable. Based on the successful completion of all Phase I objectives, the Phase II effort will consist of fabricating a true scale prototype optical link for evaluation by the Army. Also developed during this effort will be several additional optical links of varying sensitivity and input impedance which will create a more versatile link with greater measurement flexibility to benefit broader Army applications.

ISX CORP.  
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Phone: (818) 706-2020

Topic#: 90-382 ID#: 90AVS-382  
Office: AVSCOM  
Contract #: DAAJ02-92-C-0035  
PI: Carl Friedlander

Title: An Associate Systems Tool Kit for the Rotorcraft Pilots Associate System Status Knowledge Base

**Abstract:** ISX has recently completed a Phase I SBIR effort which targeted the design and development of tools that enable the knowledge engineer to efficiently collect, organize and structure knowledge for operator aiding systems such as the Pilot's Associate or Rotorcraft Pilot's Associate. The Phase I effort resulted in the creation of a Common LISP based tool hosted on a Macintosh computer and designs for additional tools. The Phase I effort validated the amenability of the previously pen and paper based plan goal graph knowledge structuring approach to computer based implementation. This system's immediate acceptance by a number of organizations, including the Lockheed's Pilot's Associate organization, Bell-Textron's D/NAPS IRAD group, and IBM's Advanced Systems Group in Owego, New York, lead us to believe that it can also be applied with strong utility to the RPA knowledge acquisition effort. The tool acceptance by these groups provides evidence that the underlying knowledge structures and representational forms are appropriate for a number of operator aiding domains and applications. In Phase II, ISX proposes porting of the existing tool from its current Macintosh based implementation to an IBM RISC-6000 implementation and development of the remaining knowledge structuring and recording tools. These tools will be delivered in a form which will be most appropriate for use by the ARMY RPA contractor. In addition, these tools support the design, development, execution, and life-cycle maintenance of real-time associate systems. IBM RISC-6000 implementations of the Plan Goal Graph editor, the Operational Sequence Diagram editor, and Requirements editor will be completed during the Phase II SBIR effort. In addition to functional code elements, complete user's guides and training aids will be implemented. The IBM

## ARMY SBIR PHASE II AWARDS

RISC-6000 implementation will make extensive use of the X-Windows for construction of its interface. This use of portable interface will assure compatibility for future machines and systems.

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Topic#: 90-319 ID#: 90ETD-016  
Office: ETDL  
Contract #: DAAL01-92-C-0233  
PI: Michael Bansley

Title: Fractal Image Compression Techniques

Abstract: Digital image data representative of Army applications will be identified and obtained. This data will be processed using Fractal Transform technology to obtain a compressed representation of the Army imagery. The use of Fractal Transform technology will be validated by the procedure developed in Phase I. The objective of this Phase II proposal is to develop several approaches to the elimination of problems inherent in storing and distributing vast amounts of visual information in Army applications using Fractal Transform technology. The objective will be met by developing demonstration applications which solve these problems in Army image handling tasks.

KDT INDUSTRIES, INC.  
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Austin, TX 78705  
Phone: (512) 474-6312

Topic#: 90-164 ID#: 90CER-057  
Office: CERL  
Contract #: DACA88-92-C-0012  
PI: Louis J. Cabano

Title: Design Features Based Project Data Organization Model

Abstract: KDT Industries Inc. proposes to develop a computer tool, called BestBuildier, that uses an object-oriented paradigm to unify design and construction information for the purpose of generating project schedules and cost estimates that accurately reflect that unified information. The primary features of the tool are: Graphical user interface for design initialization with design reuse capabilities, Smart design controls to assist user in establishing the best possible design representation, Computer-generated schedules and cost estimates consistent with the best available level of design detail (solutions generated with incomplete design information, with improved solutions generated as level of detail increases) dynamic data Exchange (DDE) with commercial software packages (supporting such software packages as Microsoft Project for scheduling and Microsoft Excel for cost estimation, with additional packages as candidates for support), Basic editing of construction object attributes in linked applications (e.g. the duration of an activity, or unit cost of a resource), Report generation for any portion of the design hierarchy as well as support of all reports available in linked applications, and Links to existing databases (e.g. cost databases, crew databases, material databases)

KINETIC SYSTEMS  
26240 Industrial Blvd  
Hayward, CA 94545  
Phone: (415) 732-1575

Topic#: 90-073 ID#: 90TAC-005  
Office: TACOM  
Contract #: 92-C-R061  
PI: C.G. O'Neill

Title: Electronically variable valve timing

Abstract: A program was performed in Phase I that addressed the design and analysis of a variable valve timing system for IC engines. The objective of this system is to provide flexible timing, duration and overlap of inlet and exhaust valve events without increase in parasitic power. The benefits that can thereby be obtained are: I. No compromise between achieving maximum torque and maximum power. II. No compromise on settings to achieve stable idling and low exhaust emissions. III. Ability to accelerate a turbocharger to avoid turbo-lag by early exhaust valve opening. IV. Early inlet valve closure eliminates a throttle and thereby reduces pumping losses. The results of the computer study revealed a number of problems that have been addressed resulting in the design of a simpler system. Two smaller flow control valves, one catering for opening, the other for closing an engine valve, have been devised. These valves can readily achieve the displacement response required for satisfactory operation. Also revealed was a cavitation situation that prevented accurate motion control. This problem has been eliminated by the addition of two passive check valves. A displacement feedback transducer was eliminated and hydraulic pressure is maintained proportional to rpm(2). Thesis feature allows displacement to be controlled by timing the start of key events and programming the control valve displacement to a pre-set area/crank angle relationship. The program proposed addresses the design and fabrication of a single cylinder system that will initially be applied to an electric motor driven cylinder head rig.

## ARMY SBIR PHASE II AWARDS

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It will then be applied to a Petter AVILAB single cylinder diesel engine for performance tests.

### KLEIN ASSOC., INC.

582 E. Dayton-Yellow Springs, Rd.  
Fairborn, OH 45324  
Phone: (513) 873-8166

Topic#: 90-176

ID#: 90ARI-004

Office: ARI

Contract #: MDA903-92-C-0098

PI: Gary A. Klein

#### Title: Integrated Performance Measurement of Tactical Units

Abstract: Our goal is to develop techniques for assessing teamwork processes of command and control organizations. We propose to formalize methods for evaluating teams within the context of command post exercises, during Home Station training and at training centers. We will provide methods that will allow training personnel to assess teamwork skills, identify areas for remedial efforts, and provide guidance to training supervisors planning future exercises. Phase I was successful in deriving an initial set of teamwork assessment measures were derived from a Cognitive Model of Teamwork, developed during Phase I, and have good face validity. The measures were revised following initial application during a brigade field exercise, to improve applicability. Key dimensions were identified and ratings scales developed for each. During Phase II we propose to: continue model development; refine the teamwork evaluation dimensions. We will establish reliability and validity, and demonstrate perceived value at the Home Stations and Training Centers. Evaluations will emphasize the use of Army training personnel for conducting observations and providing training feedback. Phase II will result in a comprehensive set of scales for evaluation teamwork skills; an improved theoretical framework; a package of Teamwork Development Scales for use in training; and a database for appraising norms of teamwork development.

### KNIGHTRONIX, INC.

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Phone: (612) 633-5795

Topic#: 90-267

ID#: 90MIC-021

Office: MICOM

Contract #: DAAH01-92-C-R364

PI: Arnold W. Knight

#### Title: High Speed, High Resolution Correlator

Abstract: The objective of this program is to develop a Correlator/tracker which operates at greater than 300 frames per second, using an image area which is greater than 50x50 pixels. The Phase II correlator shall be a prototype VME based correlator, including a high resolution camera, which is fully integrated with the Army LLADS system. It shall include functions to minimize correlation problems resulting from target rotation and closeout. The feasibility of the correlator and tracker was demonstrated, using a functional breadboard system, which was designed and built during Phase I. The Phase II effort will develop this custom, parallel correlator, which will easily operate at greater than 300 frames/second, processing a 40x40 reference over a 64x64 live image. Custom LSI gate array chips and Field Programmable Gate Arrays (FPGA) will be used to reduce the 14 Phase I circuit boards to one 6 x 9 inch VME board. With the successful completion of Phase I, the development of a prototype correlator during Phase II, which meets the requirements for the High Speed, High Resolution Correlator, is assured with a high degree of confidence.

### KOPIN CORP.

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Topic#: 90-321

ID#: 90ETD-018

Office: ETDL

Contract #: DAAL01-92-C-0240

PI: Dr. Ronald P. Baleo

#### Title: Nanostructures for Optical Sources and Detection

Abstract: This Phase II SBIR proposal addresses the research on improved nanostructures for electronic and opto-electronic devices. These devices include high electron mobility transistors (HEMT), and photopic devices such as optical thyristors. The devices to be addressed all require advanced epitaxial structures to improve performance. The proposed work comprises a collaboration between Kopin and the University of Florida. In Phase I, organometallic chemical vapor deposition was used to form InGaAsP/GaAs and InGaP(2)/GaAs lattice-matched structures on GaAs substrates, and to prove the feasibility of OMCVD growth of InGaP(2) HEMTs and optical thyristors. In Phase II, we propose to carry out the research and development necessary to realize the advantages in performance that these materials can yield. In Phase III, the resultant materials will be commercialized.

ARMY SBIR PHASE II AWARDS

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Topic#: 90-004 ID#: 90ARD-003  
Office: ARDEC  
Contract #: DAAA21-90-C-0081  
PI: A KITS VAN HEYNINGEN

Title: GPS Compatible Automatic Calibration Combat Vehicle Digital Compass

Abstract: KVH Industries proposes to complete the design, development and demonstration qualification testing of two GPS Compatible Combat Vehicle Digital Fluxgate Compass Systems. An automatic field calibration capability will ensure accurate directional information for use in vehicle navigation and target angle determination on the Abrams Main Battle Tank (MBT). The proposed micro-processor based system will retrofit on a test M1A1 MBT and will have a per unit cost less than 25% of the M1A2 Vehicle Navigation Aid System (VNAS). The proposed system will require no periodic maintenance and will require no periodic maintenance and will feature built-in-test (BIT) capability. The system will integrate with a turret angle encoder which will allow the system to simultaneously provide hull direction to the driver and both true and relative turret azimuth information to the vehicle commander/gunner. The position keeping system will be designed for use either interactively or independently of the optional GPS receiver. The system will include a driver's display which will clearly indicate magnetic directional information and, if used in conjunction with an optional GPS receiver, will also provide the driver with range, bearing and cross bearing error to the next checkpoint. As a magnetic sensor, the proposed system will be impervious to RF countermeasures, terrain blockage, and multipath errors which commonly degrade the performance of stand along GPS navigation systems, ensuring continuous accurate heading information to both the vehicle driver and commander.

LABTEK CORP.  
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Topic#: 90-030 ID#: 90-SE-009  
Office: CECOM  
Contract #: DAAB07-92-C-Q505  
PI: Thomas E. Griest

Title: Distributed Ada Real-Time Software: Development and Execution Support

Abstract: This project will conduct research and development on a Distribute Target Ada Program Support Environment (DT/APSE) product. The DT/APSE is a set of software tools and runtime routines which support the life cycle software engineering for distributed systems programmed in Ada. The end objective of this project is to advance the state of the practice in the development of software for distributed systems. Unlike many other approaches toward parallel computing, this advancement will be made in an upward compatible way by utilizing the Ada programming language. We believe this compatibility is absolutely necessary to preserve the substantial investment by the U.S. Government and the benefits of international standardization achieved by Ada.

LASER TECHNOLOGY ASSOC., INC.  
25 Ozalid Road  
Johnson City, NY 13790  
Phone: (607) 798-9064

Topic#: 90-250 ID#: 90-EW-056  
Office: CECOM  
Contract #: DAAB07-92-C-J604  
PI: David C. Brown

Title: Comprehensive Study of Diode-Pumped Dye Lasers

Abstract: Dye lasers are utilized in a wide variety of scientific, commercial, and military applications, primarily due to their ability to provide continuous tuning across a broad spectral range covering the ultraviolet, visible, and near-infrared. dye lasers are notoriously inefficient, primarily due to inefficiencies of the lasers used to pump them (argon, doubled Nd:YAG, nitrogen, excimer, etc.) During our recently completed Phase I contract, we studied the possibility of directly pumping dye lasers using already existing efficient semiconductor diode lasers, resulting in an efficient dye laser system. In addition to proving the feasibility of the approach, we identified a number of promising candidate dye/diode systems. We propose, during the Phase II effort described in this proposal, to determine the lasing parameters of, and demonstrate assisted and direct diode-pumping of two dyes in the continuous wave (CW) mode. In addition, we propose to extend the operation of at least one diode-pumped dye laser to the pulsed mode. Significant increases in the efficiency of dye lasers will be demonstrated during the proposed program.

## ARMY SBIR PHASE II AWARDS

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LB&M ASSOCS, INC.  
211 SW A Avenue  
Lawton, OK 73501  
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Topic#: 90-460 ID#: 90ARD-021  
Office: ARDEC  
Contract #: DAAA21-92-C-0100  
PI: Dr. B. Don Sullivan

Title: Fire Control Battle Management and Decision Support System Technology (Intelligent Decision Aid for Sustainment)  
Abstract: This project will result in design and development of a prototype Embedded Training System (ETS) with subsequent integration into the existing advanced artillery and armor automated crew station in the Robotics and Automation Laboratory at ARDEC. Focus is on the design, specification, prototyping, integration and testing of an Intelligent Tutoring System (ITS) that brings the classroom to the trainee (crew member, operator, etc.) thus taking the place of the expert-human instructor to determine, present, react to, critique, adjust, feed-back, record and remember the training for, in this case, individual crew members participating in individual, crew or force-level training, on-board their crew-served system. The Phase I effort led to a basic concept of an ETS whose ITS and other components link with the operational decision and emulation capabilities. The Phase II effort will refine this concept through knowledge engineering, functional requirements analyses and software development, leading to an inference engine/interactive courseware-based ITS, thus ETS prototype, developed using the "build-a-little; test-a-little" approach.

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Topic#: 90-148 ID#: 90AVS-148  
Office: AVSCOM  
Contract #: DAAJ02-92-C-0047  
PI: Dr. Robert Fan

Title: Field Repair Techniques and Equipments for Fiber Optic Components  
Abstract: Phase I effort includes an evaluation of current requirements, a review of existing technology and new design/testing for fiber optic connector/splice field termination and repair techniques necessary in the Army helicopter environment. Recommendations were prepared for specific approaches in fiber connector and splice termination improvements with limited test results to verify the validity of the recommendations. This included cleave-after-crimp fiber optic connector termination and field fiber/cable splicing. Phase II effort is the expansion of the Phase I recommendations which will result in tooling and connector/splice component hardware to provide a complete fiber optic repair system for Army helicopters. Design emphasizes minimum skill in tight confines, within an environment having highly explosive, broad temperature range, humidity-extreme, vibration, shock and other potential existing conditions. The developed complete tooling and connector/splice prototypes will be simplified for field use in ruggedized applications. Deliverables include connectors, fiber optic termini and splices which are terminated using developed tooling and procedures. All tooling, components and written instructions will be fully developed, tested and delivered with final comprehensive reporting.

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Phone: (703) 323-2230

Topic#: 90-172 ID#: 90ARI-002  
Office: ARI  
Contract #: MDA903-92-C-0094  
PI: Dr. Michael D. Mumford

Title: Cognitive and Temperament Predictors of Executive Ability: Principles for Developing Leadership Capacity  
Abstract: Leader performance is an important determinant of long-term organizational success. Unfortunately, it has proven difficult to formulate sound principles for the identification and development of organizational leaders. In the first phase of this effort, a general theoretical model of leader performance was proposed, based on the postulate that leaders must be capable of identifying and solving problems in a variable and ill-defined organizational domain. This principle was then used to specify the capacities contributing to performance at different stages of a leader's career. The intent of the proposed effort is to test certain hypotheses derived from this model with special references to continuity and change in the requirements for leader performance with changes in age, experience, and positions. Thus, a cross-sequential design was proposed that considered multiple factors influencing performance. It is anticipated that the resulting measures of continuity and change derived from this model will provide the empirical infrastructure required for sequential and progressive leadership development efforts.

ARMY SBIR PHASE II AWARDS

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Topic#: 88-021 ID#: 88ARD-021  
Office: ARDEC  
Contract #: DAAA21-92-C-0055  
PI: DR. ROBERT L. DAWES

Title: A Neural Network Kalman Filter for Multi-Sensor Based Robotics Control

Abstract: The proposed research builds upon the contractor's proprietary neural network space-time memory, the Parametric Avalanche, to determine a set of design characteristics for neurocomputing architectures that will effectively support real time acquisition and tracking of multiple targets using multiple sensors, and deploy and control multiple simultaneous responses. The approach to this problem is to use the Parametric Avalanche to implement a Kalman filter which is capable of tracking and predicting the evolution of large numbers of observable objects with widely differing dynamics, and is also capable of learning to predict and (given access to effectors) to control navel space-time patterns.

MATERIALS & ELECTROCHEMICAL RESEARCH  
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Topic#: 90-374 ID#: 90MTL-042  
Office: MTL  
Contract #: DAAL04-92-C-0017  
PI: Dr. Sumit Guha

Title: The Development of Plasma Synthesis to Produce Pre-Alloyed Ultrafine Intermetallic Aluminide Powders for Injection Molding

Abstract: With the stated objective of economically producing intermetallic powders of fine particle size for injection molding, two processes, namely Gas Phase Plasma reaction and Plasma Initiated SHS (PSHS) reactions, were proposed to be investigated for the Phase I program. The former process failed to produce impurity free intermetallic powders of controlled stoichiometry. By contrast, the latter process was successful in producing fine (approx. um size), irregular shaped powders of NiAl free of impurity. Both stoichiometry control and capability of alloying with ternary additions was demonstrated for the PSHS process. This process is being proposed for a scale-up under the Phase II program. Simultaneous to the PSHS process, a novel process termed Cathode Arc Transport (CAT) was used to successfully produce intermetallic powders of ultrafine (300-500 nm) size and spherical shapes. The Phase I program demonstrated good control over the compositional transfer process (from cathode to powder). Although the powders produced by the latter process are expected to be more expensive than those produced by the PSHS process, the CAT process is also proposed for development under the Phase II program to produce nanometer sized powders that may impart unique mechanical properties to polycrystalline intermetallic aggregates. In summary, the objective of producing intermetallic powders of size less than 20 um was achieved using two processes: PSHS and CAT. Both processes are being proposed for scale-up under the Phase II program for producing multiple pound quantities for full evaluation of injection molding, delivery of substantial quantities to the Technical Monitor and performing economic evaluation of the processes.

MEASUREMENT TECHNOLOGY NORTHWEST  
2721 N.E. Blakeley Street  
Seattle, WA 98105  
Phone: (206) 525-4099

Topic#: 90-062 ID#: 90NAT-002  
Office: NATICK  
Contract #: 92c0059  
PI: F. Timothy O'Neill

Title: Development of a Heat Pipe Thermal Manikin with an Irrigated Skin

Abstract: The accurate assessment of clothing systems using thermal manikins is dependent on tolerance of heat flux and temperature measurements, and the ability to measure the permeability of the garment. Close tolerance measurement of electrical temperature and power transducers is a common practice. However, spatial temperature variations on the skin of the manikin and the lack of well controlled irrigated skin systems are significant limits in manikins currently in use. Measurement Technology northwest proposes to fabricate and deliver the innovative thermal manikin whose feasibility was demonstrated in Phase I of this program. This heat pipe driven manikin design will limit spatial surface temperature variations to less than  $\pm 0.1$  degrees C at standard operating heat fluxes. Additionally, the controlled delivery irrigated skin will provide a well dispersed steady state perspiration rate in the physiological ranges of 100 to 500 ml/m<sup>2</sup>/hour.

ARMY SBIR PHASE II AWARDS

METROLASER  
18006 Skypark Circle, #108  
Irvine, CA 92714  
Phone: (714) 553-0688

Topic#: 90-057 ID#: 90MIC-007  
Office: MICOM  
Contract #: DAAH01-92-C-R369  
PI: Dr. James D. Trolinger

Title: Concealed Helicopter Sensor

Abstract: This is a Phase II proposal to develop a Laser Acoustic Doppler Sensor (LADS), for detecting and locating concealed enemy threats such as helicopters that can hover behind a structure or hill before popping up to perform offensive actions or which can fly undetected nap of the earth. Laser Doppler LIDAR is a well developed technique which can be adapted to identify helicopter signatures without a line of sight to the helicopter. It was shown on Phase I that an innovative combination of LIDAR and advanced signal processing would satisfy this requirement. Specifically, it was shown that an acoustic radiator impresses upon the atmosphere a fundamental frequency and harmonics which frequency shift the convective frequency creating a signature which depends on the acoustic pressure. Since the acoustic pressure is higher near the source, a systematic method could then be implemented to locate the helicopters. Analytical and experimental work will be conducted during Phase II culminating in a field experiment using a helicopter.

MIRAGE SYSTEMS, INC.  
537 Lakeside Drive  
Sunnyvale, CA 94086  
Phone: (408) 733-3200

Topic#: 90-057 ID#: 90MIC-008  
Office: MICOM  
Contract #: DAAH01-92-C-R215  
PI: Dr. Donald E. Barrick

Title: Acquisition and Classification of Helicopters in Defilade

Abstract: Phase I studies demonstrated that a BI-static sensor system operating in the HF/VHF band could provide detectable levels of signal strength beyond, and below, the crest of hills and through foliage. The studies also showed that the RCS response of a typical helicopter was detectable and certain modulation characteristics were measurable in the signal return. In Phase II Mirage Systems proposes to build hardware and develop software that will verify feasibility of the Bi-static system. Emphasis is placed on techniques that offer light-weight, low cost hardware solutions. Included in these techniques are miniature antenna technology that has been shown to provide accurate Direction Finding and special low cost signal processing that uniquely detects the threat. The hardware/software sensor system will be field demonstrated against helicopters hovering in defiled.

MISSION RESEARCH CORP.  
735 State Street, P.O. Drawer 719  
Santa Barbara, CA 93102  
Phone: (714) 754-1300

Topic#: 90-064 ID#: 90NAT-003  
Office: NATICK  
Contract #: 92C0008  
PI: Robert D. Eisler

Title: Integrated Ballistic Casualty Reduction and Ballistic Protection Model

Abstract: The proposed effort represents the first step in the development of a Computer Aided Design (CAD) system to optimize and assess the performance of personnel protection systems (body armor, helmets, ballistic goggles, protective footwear) also known as Soldier Protective Ensembles (SPEs). The proposed CAD system will enable SPEs to be arrayed against a constellation of battlefield threats and environmental conditions. The SPE/CAD system will then assess the casualty reduction potential of SPEs and compare combat mission requirements with soldier capabilities associated with different states of physiological stress. Physiological stress states considered will include trauma associated with combat related wounds, degradation in performance associated with soldier equipment loads and heat stress due to physical exertion, clothing, and environmental conditions. Combat related wounds considered include penetrating projectile wounds, blast injuries, and blunt trauma promoted by non-penetrating projectiles incident on body armor. Projectile threats include shell fragments, military bullets, and flechettes. Blast threats include effects associated with conventional explosives, enhanced blast weapons -- e.g., Fuel-Air-Explosives, and blast waves from tactical nuclear weapons.

MISSION RESEARCH CORP.  
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Santa Barbara, CA 93102  
Phone: (703) 339-6500

Topic#: 90-352 ID#: 90HDL-034  
Office: HDL  
Contract #: DAAL02-92-C-0017  
PI: Khanh Nguyen

## ARMY SBIR PHASE II AWARDS

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Title: AURORA Rise Time Sharpening with inductive Erosion in Pre-Ionized Plasma Channel

Abstract: The primary goal for this proposed Phase II SBIR program is the experimental demonstration of a technique to sharpen the simulated radiation pulse rise time of the ARUORA flash gamma ray simulator. This technique utilizes inductive erosion of the beam pulse in a preformed plasma channel to reduce the beam front rise time to the characteristic time necessary to eject plasma electrons from the channel (= 2 nsec). In addition to providing a much sharper pulse rise time, the technique also results in better uniformity of the bremsstrahlung dose rate and better shot-to-shot repeatability; it also allows for adjustment of the pulse shape (dial-a-pulse), with minimal cost in peak dose rate. The advantages achievable with the proposed technique would represent a great improvement in AURORA simulational capability. The Phase I program studies established the viability of the inductive erosion technique for ARUORA using advanced particle simulation techniques. An experimental plan and preliminary design for a Phase II proof-of-principle experiment was also developed. This plan calls for a two-step experimental verification process, first on a smaller medium pulse machine (such as the HIFX at HDL), and then on AURORA, if the first test is successful. An additional objective is the development of experimentally verified scaling laws allowing application of existing facilities and modest space requirements, thus allowing easy integration with other experiments.

MISSION RESEARCH CORP.

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Newington, VA 22122

Phone: (703) 339-6500

Topic#: 90-376

ID#: 90VAL-006

Office: VAL

Contract #: DAAD06-92-C-0016

PI: Richard Smith III

Title: Diagnostic Tool for High Power Microwave (HPM) Characterization: Non-Perturbing Electro-Optic Probe for Radiated Electric Field Measurements

Abstract: Various approaches to developing radiated-electric-field measurement probes with millimeter-sized electro-optic (EO) sensing elements attached to the ends of approx. 100 micron diameter optical fibers were investigated under the Phase-I SBIR contract. Out of this work has evolved a very appealing probe-system design which makes use of a variety of recently-perfected technologies, mainly in the form of commercially available components. The design satisfies the following E-field-probe requirements: high sensitivity, low perturbation, high accuracy, wide dynamic range, frequency response from MHz to > 10-GHz, unambiguous measurement of fields in a single direction, ease of use and calibration, good reliability and environmental immunity, and reasonable cost for a multi-channel system. These probe-system properties were quantitatively characterized in the Phase-I final report, the most pertinent discussions of which are included herein. We propose to build, test, demonstrate, and deliver such a probe system to the Vulnerability Assessment Laboratory (VAL) during Phase II. Although this work has been specifically concerned with high-power microwave (HPM) applications, the probe system will have sufficient bandwidth to measure video pulse or ultra-wideband (UWB) radiation, and sufficient sensitivity for use in special electromagnetic interference (SEMI) testing. Three separate program plans to build a probe system are proposed, from which VAL is requested to choose one. An additional option, which may be added to any of the three plans, is proposed to build and test a still higher sensitivity sensing-element using a different EO approach also investigated during Phase I.

MOLECULAR TECHNOLOGIES, INC.

145 Moore Street

Lowell, MA 01852

Phone: (508) 663-3093

Topic#: 90-274

ID#: 90NAT-012

Office: NATICK

Contract #: 92C0044

PI: Dr. Mario J. Cazeca

Title: Langmuir-Blodgett Monolayer Films of Photoprotein Systems for Dynamic Photo Response to the Surrounding Medium

Abstract: Photodynamic proteins exhibit photovoltaic, and as demonstrated in the Phase I effort photoconductive responses to visible light. It is proposed that these responses be utilized for photosensors that can with suitable amplification drive optical transducers that will replicate the field of view seen by the sensor. Thereby providing adaptive dynamic camouflage effects. The photoelectrical responses of the protein systems will be optimized by suitable device and materials engineering, including bioengineering of the proteins at the molecular level and the incorporation of conducting polymers. The investigation will include detailed optical characterization of these photodynamic systems. The design and development of photosensors and transducers on novel substrates will be investigated and a simple dynamic camouflage system, based on the technology developed, will be demonstrated.

## ARMY SBIR PHASE II AWARDS

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Oakton, VA 22124  
Phone: (703) 934-9235

Topic#: 91-021 ID#: 91ETL-302  
Office: TOP  
Contract #: DACA76-92-C-0039  
PI: Steven L. Geyer

Title: Parallel Architecture for Real Time Knowledge-Based Decision Aids

Abstract: Tactical decision making is a dynamic and challenging process requiring constant gathering, processing and analysis of battlefield information. Commanders depend extensively on broad staff support to perform these functions and allow confident decision making. Tactical Decision Aids (TDAs) assist in these tasks and provide solid and fundamental concepts for the analysis of individual aspects of the battlefield. While they analyze the increasingly complex and voluminous tactical data, current TDAs have an inadequate response time and lack the necessary domain expertise to aggregate and synthesize data into high level information. Current TDAs seldom work collaboratively with the commander by suggesting plans of actions, explaining their reasoning, and being able to adapt to choices made by the commander that differs from the TDA's analysis. This proposal presents PARADE, an innovative architecture that addresses these problems by using an open software architecture to integrate conventional tactical decision algorithms with advanced knowledge-based algorithms. PARADE is structured to take advantage of the computational power available from a heterogeneous network of commercial workstations and parallel computers while maintaining software portability. Utilizing tactical domain experts, knowledge engineers, and parallel applications experts, this effort will construct PARADE and demonstrate its advanced analysis capabilities.

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Topic#: 90-409 ID#: 90ETL-006  
Office: TOP  
Contract #: DACA-92-C-0038  
PI: Scott F. Miller

Title: Urban Warfare Digital Database

Abstract: During Phase II, a software system prototype will automatically produce wireframe models that can be directly input to the TIES mapping system for image draping and Image Perspective Transformations (IPT). Each system function was implemented in software during Phase I, demonstrating feasibility of the higher risk technical concepts. During Phase II, each function will be further specified and the Phase I implementations will be extended to incorporate further specified and the Phase I implementations will be extended to incorporate the newly specified capabilities. The resultant software system will be an operational prototype addressing a specific class of imagery and scene content.

NEW HORIZONS DIAGNOSTICS  
9110 Red Branch Road  
Columbia, MD 21045  
Phone: (410) 992-9357

Topic#: 90-049 ID#: 90CRD-018  
Office: CRDEC  
Contract #: DAAA15-92-C-0054  
PI: Lawrence Loomis

Title: Multianalyte Test Kit for Biological Agents

Abstract: New Horizons Diagnostics (NHD) has several U.S. patents for novel rapid and simple ligand-receptor assays. NHD's goal has been to produce assays simple enough to be performed by unskilled or untrained individuals in the field. In 1991, NHD provided SMART detection test kits to the U.S. Military for field testing for the detection of biological agents. Each test required approximately 200 microliters of air sampling fluid and could provide a test result in fifteen minutes. NHD proposes to develop this test system further by providing a multiple analyze test card. The proposed multiple analyze test card will use a single fluid sample and will simultaneously test for the presence of several biological agents. This card will have a sample application area, wherein the liquid sample will diffuse into strips of absorbent paper containing dried metal sol labeled antibody reagents. The reactants will mix and diffuse into a capture area, wherein the reaction could be visualized. In this format, any immunocomplexes formed are captured on a membrane, appearing as a pink to purple spot. The multiple analyze test card will be developed as a single use test with room temperature stability capable of being used as a field detection-identification kit.

NOVA ENGINEERING, INC.  
630 Stonewall Lane  
Fairfield, OH 45014  
Phone: (513) 858-1232

Topic#: 90-226 ID#: 90-C3-036  
Office: CECOM  
Contract #: DAAB07-92-C-B258  
PI: Terrance J. Hill

ARMY SBIR PHASE II AWARDS

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Title: A Sinusoid-Free Spread Spectrum Communication system Employing Pure Noise As A Carrier

Abstract: Spread spectrum techniques are widely acknowledged to provide low probability of intercept (LPI) capability. Conventional direct sequence spreading, however, suffers from the shortcoming that an interceptor requires only very simple processing to collapse the spread signal to a readily detectable unmodulated sinusoid. Furthermore, high levels of LPI are only achieved by using high speed generators for the spreading signals, necessitating complex synchronization algorithms. The approach described here eliminates these undesirable characteristics by replacing the sinusoidal carrier with a pure noise waveform. This prevents an interceptor from using non-linear techniques to exploit some deterministic element of the signal because there are none to exploit. In addition, since the spectral spreading is not a function of the rate at which the TRANSEC generator is clocked, very slowly changing (or fixed) TRANSEC can be used, thereby greatly simplifying (or eliminating) the synchronization process.

OPHIDIAN PHARMACEUTICALS, INC.  
2800 South Fish Hatchery Road  
Madison, WI 53711  
Phone: (608) 271-0878

Topic#: 91-027 ID#: 91MED-302  
Office: MEDICAL  
Contract #: 91C1108  
PI: Doug Stafford

Title: Development of a Multivalent Avian Antitoxin

Abstract: Recently, Ophidian Pharmaceuticals successfully completed a SBIR Phase I feasibility study by developing and showing the effectiveness of an avian antitoxin against ricin intoxication. Subsequent mouse protection studies performed at USAMRIID independently confirmed the in vivo toxin neutralization results, and demonstrated the superior performance of these polyclonal antibodies over previously characterized goat polyclonal and murine monoclonal antibodies. These results confirm our previous studies showing the superior toxin-neutralizing capability of polyclonal antibodies produced in the laying hen. These antibodies are expected to be clinically safer and more effective because of their enhanced purity. In addition, avian antibodies do not activate human complement, and are therefore less likely to cause nonspecific complement-related side effects commonly observed with the injection of antitoxins consisting of mammalian production-scale source of antibodies at costs substantially lower than conventional large mammals, such as horses. In this proposed Phase II effort, methods shown effective in producing an avian ricin antitoxin will be expanded to include the development of a broadly reactive antitoxin against botulinum toxins, saxitoxin and staphylococcal enterotoxin. Development of this "multivalent" antitoxin will include feasibility research, process methods development, dosage form development, documented pilot production, and formal animal effectiveness and toxicology testing.

OPHIR CORP.  
3190 South Wadsworth Blvd, Suite 100  
Lakewood, CO 80227  
Phone: (303) 986-1512

Topic#: 90-100 ID#: 90ASL-001  
Office: ASL  
Contract #: DAAL06-92-C-0013  
PI: Dr. Loren D. Nelson

Title: Microwave Radiometer for Nowcasting Atmospheric Temperature Profiles

Abstract: In our Phase I effort we investigated the feasibility of a multi-channel millimeter wave radiometer for measuring atmospheric temperature profiles and inversions passively and without resort to radiosonde observation. The Phase I research was successful. The investigation and selection of an antenna splitter, an antenna isolator, receiver design, optimum frequencies, and an absolute calibration technique/system were accomplished during the Phase I research. In Phase II we propose to incorporate into our existing commercially available 23/31 GHz microwave radiometer the U band hardware necessary to invert temperature profiles. The device will utilize multiple passive channels at 23, 31, and 50-60 GHz. It will continuously measure water vapor, cloud liquid water and temperature structure in the atmosphere from a light-weight portable platform. We also propose to fabricate an absolute calibration system to be used in support of the proposed radiometer hardware.

ORBITAL TECHNOLOGIES CORP.  
402 Gammon Place, Suite 10  
Madison, WI 53719  
Phone: (608) 833-1992

Topic#: 89-068 ID#: 89HEL-002  
Office: HEL  
Contract #: DAAA15-92-C-0022  
PI: Ronald R. Teeter

Title: ORBITEC Telerobotic Control Glove (OTCG)

Abstract: This project proposes to develop a Telerobotic Control Glove for the control of robotics dexterous end-effectors. The

ARMY SBIR PHASE II AWARDS

ORBITEC Telerobotic Control Glove (OTCG) will allow accurate and comfortable human control of the "fingers" of a dexterous robotics end-effector. Feedback of tactile and force information will be provided to the operator. The system will be easily integrable with telerobotic arm control systems and existing end-effector systems and sensors and may be used independently or coincidentally with force reflection systems. The OTCG will greatly improve the capability of teleoperators to perform tasks using telerobots equipped with dexterous end-effectors.

PACIFIC-SIERRA RESEARCH CORP.  
12340 Santa Monica Blvd.  
Los Angeles, CA 90025  
Phone: (310) 820-2200

Topic#: 90-386 ID#: 90AVS-386  
Office: AVSCOM  
Contract #: DAAJ02-92-C-0045  
PI: Kevin O'Rourke

Title: Digital Terrain/Feature Database Application Analysis

Abstract: In the near future, Army Aviation assets will utilize Digital Terrain/Feature Databases (DTFD) within their target acquisition and terrain navigational systems. It is crucial to determine the effects various digital data products will have on target acquisition and terrain navigational systems. The Defense Mapping Agency (DMA) has many digital data products that can offer increased mission planning, target acquisition, and navigation capability. PSR will expand upon the Phase I effort, that determined the effects of resolution and accuracy of Digital Terrain Elevation Data on line-of-sight prediction capability. Phase II tasks will include a probability/error analysis, and digital feature data analysis. Phase II work will also establish the capability of generating high resolution data from existing digital products. PSR will assimilate all analyses conducted under Phase II and Phase I to ascertain the realistic benefits and limitations of utilizing digital data products for mission planning, target acquisition systems, and navigation systems.

PARTICLE TECHNOLOGY, INC.  
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Topic#: 90-045 ID#: 90CRD-003  
Office: CRDEC  
Contract #: DAAA15-92-C-0075  
PI: M. B. Ranade

Title: Device for Sorting Powders Based on Size and Aspect Ratio

Abstract: The proposed Phase II project will develop a concept for sorting powders by shape and size characteristics into a prototype for a production scale machine for several defense and industrial uses. The concept based on a combined aerodynamic and electrostatic separation of fibers and flakes from regular sized particles was shown to be feasible in a Phase I program.

PERII, INC.  
625 North Maple Avenue  
Ho-Ho-Kus, NJ 07423  
Phone: (201) 670-5700

Topic#: 90-316 ID#: 90ETD-023  
Office: ETDL  
Contract #: DAAL01-92-C-0225  
PI: Martin Moody

Title: Development of Test Engineering tools that Take Advantage of the Microwave Hardware Description Language (MHDL)

Abstract: PerII Systems, Inc., will provide test engineering automation tools which will improve the productivity of the engineering product community. These tools will read the Mimic Hardware Description Language (MHDL) program describing a specific product and automatically develop test requirements documents (TRD) and define commercial instrumentation appropriate for test procedure execution. In addition, a tool will be developed to allow an engineer to validate an existing test set design and modify that design for the MHDL program describing a new product. The decision to develop these tools is based on extensive market research showing a definite need on the part of engineering product developers for a method to comprehensively document their designs electronically and have automated methods of performing standard test engineering functions. This proposal defines the problem currently faced by electronic product developers, outlines a feasible solution to the problem and provides a plan by which the solution can be arrived at in a cost effective manner.

PHYSICAL OPTICS CORP.  
20600 Gramercy Place, Suite 103  
Torrance, CA 90501  
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Topic#: 90-063 ID#: 90NAT-026  
Office: NATICK  
Contract #: 92C0042  
PI: Dr. Gajendra Savant

## ARMY SBIR PHASE II AWARDS

### Title: X(3) Polymer Agile Laser Filters

Abstract: The deployment of tactical military lasers in the modern battlefield necessitates immediate ocular protection against laser radiation. In response, Physical Optics Corporation (POC) proposed the PAG device for eye protection. The PAG principle of operation involves coupling the incoming laser light to a counter-propagating (reflected) portion of the beam by means of a self-induced absorption grating formed in a nonlinear absorber material. The PAG device is capable of providing extremely fast protection against a full range of laser threats, from near UV to near IR wavelengths. Successful experimental proof-of-concept of the PAG in Phase I indicates that the device can be optimized for high reflectivity to agile laser threats. The PAG device is not sensitive to the polarization state of the laser threat. In Phase II, POC intends to develop and fabricate the PAG filter, optimizing the photopic/scotopic performance with respect to the selection of nonlinear absorbers. Design simplicity and flexibility will enable the PAG filter to be installed in Army systems or compactly packaged for soldiers' goggles or visors. In this format it holds strong promise for practical realization and mass production.

PHYSICAL SCIENCES, INC.

20 New England Business Ctr

Andover, MA 01810

Phone: (508) 689-0003

Title: Heat Flux Sensor for Vulnerability Testing

Abstract: A engineering development program for a novel approach to heat flux measurement in the live fire testing environment is proposed. Multi-element pyroelectric film transducers provide simultaneous direct measurement of fast temperature and acoustic (shock wave or over pressure) transients, and accurate instantaneous heat flux, both the convective and radiant parts independently, over large, small, curved or flat areas. The Phase I effort has yielded a compact laboratory prototype heat flux transducer with less than 20ms response time demonstrating these characteristics. In addition, the Phase I results show that the device offers the important capability of continuous acoustic calibration and self-testing before, during and after live fire tests. Due to unique self-shielding properties, the transducer functions well in extreme EMI/RFI environments. The proposed Phase II development program would result in engineering prototype transducers suitable for relive fire field tests to be performed during the Phase II program. Data analysis software and optional user interface, as well as continuous acoustic calibration techniques, will be provided to facilitate direct input of data into burn models (e.g. Knox, PSI, USAARL, etc.). Lastly, a technical Data Package for the complete system will be provided, in order to evaluate the manufacturing cost of a number of transducers. It is anticipated that such transducers will provide superior data at unit cost less than or comparable to current devices.

Topic#: 89-049

ID# 93TEC002

Office: TECOM

Contract #: DAAD05-92-C-0152

PI: R. Daniel Ferguson

PHYSICAL SCIENCES, INC.

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Phone: (508) 689-0003

Title: Compact, Fast Response Transducer for Direct Heat Flux Measurement

Abstract: A engineering development program for a novel approach to heat flux measurement in the live fire testing environment is proposed. Multi-element pyroelectric film transducers provide simultaneous direct measurement of fast temperature and acoustic (shock wave or overpressure) transients, and accurate instantaneous heat flux, both the convective and radiant parts independently, over large, small, curved or flat areas. The Phase I effort has yielded a compact laboratory prototype heat flux transducer with less than 20 ms response time demonstrating these characteristics. In addition, the Phase I results show that the device offers the important capability of continuous acoustic calibration and self-testing, before, during and after live fire tests. Due to unique self-shielding properties, the transducer functions well in extreme EMI/RFI environments. The proposed Phase II development program would result in engineering prototype transducers suitable for live fire field tests to be performed during the Phase II program. Data analysis software and optional user interface, as well as continuous acoustic calibration techniques, will be provided to facilitate direct input of data into burn models (e.g. Knox, PSI, USAARL, etc.). Lastly, a Technical Data Package for the complete system will be provided, in order to evaluate the manufacturing cost of a number of transducers. It is anticipated that such transducers will provide superior data at unit cost less than or comparable to current devices.

Topic#: 90-294

ID# 93TEC018

Office: TECOM

Contract #: DAAD05-92-C-0172

PI: R. Daniel Ferguson

ARMY SBIR PHASE II AWARDS

PHYSICS MATHEMATICS & COMPUTERS, INC.

P.O. Box 787  
Socorro, NM 87801  
Phone: (505) 835-2951

Title: Advanced Concept Evaluation

Abstract: The proposed research is to integrate a number of armor design and evaluation models into an interactive computing environment. The resulting computer code will have a graphical user interface and will incorporate interactive 3D graphics to display results to the user. the threat weapons to be included are shaped charges, kinetic energy penetrators, fragments, armor piercing ammunition, and mines. The user will be allowed to modify the armor configuration interactively, thus greatly decreasing the turnaround time for new design analyses.

Topic#: 90-070  
Office: TACOM  
Contract #: 92-C-R057  
PI: Patrick Buckley

ID#: 90TAC-002

PRECISION COMBUSTION, INC.

25 Science Park  
New Haven, CT 06511  
Phone: (203) 786-5215

Title: Catalytic Glowplugs for Cold Starting

Abstract: The goal of this project is to develop catalytic glow plug technology to enable improved cold starting in direct and indirect injection diesel engines. Rapid testing using a two cylinder, indirect injection diesel engine, with jet-A fuel and 15 second plug preheat, achieved rapid cold starting at an ambient temperature 20 deg. F colder than the limit for a non-catalytic plug (-26 deg. F vs -6 deg. F., respectively). In addition, with lower catalytic surface temperature required for a given effectiveness, power requirement can be reduced and a longer glow plug life can be achieved. Phase I results fully met Phase I objectives. The application of the technology is for retrofitting existing glow plug-equipped diesel engines, as well as for future direct injection engines which could be designed for glow plug usage. Phase II will undertake further catalytic glow plug ignitor development and demonstrate prototypes in the indirect injection 6.2 liter GM engine as well as in a direct injection diesel engine.

Topic#: 90-071  
Office: TACOM  
Contract #: 92-C-R041  
PI: William C. Pfefferle

ID#: 90TAC-003

PRODUCT PLANNING, INC.

2125 Oxford Road  
Des Plaines, IL 60018  
Phone: (708) 296-1000

Title: High Speed Aerial Cable Target Trolley

Abstract: Applications concerning free hanging cables of extremely long length have become a new and rapidly developing science. Recently, oceanographers have been attempting to hang cables to 30,000 foot ocean depths for weather forecasting. IN space, NASA is considering stretching a 66,000 foot cable between satellites for energy replenishment. The intent of this research concerns the feasibility of designing a trolley capable of traveling at speeds up to 550 knots on a 15,500 foot catenary cable stretched between two mountain peaks. Long length cable applications have one command using consideration, the cable is stressed to a maximum by its own weight. Trolley research has the added complication of ultra high velocity transport. Our Phase I feasibility study compared four trolley design configurations by evaluation their capacity to achieve controlled 550 knot transport, using standard engineering practices at a component level. the X-DRUM Trolley was the one mechanism that had the potential of meeting system velocity requirements. Its natural nonsliding force distribution, elliptical bend radius multiplication, low inertia, etc. solve many high speed trolley problems. The objective of continued research is to maximize catenary reliability and life cycle. The unit level objective of this proposed Phase II trolley research is to define trolley to catenary cable reaction, then designs trolley that will operate within cable reaction restrictions. Our success will depend heavily on the research of nonlinear variables, the modeling of cable reverberation forces and the research of rope messenger design.

Topic#: 90-291  
Office: TECOM  
Contract #: DAAD07-92-C-0122  
PI: Bernard Bishop

ID#: 90TEC-016

QUEST INTEGRATED, INC.

21414-68th Ave. S.  
Kent, WA 98032  
Phone: (206) 872-9500

Title: Development of an Automated, Laser Based Gun Tube Inspection System

Topic#: 90-085  
Office: TECOM  
Contract #: DAAD05-92-C-0216  
PI: James L. Doyle

ID#: 90TEC-010

## ARMY SBIR PHASE II AWARDS

Abstract: Repeated firing of 120-mm chrome-plated gun tubes induces a loss of chrome in localized patches. It is necessary to detect pitting as small as 1 mm in length and approximately 0.18mm (0.007 in.) deep, in five regions of the tube, with an accuracy to within 10% of the flawed surface area. The inspection method currently employed at Aberdeen Proving Ground (APG) is based on a manual operation in which a technician visually inspects the tube surface with a bore scope and records the results. The results are then manually entered into a computer database. The operation is time-consuming, labor intensive, and subject to errors. This proposal addresses the need to cost-effectively improve the inspection process for the 120-mm cannon at APG. A Phase I SBIR investigation has successfully demonstrated the feasibility of developing an advanced gun tube inspection system (GTIS). The proposed system, based on the field-proven technology of laser-based optical triangulation, will automatically generate an accurate and quantitative map of the tube surfaces. Data will be provided in a digital format that will be directly compatible with existing computer data bases. In addition, the system will provide accurate bore diameter dimensions, replacing the current manual gauging operation.

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Topic#: 90-288 ID#: 90TEC-014  
Office: TECOM  
Contract #: DAAD05-92-C-0215  
PI: Dr. (Peter) H. T. Liu

Title: Development of a Fiber-Optic Chamber Pressure Transducer

Abstract: The feasibility of developing a fiber-optic pressure transducer (FOPT) based on a patented fiber-optic sensing method has been demonstrated in Phase I for measurements in pressure chambers at pressures from 350 to 840 MPa (50 to 120 KEI). Phase II research and development is proposed to develop two to three FOPT prototypes. The FOPT, operating in an amplitude-modulation mode, detects the displacement of a diaphragm as a measure of the external pressure. The FOPT will be designed to have high resonant frequency to achieve a frequency response of better than 100 kHz. Unlike the piezoelectric transducer, the FOPT measures the static rather than the dynamic pressure. Optical sensing via a fiber-optic link isolates the electronics from the hostile environment and alleviates electronic drift due to interference from strong electromagnetic and radio frequency fields and/or temperature variations, an essential feature for measurements in electrothermal gun chambers. Special sensor configurations will be designed employing a finite element algorithm to maximize sensitivity and dynamic response and to minimize concentration of local stress. Optically, maximum sensitivity and long-term stability will be achieved through optimum selection and design of the reflective coating, light source, photodetector, and optronics.

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Topic#: 90-117 ID#: 90HEL-015  
Office: HEL  
Contract #: DAAD05-92-C-0055  
PI: Richard D. Rallison

Title: Catface Stereo HMD System

Abstract: A Folded Catadioptric helmet or headset mounted video display system is presented that has a possible 50 X 90 degree FOV and resolution comparable to CGA standards with possible upgrade to VGA or better. A top mounted LCTV is proposed as an image generator coupled directly to a section of fiber optic faceplate material. A holographically made planar reflector folds the light into a spherical collimator. The device has see-through capability when constructed with conformal spherical holographic reflectors. The spherical reflector images a small LCTV at near-infinity by imaging the correctly shaped output end of a coherent fiber bundle. Full color and stereo displays are proposed in resolutions limited primarily by the available image generators. There are no refractive optics and no dispersion in the imaging train, all primary distortion and aberration is removed at its source by shaping the faceplate to match the distortions. The system includes input cameras, frame grabbers, buffers, and position sensors.

REDZONE ROBOTICS, INC.  
401 Bingham Street  
Pittsburgh, PA 15203  
Phone: (412) 481-3477

Topic#: 90-069 ID#: 90TAC-001  
Office: TACOM  
Contract #: 92-C-R036  
PI: Sanjiv Singh

Title: Robotics Convoy Capability

Abstract: RedZone Robotics, Inc. has completed a feasibility study of the development of robotics convoy capability. The results

## ARMY SBIR PHASE II AWARDS

indicate that technologies for robotics conveying are within our grasp at this time. Therefore, we propose a 2-year program to develop and demonstrate robotics conveying. Effort will be devoted to several key technologies: integration of global position sensing from satellite link, inertial navigation and dead-reckoning; refinement of vision-based neural net systems for local or relative-position navigation of unmanned vehicles; integration of the above technologies into a path-tracking system; development of intervehicle communications for robotics conveying; specification, fabrication and integration of prototype equipment for unmanned convoy vehicles. The project will demonstrate a two-vehicle convoy, in which the lead vehicle is driven over a course by a human operator. The lead vehicle is driven over a course by a human operator. The lead vehicle will automatically map the course using integrated global and local navigation systems, and will transmit this map via telemetry to the follower vehicle. The follower vehicle will follow the course without human intervention, maintaining a specified stand-off distance from the lead vehicle. The convoy will operate at speeds up to 50 kph; the follower vehicle will follow the path of the leader vehicle with lateral error less than 1 meter.

RETICULAR SYSTEMS, INC.  
4095 Calgary Avenue  
San Diego, CA 92122  
Phone: (619) 457-0709

Topic#: 90-155 ID#: 90AVS-155  
Office: AVSCOM  
Contract #: DAAJ02-92-C-0034  
PI: Dan R. Ballard

Title: Situation Assessment by Plan Assumption Monitoring

Abstract: Reticular Systems Inc. has conducted an extensive research program to develop a Situation Assessment subsystem for use aboard next generation rotorcraft. Phase I effort completed analysis of functional and performance requirements for a rotorcraft SA system. A knowledge-based problem solving architecture was characterized, the knowledge base requirements, knowledge representation mechanisms and knowledge base contents required in a real-time SA system were defined. An experienced scout/attack helicopter pilot was used as a domain expert. A mission scenario was developed featuring desert terrain, numerous flight hazards and multiple simultaneous threats. Development of a rapid prototype of the SA system was initiated. The rapid prototype was used for testing critical SA functions. A simulation environment and test bed for simulating the rotorcraft, pilot and associated subsystems and testing the SA prototype was developed. Functional specifications, software development plans, interface specifications, knowledge base descriptions and software test plans have been generated. During Phase II the SA system will be implemented. Knowledge acquisition and knowledge base construction using the rotorcraft pilot will continue. This SA implementation advances the state-of-the-art in rotorcraft SA technology. Features include supporting air-to-air combat mission, situational awareness including own flight (formation) aircraft, recognition/differentiation between threat and friendly forces, an explanation system for describing SA reasoning processes to the pilot and real-time performance capability.

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Topic#: 90-356 ID#: 90HDL-036  
Office: HDL  
Contract #: DAAL02-92-C-0038  
PI: Dr. Dean Faklis

Title: Application of surface-relief diffractive optics to acousto-optic signal processors

Abstract: During the SBIR Phase I research and development effort, a series of optical signal processing systems were investigated with special emphasis given to decreasing overall optical system size and weight and increasing performance. The optical systems for both acousto-optic compact spectrum analyzers and time-integrating correlators were investigated. It was found that through the use of surface-relief diffractive optics technology, compact laser collimators and Fourier-transform optics are feasible and can be implemented with current fabrication technologies. For example, through reductions in the number of optical elements in open particular collimator design, a decrease in weight of more than 80% was realized with an overall increase in optical performance. Based on the success of Phase I, our primary goal in Phase II is to fabricate and test prototypes of diode laser optics for acousto-optic signal processing systems that utilize combinations of conventional refractive and diffractive optical elements. The diffractive elements will be used primarily to implement anamorphic phase functions; this will demonstrate general laser beam shaping capabilities. Hardware will be assembled to fabricate the diffractive components and the prototype lens systems will be subject to extensive evaluation to determine imaging and environmental performance. Assuming that the proposed SBIR Phase II program is successful, compact, environmentally stable optics modules will be delivered to the U.S. Army for direct implementation in signal processing programs. These innovative optical systems represent a specialized capability for military signal processing systems and offer extraordinary commercial opportunities. We intend to

## ARMY SBIR PHASE II AWARDS

pursue aggressively the development of anamorphic diffractive lenses for military and commercial laser application through phase III.

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Topic#: 90-426 ID#: 90MED022  
Office: MEDICAL  
Contract #: 91C1018  
PI: Dr. Dean Faklis

Title: Diffractive Multi-Color Phoropter Based on Laser Speckle (Portable rugged laser optometer)

Abstract: The actual implementation of optometric instruments in hazardous environment has significant challenges. Large variations in temperature and pressure, severe shock and vibration, and corrosive conditions necessitate certain constraints on the system design. Conventional instruments for refracting the human eye are not designed to stand up to the harsh environments of warfare. The Army has identified a need for an advanced optometer that can be used under a wide range of conditions. As demonstrated in Phase I, the laser optometer has the potential for a compact, rugged instrument that can offer increased reliability and objectivity. This instrument offers the potential to provide the optimum correction for an individual in the actual work environment. The device can be portable (rugged and battery operated), it can incorporate subjective and objective tasks in a single unit and it requires no standard wall charts or room sizes. The ultimate goal of such a device is to help optimize the soldier's job performance and minimize error in tasks under a range of operating conditions. The primary goal of Phase II development is to design and construct a prototype of a portable, rugged laser optometer and to test the instrument in human trials against conventional refraction techniques. The prototype will be built in a hardened case with on-board video display and computer system. The computer will include a data logger so that test data can be archived. The system will also have a small hard copy output device. It is anticipated that the measurement cycle will include both objective and subjective tests of refractive state.

ROOS INSTRUMENTS  
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Topic#: 90-322 ID#: 90ETD-022  
Office: ETDL  
Contract #: DAAL01-92-C-0251  
PI: Mark D. Roos

Title: Proposal for Development of an Automated Multi-function MMIC Wafer Probe Test Station

Abstract: The objective of the proposed project is to continue development of a test system architecture that would reduce acquisition cost and test times for RF and microwave test stations. The architecture is based on the integration of currently available commercial test equipment with custom hardware to minimize redundant system elements that contribute to total system cost and by structuring system control and software to maximize system speed. The proposed Phase II effort is to prove the predictability of the Automated Multi-function MMIC Wafer Probe Test Station studied in Phase I. This effort includes the construction of a completely operational prototype of the system, the evaluation of its performance, and the development of the software necessary to fully utilize the system. This system is expected to have the accuracy of current on wafer test systems, but the throughput will be thirty times faster and the cost of the system will be halved. The software will let any user take full advantage of the system's performance via a graphical test plan entry and optimizing compiler. In addition, we plan from the start to handle large quantities of test data and make it available via standard relational databases.

SARCOS RESEARCH CORP.  
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Salt Lake City, UT 84111  
Phone: (801) 581-3746

Topic#: 90-364 ID#: 90HEL-010  
Office: HEL  
Contract #: DAAA15-92-C-0050  
PI: Fraser Smith, Ph.D.

Title: Multi-digit Sensor-Equipped, Telerobotic End Effector and Wrist

Abstract: The current manipulator being used with a remote controlled, unmanned vehicle is not able to carry out a number of essential tasks due to a lack of dexterity. SARCOS will design and produce a hand and wrist assembly that provides a high degree of dexterity by: 1) increasing the number of useful degrees of freedom (DOFs) in the hand to three, 2) making a high mobility wrist with all three rotational axes intersecting, 3) equipping all DOFs with position and load sensors to provide high-fidelity force reflection, 4) making an easy-to-don, comfortable, exoskeletal master to provide a transparent man-machine interface, and 5) implementing advanced intersystem stiffness control algorithms to optimize the operator's control of the slave.

## ARMY SBIR PHASE II AWARDS

The Phase II effort will produce a fully functional prototype and effector and high mobility wrist, complete with a high resolution force reflective master and all the necessary control hardware and software for carrying out tasks in teleoperation mode. Both the master and slave will possess 6 DOFs each. The prototype will be designed to be rugged and yet possess a high level of dexterity, and will therefore be reliable and robust, while being able to perform a wide variety of useful tasks. The slave hand/wrist will be attached to the existing Odetics arm, and will be powered hydraulically to obtain the desired power density requirements. The prototype will be capable of being controlled using both autonomous and teleoperation modes.

### SATCON TECHNOLOGY CORP.

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Phone: (617) 661-0540

Topic#: 90-383 ID#: 90AVS-383  
Office: AVSCOM  
Contract #: DAAJ02-92-C-0052  
PI: Vijay Gondhalekar

#### Title: Magnetic Bearings for Gas Turbine Engines

Abstract: SatCon Technology Corporation evaluated the high temperature, high speed and rotor dynamics control capabilities of magnetic bearings within the context of the GE T700 gas turbine engine in a Phase I design study. As a logical progression to this study, SatCon proposes a Phase II program to build and integrate a set of radial and thrust magnetic bearings into the power turbine of an existing PLT210 engine test rig for a practical and realistic demonstration of this technology. The PLT210 is representative of IHPTET engines and a suitable candidate for this demonstration. Textron-Lycoming has agreed to the use of their gas turbine test facilities for conducting these tests. The program will result in a realistic demonstration of load carrying capacity, rotor dynamics control, high speed and temperature of 850 degrees F. This program will create a platform for testing magnetic bearings in a realistic gas turbine environment and will provide invaluable data for future IHPTET engine development programs. The test data will provide a realistic basis for extrapolating magnetic bearing performance to other gas turbine engines.

### SCHUYLER DYNAMICS, INC.

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Topic#: 90-124 ID#: 90HDL-003  
Office: HDL  
Contract #: DAAL02-92-C-0013  
PI: Michael V. Wiernicki

#### Title: A High Speed Solder Paste Printer for Surface Mount Applications

Abstract: The feasibility of 100 DOT per sendon application of solder paste to surface mount assemblies busying single pin transfer techniques has been confirmed by our Phase I work. Phase II will concentrate on software development, auto calibration, application error detection, and further head development. The head development effort will attempt to reduce the deposited DOT diameter from .5mm to .3mm, improve the deposition accuracy form .08mm to .05mm, and reduce the error rate from 450ppm to 200ppm or less. The overall goal is to make the printer useful for production floor use.

### SCHWARTZ ELECTRO-OPTICS, INC.

3404 North Orange Blossom Tr.  
Orlando, FL 32804  
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Topic#: 90-393 ID#: 90AVS-393  
Office: AVSCOM  
Contract #: DAAJ02-92-C-0040  
PI: Richard J. Wangler

#### Title: Helicopter Obstacle Proximity Sensor System (HOPSS)

Abstract: The Phase II program will develop a Helicopter Obstacle Proximity Sensor System (HOPSS) based upon the Phase I brassboard HOPSS, which successfully satisfied all requirements set forth in SBIR Topic A90-393. The brassboard HOPSS was a pulsed time-of-flight laser radar which was scanned continuously in a 360 degree horizontal plane at a rate of three revolutions per second. Range measurements were made every 0.08 degrees. The brassboard sensor detected and ranged to wires or cables at 75 feet and trees, bushes and rocks at 350 feet, with better than 1 foot accuracy. The brassboard sensor also provided the angular location of an object closer than a preset warning range. The major objective of the Phase II program will be the integration of the HOPSS into a helicopter, followed by extensive testing. A pre-production prototype HOPSS unit will be installed on an aircraft for verification testing. Prior to system integration, there will be an extensive system requirement definition phase. The requirement definition will result from extensive contacts with the U.S. Army Aviation Systems Command, helicopter pilots, FAA, and helicopter manufacturers. This definition phase will provide a specification to which the Phase II sensor will be designed and fabricated.

ARMY SBIR PHASE II AWARDS

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Topic#: 90-097 ID#: 90ARO-007  
Office: ARO  
Contract #: DAAL03-92-C-0014  
PI: Harold L. Grubin

Title: The Design and Development of Low Noise, High Speed High Electron Mobility Transistors (HEMT)  
Abstract: AllnAs/GalnAs on InP HEMTs have been investigated for low noise, high speed operation. For this technology to impact the commercial and military marketplace it is necessary to produce these devices at the lowest possible cost. In particular, it is desirable to have procedures for screening material properties and device performance which enables organizations to produce devices with a minimal amount of experimental work. While a broad laboratory data base would produce such screening procedures, developing such a base will require high financial resources. A more practical approach is to implement validated advanced numerical simulation procedures screen devices. The term validated is taken to mean numerical simulation procedures that predict trends believable by scientists and engineers involved in device design and fabrication. This proposal deals with the establishment, through simulation and experiment, of a validated numerical user oriented algorithm for reducing the cost of the design and development of advanced HEMT structures.

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Topic#: 90-122 ID#: 90HDL-001  
Office: HDL  
Contract #: DAAL02-92-C-0030  
PI: Chung-Dyi Hsu

Title: A Temperature Stable High Performance Multi-Layer Microstrip Antenna  
Abstract: Feasibility studies including analyses and experiments performed in Phase I indicated that there is a suitable technique for producing small multi-layer wide band microstrip patch antennas for an artillery proximity fuze application. In Phase II, Scientific Technology, Inc. will continue the effort to develop low cost and reliable fabrication techniques for the wide band multi-layer microstrip antennas (MLMA). A theoretical model based on full-wave analysis method will be evaluated for the prediction of the antenna performance, including radiation pattern, return loss, and antenna efficiency. A tolerance study will then be performed using the software to predict performance variations due to manufacturing variations which in turn aid in the choice of a manufacturing process. STI will demonstrate the feasibility of achieving low cost production using a thermal stable substrate identified in Phase I. Successful development of the multi-layer antenna will benefit not only the proximity fuze program but other DoD programs which require use of wide band, broad beam antennas. The software can also save development time and labor for other DoD antenna and microwave developmental programs.

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Topic#: 90-328 ID#: 90HDL-013  
Office: HDL  
Contract #: DAAL02-92-C-0021  
PI: Bar-Giora Goldberg

Title: Digital Waveform Generation

Abstract: Sciteq will design and produce a direct-digital waveform generator that supports complex modulation over a wider bandwidth and with better spectral purity than is now attainable. The result will exploit advanced semiconductor technologies identified in Phase I, sound design principles, and aggressive waveform construction algorithms. During Phase I, Sciteq evaluated a variety of semiconductor technologies, devices, and architectures and tested examples of each, when possible. Further, Sciteq produced a Statement of Work and Source Control Drawing that will be used as a basis of Phase II. During Phase II, Sciteq will produce a hardware implementation of the design selected during Phase I, and will tune/modify it as required to optimize performance. Five (5) operational breadboards will be produced and delivered, plus key production engineering data and test procedures.

SEC STRUCTURAL ENGINEERING CORP.  
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Phone: (714) 693-0480

Topic#: 90-405 ID#: 90CER-006  
Office: CERL  
Contract #: DACA88-92-C-0013  
PI: Dr. Shayan Pazargadi

Title: Development of an Improved Rapid Seismic Analysis Procedure (RSAP)

ARMY SBIR PHASE II AWARDS

Abstract: The methodology that has been developed under the Phase I effort of the Improved Rapid Seismic Analysis Procedure (IRSAP) will be used to create the data base and will be automated and tested against selected buildings and example problems. The IRSAP incorporates ATC-22 questionnaire to categorize the type of building as well as whether the system is ductile or not. In the first half of the Phase II effort a data base will be prepared by applying the detailed analytical approach developed under Phase I to a set of selected buildings. In the detailed analysis a finite element model of the building is developed with the aid of IMAGES-3D or a similar structural analysis program. Nonlinear dynamic behavior of the system is analyzed in linearized incremental steps to develop the Capacity Spectrum. Value of the demand reduction factor at the ultimate level is obtained from the force-deflection characteristics of the structure. The results of this effort is to develop a method that more accurately and realistically estimate the damage level to various earthquake levels. In the second half of the Phase II effort, all of the tasks mentioned above will be automated that an engineer can focus on the judgement rather than detailed hand calculations. The final product is a software package that performs the IRSAP as well as performing the detailed evaluation that creates the data base.

SENTEC CORP.

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Phone: (313) 642-1611

Title: Inexpensive Optical Sensor for Aerosol Analysis

Abstract: The current optical sensor for the characterization of aerosol has marginal sensitivity and accuracy. A significant improvement of these characteristics has been demonstrated in a feasibility level developmental nephelometer during Phase I of the project A90-101. The improvements were achieved through the enlargement and reshaping of the optically sensitive volume of the system, and the increase of both the gain and the system signal-to-noise ratio. Performance of the new design was compared to a standard model RAS-1 nephelometer, demonstrating the magnitude of the improvements in all pertinent characteristics required for the detection and analysis for both small particle, and long fiber aerosols. The completion of the research and preparation for commercialization of the inexpensive high performance sensor system is proposed for the Phase II based on the Phase I results. The work will be conducted on all aspects of the product, including field tests at WEMR, NM. Engineering prototypes will be used for verification of the product. The proposed sensor system will consist of several functional modules. This is (1) to make the product applicable for a variety of applications and (2) to make it most cost effective for users.

Topic#: 90-101

ID#: 90ASL-002

Office: ASL

Contract #: DAAL06-92-C-0011

PI: Takeo Sawatari

SETS TECHNOLOGY, INC.

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Mililani, HI 96789

Phone: (808) 625-5262

Title: Development of a Hyperspectral Gas Analysis System (HyGAS)

Abstract: This Phase II proposal responds to the request that unique approaches for a real time knowledge engineering based tactical decision aids system be developed involving parallel computer architectures. The opportunity is to develop a system that acquires and translates the expert's knowledge into a representation utilizable by a moderately-trained analyst under a robust set of scenarios, including probability constraints. The objective of Phase II is to implement the detailed conceptual design, developed under Phase I, for the entire knowledge-based system that utilizes hyperspectral data for the remote detection, identification, and analysis of gaseous materials, based upon requirements, sources, and methods for populating the gas data base. The knowledge base for the system shall be a database of high resolution spectra and the associated tables of diagnostic spectral parameters, as defined by expert analysts. The system is to use hyperspectral and spatial processing methods in a parallel-processing computer environment. This implementation will result in a prototype Hyperspectral Gas Analysis System (HyGAS).

Topic#: 91-021

ID#: 91ETL-303

Office: TOP

Contract #: DACA76-92-C-0037

PI: Pamela Blake

SILICON DESIGNS, INC.

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Phone: (206) 391-8329

Title: An Improved Fusible Link for FASCAM Mines

Abstract: Current microfuses for FASCAM mines have reliability problems. They are relatively fragile, they are not

Topic#: 90-011

ID#: 90ARD-010

Office: ARDEC

Contract #:

PI: John C. Cole

## ARMY SBIR PHASE II AWARDS

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hermetically sealed and they are well suited for high volume production. Silicon Designs has developed a new technology for making detonators using thin-film bridges on substrates fabricated like integrated circuits. In the Phase I work, we investigated this technology for microfuses and found that it works well. Thin-film fusible links were tested electrically and found to pass easily the all-fire and no-fire levels of the existing fusible links. These units can be packaged in hermetic packages using high volume semiconductor equipment and appear to solve all known problems with fusible links. They are low cost to produce and assemble on boards using standard IC assembly equipment. In Phase II we propose to design thin-film fusible links for use in the MSEP program in a configuration best suited for high-volume mine production. We will then produce and deliver prototypes that would be used in the mine development at Picatinny. We will conduct qualification tests on them to verify resistance to shock, vibration and corrosion. We will supply the fusible links for the initial production of 1000 mines.

### SOFTWARE AND ELECTRICAL ENGINEERING

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Topic#: 90-217 ID#: 90-C3-061  
Office: CECOM  
Contract #: DAAB07-92-C-B260  
PI: Victor Civie

Title: Computer Virus Electronic Counter Measure (ECM)

Abstract: Sophisticated Virus, Parasite and Resource Management systems are to be constructed to alter or report on the operation of a designated target. Specific systems include the Tape Worm, a low profile smart Parasite featuring comprehensive resource management operations, the Stealth Striker, an ultra low profile targeting virus, the Transport, an ultra low profile utility virus used to transport, load and execute large programs and various surveillance and maintenance systems. Virus/Parasite objectives include securing a stable base, fixing, relocating and reproducing in the target system, the ability to find and infect other systems, alter/record/monitor/recall computer operations, and alter/record/monitor/recall data and output. The effort will also produce a Code miniaturization strategy and apply the principals to the EMC programs. compact Task Oriented Routines are designed to create code to perform assigned tasks.

### SOFTWARE COMPOSITIONS

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Topic#: 90-032 ID#: 90-SE-011  
Office: CECOM  
Contract #: DAAB07-92-C-Q509  
PI: Kathleen Gilroy

Title: Preventative Maintenance Tools and Techniques for ADA Software Reuse

Abstract: The overall objective of this effort is to apply preventive maintenance tools and techniques to the problem of software reuse, exploiting the growing base of existing Ada software in the creation of new reusable components. Phase I of this effort explored the relationships between the processes of software development, maintenance, and reuse, and identified possible uses of preventive maintenance technology (such as restructures and reverse engineering tools) to software reuse. A primary result was the development of a comprehensive method for applying an approach called Reuse by Transformation, and the specification of a toolset which would support a portion of the method. The objective of Phase II is to further refine this method, and to implement a prototype version of the proposed toolset.

### SPACE APPLICATIONS CORP.

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Topic#: 90-241 ID#: 90-SE-049  
Office: CECOM  
Contract #: DAAB07-92-C-Q511  
PI: David F. Kinsey

Title: Technology for Re-engineering Tactical Software Systems

Abstract: Software re-engineering is a technology for renewing and revitalizing aging software applications. The re-engineering process consists of evaluating existing software systems and re-implementing them as new programs to improve their maintainability and reliability, and to support new languages and platforms. While many automated tools exist to assist in this process, a coherent method for planning and managing re-engineering projects is needed. The Phase II research addresses the problems of re-engineering project planning, economics, and process control, as well as the use of automated engineering tools. Specifically, the issues of project costing, defining process control metrics, and interfacing automated tools are examined. For this study, the Space Applications' re-engineering methodology is refined using the results of the Phase I project, and through experience gained during two rigorously monitored Phase II experiments. Models and working prototypes for evaluating

## ARMY SBIR PHASE II AWARDS

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re-engineering cost, and for implementing process control metrics, are employed during the experiments. Also, an architecture standard for selecting and integrating of automated re-engineering tools is defined and tested.

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Topic#: 90-300 ID#: 91SDC-022  
Office: SDC  
Contract #: DASG60-92-C-0172  
PI: Dr. C. K. Shum

Title: Analysis and Precise Determination of Ballistic Trajectory

Abstract: This proposed investigation will perform an elaborate error analysis and will develop appropriate force and measurement models to precisely determine the Vandenberg-Kwajalein ballistic missile trajectory. Among the error sources considered will include (1) station coordinate errors for the three tracking stations located at Vandenberg, Hawaii and Kwajalein; (2) gravity anomaly model errors at launch site, in mid-trajectory, and at impact area; (3) atmospheric and aerodynamic model errors and the measurement model errors affecting the ballistic trajectory. The software tools to be used include the Trajectory Analysis Program (TRAP) which was developed at the University of Texas at Austin and is also operational at Sandia National Laboratory. However, TRAP has limitations in some of modelings needed to perform the proposed investigation. If necessary, the University of Texas Orbit Processor (UTOPIA) will also be used in providing trajectory analysis to identify some of the error sources. State-of-the-art gravity models, including the University of Texas Geopotential (TEG-2), WGS-84 and the Ohio State University field OSU89B will be used to choose the best model for the problem. Tracking station coordinates will be estimated relative to the Terrestrial Reference System determined by satellite laser ranging to LAGEOS (accurate to within 5 cm) to assess its effect on the ballistic trajectory. It is envisioned that Phase I work will produce a detailed error analysis and Phase II and Phase III tasks will perform the appropriate modeling and software development. The eventual objective is provide software tools and analytical means to precisely determine ballistic trajectories to within several meters of accuracy (root-mean squared).

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Topic#: 90-138 ID#: 90VAL-003  
Office: VAL  
Contract #: DAALO6-92-C-0008  
PI: Robert J. Grasso

Title: Spectrally Enhanced Pulsed Plasma (Development of Advanced Surface Discharge Countermeasures)

Abstract: This proposal represents the second phase of a program to develop spectrally enhanced countermeasures for use against advanced IR missiles. In the Phase I program, we demonstrated a high degree of radiant spectral enhancement from a surface discharge plasma based solely upon the composition of the surface discharge substrate. The program proposed here addresses the development of this promising new technology directed towards improving the effectiveness of active countermeasures against existing and emerging threats. The program will develop, through theoretical and experimental techniques, an optimized spectrally enhanced surface discharge plasma operating in the 1.0 to 1.5 um near and mid-infrared spectral regions. The program proposed here is important because it will lead to effective, efficient, and economical countermeasures to deter the threat from advanced IR missiles. These countermeasures, with their output enhanced in the near and mid-infrared regions, would be effective at defeating threats with multiple wavelength discriminating seekers. A surface discharge based countermeasure would offer compact and rugged construction without suffering from limitations such as lack of spectral selectivity and low efficiency associated with current IR sources. The long term importance of this work is that it will lead to the development of effective new countermeasures based upon a sound technology that will provide greatly increased protection against current and future threats.

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Topic#: 90-140 ID#: 90AVS-140  
Office: AVSCOM  
Contract #: DAAJ02-92-C-0029  
PI: Dr. Irving B. Osofsky

Title: Flechette Expulsion Augmentation Mechanism

Abstract: The effectiveness of the Hydra-70 2.75 Inch Rocket Air to Air Flechette (ATAF) warhead can be enhanced without developing a new warhead or weapons system. A Phase I program demonstrated through flight tests that the lateral motion of flechettes can be controlled by modifying their fins. When the fin modifications are combined with a bladder type expulsion

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mechanism, the flechette pattern size on target can be doubled without loss of pattern uniformity. A two year Phase II development program will design, fabricate and test a Flechette Expulsion Augmentation Mechanism for the existing ATAF warhead. The program will include development and testing of a bladder type expulsion mechanism, manufacture of flechettes with modified fin configurations, assembly of test articles replicating ATAF warheads and flight tests. Free flight rockets will accelerate the warheads to 450 M/sec and trigger the expulsion charge; a 75 m square polyethylene fabric target will record the full warhead flechette patterns.

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Phone: (513) 436-4454

Topic#: 90-392 ID#: 90AVS-392  
Office: AVSCOM  
Contract #: DAAJ02-92-C-0037  
PI: Glen L. Harris

Title: Effectiveness of Active versus Passive Countermeasures

Abstract: The objective of this effort is to integrate/develop and apply a user friendly workstation for evaluating tradeoffs between active and passive countermeasures for rotorcraft operations. The primary technical objectives are to : 1) expand the Phase I analysis against additional RF and IR threats; 2) integrate a much more capable Countermeasures Effectiveness Workstation (CMEWS); and 3) develop a Methodology Control Structures (MCS) that provides an innovative user friendly top level analyst interface to the CMEWS models for both conducting and presenting analyses. S\*R proposes to use mature, operational portions of the Joint Modeling and Simulative System (JMASS) Simulation Support Environment (SSE) as the foundation for developing the CMEWS. The JMASS SSE Graphic User Interface (GUI) conventions will be used to implement the MCS. The effort will also take maximum advantage of other government owned simulation and workstation software. S\*R proposes five additional nine month options. Three of the options expand the capability of the CMEWS by integrating it with additional models, developing a methodology tutorial and interfacing the system with a JMASS workstation. Two of the options expand the analysis by adding additional threats and supporting a test program.

SPECTRUM MANAGEMENT GROUP, INC.  
4460-A Brookfield Corp. Drive  
Chantilly, VA 22021  
Phone: (512) 340-4792

Topic#: 90-027 ID#: 90-EW-006  
Office: CECOM  
Contract #: DAAB07-90-C-J009  
PI: Dr. Nicholas Lawrence

Title: Multi Sensor Automatic Template Generation with Correlithms

Abstract: Under the SBIR Phase I contract number (DAAB07-90-C-P015), spectrum Management Group, Inc. (SGM) proved the feasibility of using the SMG Artificial Neural Network (ANN) to generate radar signature templates automatically. We continue this work to produce a production prototype system. This is product development work and is expected to result in a commercially viable product line to address Phase III commercialization requirements.

SRICO OPTICAL ENGINEERING  
664 Petworth Court  
Powell, OH 43065  
Phone: (614) 846-3239

Topic#: 90-123 ID#: 90HDL-002  
Office: HDL  
Contract #: DAAL02-92-C-0018  
PI: Dr. S. Sriram

Title: Optical Interferometers for Sensing Electromagnetic Fields

Abstract: The object of the proposed effort is to develop an integrated optic Mach-Zehnder interferometer for measuring electromagnetic fields. During Phase I, SRICO demonstrated the feasibility of producing an electrode-less Mach-Zehnder interferometer using the electro-optic lithiumniobate crystal. The optical beam propagating through the crystal is modulated by the electromagnetic field experienced by the crystal. This electrode-less device is expected to be more accurate than a conventional device due to the absence of any metal electrodes that tend to disturb the fields. Non-invasive measurement of fast, transient electromagnetic fields are thus made possible. Optical fibers will be attached to the integrated optic Mach-Zehnder interferometer to facilitate operation of the sensor in a remote environment. Optical fiber links greater than 100 meters could easily be deployed to separate the sensor from the optoelectronic instrumentation. The sensor system proposed has a dynamic range greater than 40 dB over a 1 GHz measurement bandwidth. The sensor could be designed to operate over a wide frequency range from DC to 30 GHz. A complete instrumentation package including a laser, a photodetector and signal processing electronics will be developed during this Phase II SBIR program. The instrumentation package will be tested and delivered to

ARMY SBIR PHASE II AWARDS

the U.S. Army Harry Diamond Laboratories.

SRS TECHNOLOGIES  
990 Explorer Blvd, Cummings Research Park  
Huntsville, AL 35806  
Phone: (205) 971-7000

Topic#: 90-450 ID#: 91SDC-027  
Office: SDC  
Contract #: DASG60-92-C-0121  
PI: Richard K. Steinberg

Title: Display Development for USAKA Mission Data

Abstract: In the Phase I effort, innovative display concepts were developed to significantly increase the amount of mission data displayed from the GBR-X & KREMS radars. In the Phase II effort, display data will be selected, prioritized, and finalized. Software routines and display concept software templates will be developed to enable rapid development and modification of mission displays. The software will be developed using newly developing graphics standards that will provide software that is highly transportable to existing hardware and compatible with more powerful evolving hardware. This software will be used to display concepts for Theater Missile Defense (TMD) and other range displays. Realtime display of multiple object track requires the use of innovative graphical concepts such as those developed in the Phase I effort, and the software to be developed in the Phase II. Major display features include the correlation of visual cues with decision aids, interactive graphics and embedded graphical display concepts.

STABLELASE, INC.  
1042 Stagecoach Road  
Santa Fe, NM 87501  
Phone: (505) 983-5605

Topic#: 90-089 ID#: 90BRL-001  
Office: BRL  
Contract #: 92C-0074  
PI: Robert C. Sze

Title: Compact and Field-Worthy Ultraviolet Laser

Abstract: In Phase I we designed and constructed a compact exciter laser capable of operating at XeCl, Xef, KrF, KrCl and ArF wavelengths with a simple change in gas fill and without the need for passivation. The laser is designed to meet the specifications of 25 mJ per pulse in ArF and 100 Hz operation frequency. In Phase II we will address system dependability, diffraction-limited beam quality and long life gas compatibility issues. pulse Nd(3+) solid state laser for laser triggered munitions application.

STEINBRECHER CORP.  
185 NEW BOSTON STREET  
WOBURN, MA 01801  
Phone: (617) 935-8460

Topic#: 91-013 ID#: 91ETD-301  
Office: ETDL  
Contract #: DAAL01-92-C-0224  
PI: Dr. Dean F. Peterson

Title: Millimeter Wave Power Amplification and Frequency Multiplication

Abstract: The Phase II development effort will extend the investigations undertaken in Phase I and expand the technology base for producible and reliable EHF power generation with frequency multipliers using epitaxially-stacked (ISIS) varactor diodes. The work effort will be focused in three areas and culminate in the demonstration of significant CW power output at 94 GHz. One phase of the program will be concerned with the design and manufacture of 2- and 3-stack ISIS diodes for reliable operation at W-band (94GHz) with a goal of 1 watt output power from a single device. This effort will be subcontracted to Microwave Device Technology, Inc. (MDT). In-house efforts will design and develop circuits and combiners suitable for achieving high output power levels from the MDT devices. Both conventional waveguide and planar circuits will be designed and evaluated, and power-combining techniques most suitable for ISIS multipliers will be identified and implemented on a modest level. A deliverable 94 GHz power source representative of the technology developed under the Phase II program will have a goal to demonstrate a reliable 2 watts output power over a 1 GHz bandwidth.

STRAINOPTIC TECHNOLOGIES, INC.  
108 West Montgomery Ave  
North Wales, PA 19454  
Phone: (215) 661-0100

Topic#: 90-005 ID#: 90ARD-004  
Office: ARDEC  
Contract #: DAAA21-92-C-0056  
PI: Alex S. Redner

Title: Development of Broadband-Ultrasonic Pulse Method for Measuring Residual Stresses and their Gradients

## ARMY SBIR PHASE II AWARDS

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**Abstract:** The objective of the proposed research is to develop a new method for measuring surface-stress gradients using a broadband ultrasonic wave. Phase I research proved the feasibility of the concept, demonstrating that the ultrasonic surface hugging waves can reveal stresses within a depth that is frequency dependent. The Phase II research effort should develop and provide the needed background to permit a quantitative stress gradient measurement. The research will include investigation of effective depth of surface-waves, development of suitable transducers, design of a PC-based readout system, preparation of software for data acquisition and analysis, evaluation of temperature effects and testing of a deliverable system.

SYNETICS CORP.  
540 Edgewater Drive  
Wakefield, MA 01880  
Phone: (619) 442-3703

Topic#: 90-024 ID#: 90-C3-003  
Office: CECOM  
Contract #: DAAB07-92-C-B261  
PI: D.S. Bargabus

**Title:** Automatic Speech Recognition for Control of UNIX-based C2 Applications

**Abstract:** The offeror proposes the development of an Inexact Speech system that will permit Army personnel to communicate with computer-based Command and Control system using a relatively loosely-structured syntax. This Phase II proposal combines the advanced technologies of Automatic Speech Recognition and Artificial Intelligence in a novel client/server network architecture that combines the best features of low-cost, familiar MS-DOS at the user interface with powerful UNIX-based multitasking at the server. The system accommodates the user's natural syntax, as opposed to requiring that the user adapt to the system's rigid syntax.

SYSTEM DYNAMICS INTERNATIONAL  
4432 NW 23rd Avenue, Suite 5  
Gainesville, FL 32606  
Phone: (904) 371-8035

Topic#: 90-054 ID#: 90MIC-004  
Office: MICOM  
Contract #: DAAH01-92-C-R217  
PI: William R. Graham

**Title:** Alignment Transfer for Helicopter Launched Inertially Guided Missile

**Abstract:** The objective of this proposed SBIR Phase II effort is to pursue brassboard development of the helicopter-INS to missile-IMU transfer alignment algorithm developed under Phase I. The Phase II effort will transition from the model-based computer simulation environment, to an inertial test lab, and ultimately to a flight-test program. A real-time Kalman filter algorithm will be developed and tested based on the optimal filtering results documented for Phase I. The real-time Kalman filter development effort is directed at reducing the filter's state size (from the optimal 76-states) by the judicious selection of those filter states determined to be critical for accurate transfer alignment. The real-time filter will be designed to be consistent with the throughput rate, memory capacity, and computational capabilities of currently-available tactical-missile-grade microprocessors, while maintaining near-optimal accuracy and robust operation. The Kalman filter will be coded into a microprocessor and tested in a representative helicopter/missile environment (first in the laboratory and then in an AH-64 Apache helicopter.) the Kalman filter architecture will be designed with enhanced modularity to facilitate potential implementation into a wide-range of advanced weapon systems.

SYSTEMS & PROCESSES ENGINEERING CORP.  
1406 Smith Road  
Austin, TX 78721  
Phone: (512) 385-2067

Topic#: 90-306 ID#: 90ASL-005  
Office: ASL  
Contract #: DAAL06-92-C-0014  
PI: Robert C. Chin

**Title:** Laser Remote Sensing of Clandestine Drug Facilities

**Abstract:** In Phase I, Systems & Processes Engineering Corporation (SPEC) experimentally demonstrated that Phase-Resolved Fluorescence Spectroscopy (PRFS) can be used to detect and classify specific targeted compounds or materials. The Phase I Remote Sensor design and analysis results indicate that PRFS technology has significant potential for FLUORESCENCE INTELLIGENCE, to support vital Army operation -- drug interdiction, chemical/biological agent detection, minefield detection, vehicle IFF, and detection of low RCS, low IR signature or camouflaged targets not accessible by conventional sensor systems. The Phase II Program provides the technology foundation for a Phase III airborne PRFS remote sensor and will consist of 1) development of a PRFS Breadboard Demonstration System, 2) expansion of the Phase I PRFS experiments and Excitation-Emission-Frequency Array (EFFA) database development, and 3) major technology deliverables: A Micro-Channel Plate, Multi-Anode Detector (MCP-MAD) system for parallel detection and processing of multiple emission wavelengths

## ARMY SBIR PHASE II AWARDS

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(UV-VIS) and modulation frequencies; A mode-locked, diode pumped ND:YAG laser with UV output; EEFA-EEM Extraction Signal Processing Software. SPEC has obtained Phase II commitments from major partners: Radian Corporation, Texas Department of Commerce, Texas Department of Agriculture, Texas A&M University, NASA Goddard, and the USDA.

TAI, INC.  
12021 Suite P-4, South Memorial Parkway  
Huntsville, AL 35803  
Phone: (205) 881-4999

Topic#: 90-219 ID#: 90-C3-057  
Office: CECOM  
Contract #: DAAB07-92-C-B006  
PI: Loy W. Shreve II

Title: Method for Detecting Pinholes in Hermetic Coatings of Optical Fibers

Abstract: In Phase I of this project a method for inspecting and detecting pinholes in hermetically coated fiber was demonstrated. The instrument was in-line, non-destructive, non-contacting, real-time, and did not alter the present manufacturing process. Some modifications and enhancements to the system are planned for Phase II. All of the objectives of phase I were not only met but the experimental work went far beyond the scope of work. The on-site experimental work at the fiber manufacturing facility gave insight to needed modifications and enhancements. For Phase II of this project a fully functioning monitoring and inspection system is to be installed on a drawing tower ready for production of commercially available hermetically coated optical fiber that has been 100% inspected. Coordination with existing government programs that have a need for hermetically coated optical fibers is planned as a portion of the Phase II scope of work. With the modifications and enhancements implemented, the system developed for this project will open new doors for not only the manufacturers of optical fiber but the end user as well. Once it is shown that the hermetically coated fiber can overcome many of the difficulties encountered by the end users, such as salt water degradation, hydrogen ion erosion, and shelf-life degradation. Both military and commercial applications (including high reliability data links, sensors, controls, and environmental monitoring, etc.) can benefit from this endeavor tremendously.

TDA RESEARCH, INC.  
12242 W. 49th Ave., #6  
Wheat Ridge, CO 80033  
Phone: (303) 420-4329

Topic#: 90-269 ID#: 90NAT-007  
Office: NATICK  
Contract #: 92C0030  
PI: William L. Bell

Title: Applications of New Chemical Heat Sources

Abstract: The performance of soldiers in the field is enhanced by providing them with a hot meal. To heat rations in situations where a field kitchen is not available, the Army currently uses a chemical heat source, the Flameless Ration Heater (FRH). The FRH is effective in heating the Meal, Ready-to-Eat (MRE). However, the FRH produces substantial volumes of flammable hydrogen gas, which is both an inconvenience to the user and a potential safety hazard. The FRH is also relatively expensive, at roughly 50 cents per unit. An improved ration heater which avoided hydrogen production and lowered the cost would be highly desirable. In Phase I, TDA Research, Inc. (TDA) examined chemical heat sources for ration heaters. We conducted a comprehensive literature survey, aided by a computerized search, and also generated a large number of candidate reactions from fundamental chemical principles. We also evaluated the reaction used in the FRH for purposes of comparison. We selected the best reactions for ration heaters through an analysis using data on materials costs, reaction rate studies, and calorimetry to measure heat output. We identified two compositions which can provide the same heat as the FRH with a small increase in weight, and do not produce any hydrogen. We concluded that the new materials have the potential to produce a heater which is more convenient and less hazardous (by avoiding the production of hydrogen), while significantly lowering the cost. In Phase II TDA will prepare and test prototype ration heaters using the new materials developed in Phase I. We will first carry out tests to establish the best material formulation. We will prepare small quantities of ration heaters using several different designs, and test them to select the best design. TDA will then prepare a larger quantity of ration heaters for further evaluation. Two thousand ration heaters will be provided to the Natick RD&E Center for testing at that facility. The safety of the new heaters will be established by an ongoing system safety analysis. An engineering analysis will estimate manufacturing cost for large scale production.

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Huntsville, AL 35805  
Phone: (205) 539-1267

Topic#: 90-031 ID#: 90-SE-010  
Office: CECOM  
Contract #: DAAB07-92-C-Q506  
PI: James F. Miller

## ARMY SBIR PHASE II AWARDS

### Title: Requirements Engineering Methodology and Techniques

Abstract: This Phase II research effort will explore several innovations in the area of requirement and documentation management via a Change Identification and Review System (CIRS) testbed. We propose to provide the following key innovative capabilities: 1) change identification and change analysis for the evolution of a requirements document on any level; 2) requirements traceability over multi-level documents for the evolution of systems requirements; 3) convenient recording of change rationale; 4) automated support for the identification of critical changes; and 5) consolidation of terminology across requirements documents throughout a project. Additional innovations will be the use of a rule based system to facilitate the above capabilities and a "front end" to link CORE, a commercial CASE system for requirements elicitation. From the user perspective, this testbed will allow the Program Manager to track, identify, verify, and review requirement specification changes and validate that the revised document reflects only approved changes. This testbed will be used and refined through field usage at one or more Program Manager sites.

### TECHNICAL DIRECTIONS, INC.

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Ortonville, MI 48462

Phone: (313) 625-0758

Topic#: 90-268

ID#: 90MIC-023

Office: MICOM

Contract #: DAAH01-92-C-R392

PI: Vern E. Brooks

### Title: Integrated Starter-Generator for Small Turbojet Engines

Abstract: The technical feasibility of an integral starter/generator for small turbojet engines was established in the initial phase of this program. Test results show that the electrical starting system can provide engine starts that are as fast as pyrotechnic equipment starts. The Phase I results show that a small turbojet engine can be started and accelerated to maximum thrusts within a 6.0 second period. The Phase II portion of the program will create the hardware to demonstrate a combined function starter/generator which permits the minimum of equipment to be installed on the vehicle, and allows the starting equipment to be re-used. This system provides the necessary electrical power on-board the air vehicle at the lowest cost of expendable hardware in a tactical mission.

### TECHNICAL RESEARCH ASSOC.

410 Chipeta Way, Suite 222

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Phone: (801) 582-8080

Topic#: 90-423

ID#: 90MED-019

Office: MEDICAL

Contract #: 91C1020

PI: Owen D. Brimhall

### Title: Development of Multipurpose Centrifuge

Abstract: The purpose of this Phase II project is to provide advanced development of a lightweight, rugged battery operable multipurpose medical centrifuge for combat casualty care units based on innovative concepts tested in the Phase I study. The centrifuge will be equipped to perform microhematocrit, urine sediment, fecal concentration, plasma preparation, quantitative buffy coat analysis tube centrifugation and manual settings using a built-in two stage rotor system and standard tubes. The split rotor design decouples the high speed portion of the rotor for the hematocrit and QBC separations to conserve battery power and reduce weight and strength required for the larger buckets which are only driven when filled. The prototype integrates a digital semi-automatic hematocrit measuring scale, operators manual and precise experimental protocols for various centrifugation tests by storing them in digital memory. The HELP files are retrieved by simple graphical three key user input and displayed on an integral LCD screen. The prototype apparatus developed under Phase I demonstrates the feasibility of a multipurpose centrifuge meeting all the requirements set for 5th by the original objectives and provides a substantial basis for an orderly Phase II advanced development. The Phase II effort will provide for advanced engineering design for manufacture and qualify the system for the ruggedized medical environment. Five pre-production devices will be delivered for evaluation.

### TECHNICAL SOLUTIONS, INC.

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Mesilla Park, NM 88047

Phone: (505) 524-2154

Topic#: 90-474

ID#: 90ARD-034

Office: ARDEC

Contract #: DAAA21-92-C-0102

PI: George C. Ober

### Title: Computer Model for Indirect Fire Control System Simulator

Abstract: A requirement exists for a means of analytically identifying the weapons improvements in effectiveness for indirect fire achievable through reduction of various sources of error in delivery accuracy, the desired means of performing this analysis

## ARMY SBIR PHASE II AWARDS

is a workstation embodying both trajectory simulation and accuracy (to include effectiveness) analysis capability. Many simulations of internal and external trajectory calculations, as well as accuracy analysis simulations, exist. These varying degrees of detail, and having varying degrees of acceptance by the US Army as being authoritative. Preliminary research conducted in Phase I indicates that no authoritative models exist that incorporate more than a few of the error sources affecting delivery accuracy. An opportunity exists to identify available models, improve them with newly developed methodology and provide an integrated indirect fire control analysis tool. The resulting model will be incorporated into a workstation, provide a well-conceptualized user interface and database management capability, and interface the results of simulations (output) to commercial analytical tools. Additionally, an interface to simulation of tactical issues in the employment for artillery will be provided.

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Suite 620, 7833 Walker Drive  
Greenbelt, MD 20770  
Phone: (217) 337-3604

Topic#: 90-092 ID#: 90ARO-003  
Office: ARO  
Contract #: DAAL03-92-C-0018  
PI: H. Russell & M. Pursley

Title: Use of Side Information in Adaptive Protocols for Spread-Spectrum Packet Radio Networks

Abstract: Reliable data distribution within spread-spectrum packet radio networks requires high performance from the communication links and the network protocols. In this project, we will utilize side information that can be extracted from received spread-spectrum signals that are embedded in noise and interference. This side information will be used to improve the quality of the links and to aid the network protocols in establishing reliable routes in a spread-spectrum packet radio network with mobile partial-band jamming and other interference. In the proposed Phase II project, side information will be employed in an adaptive error-control coding system to enhance link quality and efficiency, and it will be utilized in forwarding, routing, and flow control protocols to increase throughput and decrease delay.

TECHNOCHEM COMPANY  
203-A Creek Ridge Road  
Greensboro, NC 27406  
Phone: (919) 370-9440

Topic#: 90-312 ID#: 90ETD-010  
Office: ETDL  
Contract #: DAAL01-92-C-0219  
PI: Shyam D. Argade, Ph.D.

Title: Rechargeable pulse power molten salt lithium battery

Abstract: Future US Army missions require a rechargeable lithium molten salt battery for pulse power applications for electric weapons. The Phase I of this program focused on the development of novel cathodes for this battery system. In this study, carbon electrode materials are developed which incorporate the electrochemically and thermally stable additives. These carbon cathodes suitably augmented with stable additives have OCV's of 2.8-3.3 V, high rate capability and simple chemistry compared to the conventional cathodes. The selected cathodes of this study have demonstrated at 2" diameter stacked-wafer configuration cell level specific cathode capacities of 0.17-0.21 Ah/g at current densities of 124mA/cm(2) to 248 mA/cm(2). Pulse power levels of 1.5-2.0 W/cm(2) with 3.5 second and 8-second duration pulses and current densities of 0.6-1.0 A/cm(2) are also demonstrated with unoptimized cells. Further performance improvement is feasible. Performance projection, based on these data using a conceptual design at the system level indicates specific energy and energy density of 145 kJ/kg and 248 Kj/L for pulses of 8-second duration, 10-s/pulse. The specific power and power density of 4.3kW/kg and 7.3 kW/L are projected. Further development of these cathodes into system hardware is warranted in a Phase II program with the objectives of: (a) Optimize novel chlorine cathode structures with the best performing additive; (b) develop 3" diameter cell design parameters to achieve the highest possible power density for a mission-specific US Army application; (c) design, fabricate and test cell stack design for a 1-k W Pulse power device to establish stable performance under repetitive pulsing conditions with a minimum of rest period between successive pulses. The projected goals for this development are: 200kJ/kg 340kJ/L and power levels of 5kW/kg 7 kW/L for the repetitive 5-s duration pulses.

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Wayne, PA 19087  
Phone: (215) 687-9669

Topic#: 90-265 ID#: 90MIC-019  
Office: MICOM  
Contract #: DAAH01-92-C-R380  
PI: Richard C. Foedinger

Title: Design Concepts for Composite Motorcase to End Closure Attachment

## ARMY SBIR PHASE II AWARDS

Abstract: Innovative composite motorcases-to-end closure attachment design concepts for small diameter tactical rocket motors have been developed as a result of the Phase I SBIR program sponsored by MICOM. Each of these design concepts offer improved efficiency compared with current mechanical attachment concepts. Three design concepts which have been identified as offering the greatest benefit in terms of productibility and cost for next generation and future systems are: (1) an integrally wound threaded adapter concept, (2) a fiber reinforced thermoset forward closure/bonded joint concept and (3) a fiber reinforced thermoplastic composite closure/welded joint concept. The primary technical objective of the proposed Phase II program is the demonstration of efficient motorcase/end closure attachment design concepts for small diameter composite motorcases. To achieve this program objective, the initial design identification and assessment activities conducted in Phase I will be expanded to include in-depth analyses and experimentation of these three most promising attachment designs. Experimentation in Phase II will include coupon testing, component testing and full-scale hydroproof tests. This testing will result in the delivery of final full-scale motorcases and forward closure assemblies to MICOM at the end of the Phase II program.

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Albuquerque, NM 87109  
Phone: (505) 345-8623

Topic#: 90-162 ID#: 90CER-001  
Office: CERL  
Contract #: DACA88-92-C-0007  
PI: William M. Moeny

Title: Efficient Laser Paint Removal and Residue Disposal System

Abstract: One of the significant issues in the refurbishment and maintenance of Army bridges and dams is the removal, handling, and disposal of lead-based paint. Numerous environmental and safety restrictions exist that hamper and influence the paint removal systems. For refurbishment, it is important that the techniques for removing the paint do not adversely affect the substrates in which they are applied and also are able to successfully remove coatings from substrates with unusual surface contours, such as mounting bolts or joints. Particularly in the case of lead-based paint, it is important that the residue not enter into the atmosphere or contaminate the workers removing the coating. Tetra has applied Tetra's Small Repetitive Laser (SRL) technology to the Army's problem of removing paint from bridges and dams. Tetra has developed a conceptual design of this new approach for removing and capturing the paint residue. The objective of the Phase I program was to determine the practical feasibility of the paint removal concept, develop a conceptual design of the laser Paint Removal System (LPRS), and provide an estimate of the cost of the system. The Phase I effort demonstrated the practical feasibility of the concept and laid the foundation for development of the system in Phase II. The Phase II objective of the LPRS program is to complete development of the LPRS technology which started in Phase I, to design and fabricate a LPRS, and to demonstrate the paint removal performance at a bridge or dam site chose by the Army.

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Topic#: 90-214 ID#: 90-AS-025  
Office: CECOM  
Contract #: DAAB07-92-C-B751  
PI: William C. Taylor

Title: Modular Soldier's Computer (MSC)

Abstract: The soldier's Computer has become a highly visible and very important program for the Army. While it is in the early stages of concept and development, demand for early incremental availability of basic capabilities has emerged. The ultimate Soldier's Computer will manifest itself in several different configurations. The most visible concept of the Soldier's Computer is that of the infantry small unit leader in battle, enhancing his command and control, communications, and decision making capabilities, other concepts include use by a maintenance technician to maintain sophisticated systems; use for a logistics field inventory and equipment allocation, or for in the refresher training. While the basic elements of the Soldier's Computer for each application may be similar, the basic input/output and display device requirements may vary widely. Texas Microsystems, Inc., proposes to develop an early configuration of a Modular Soldier's Computer (MSC) under Phase II of the SBIR Program. This effort is an extension of Texas Micro's ongoing work to develop similar capabilities for commercial clients. This early MSC will be small (pocket-sized), lightweight, rugged, powerful, and have an advanced user interface within the technology constraints of 1992/1993. This early MSC will be based upon an architecture which allows the addition of several optional capability extensions, allows testing of various input/output devices, and most importantly, provides a direct evolutionary path to the achievement of the ultimate Soldier's Computer configuration in the 1998 time frame.

## ARMY SBIR PHASE II AWARDS

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

Topic#: 90-109 ID#: 90ETD-005  
Office: ETDL  
Contract #: DAAL01-92-C-0203  
PI: Kenneth Lakin

Title: Thin Film Resonator Microwave-Acoustic Filter

Abstract: Frequency control is a major part of communication, radar, electronic warfare, navigation and telemetry systems. Recent advances in microwave integrated circuits has significantly reduced the size and cost of amplifying and other active components through MIMIC and other DoD program initiatives. Relatively little effort has been directed towards reducing the size of passive frequency control components used in conjunction with microwave integrated circuits in electronic systems. This proposed program addresses the problem of miniature RF components using the Thin Film Resonator (TFR) technology. The TFR technology embodies a broad class of frequency selective devices offering significant size and performance benefits over other present filtering technologies limits the overall system size reductions resulting from higher levels of circuit integration possible with present MMIC technology. The TFR technology is synergistic with MMIC technologies, providing a mechanism for pursuing advanced concept chips and module developments that offer a potentially high payoff to future systems.

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Phone: (708) 357-0004

Topic#: 90-047 ID#: 90CRD-010  
Office: CRDEC  
Contract #: DAAA15-92-C-0064  
PI: Dr. Joseph R. Stetter

Title: Modular Intelligent Sampling System (ISS) for IMS Technology

Abstract: This is a revised Phase II proposal that is submitted at the request of Mr. Ernest D. Henry, Contracting Officer, Procurement Directorate, CRDEC, and incorporates the suggestions of his letter of 24 Sept 91, and by Mr. Hinkle, Technical Industrial Liaison Office, CRDEC, at a meeting on 30 Oct 91. A revised Cost Proposal and Follow-On funding commitment are enclosed. A panel of scientific experts in IMS have identified several near-term improvements to IMS technology. These improvements will increase the effectiveness of IMS in existing military use and significantly expand the number of applications now possible for IMS technology. The Phase II proposal is focused on the development of new IMS capability. The proposed effort will include the design, development, construction, test, evaluation, and delivery of two model ISS, for evaluation at CRDEC.

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St. Louis, MO 63141  
Phone: (314) 991-3096

Topic#: 90-412 ID#: 90ETL-009  
Office: TOP  
Contract #: DACA76-92-C-006  
PI: Marshall B. Faintich

Title: Development of a Statistical Method for Three-Dimensional Terrain Elevation Error Analysis

Abstract: Army users of DTED are not familiar with the accuracy limitations resulting from specification limitations, as well as from materials and processes used in DTED production. This unawareness of DTED limitations may lead to critical errors in the tactical decision making process. A comprehensive analysis is required of the effects of DTED error on tactical applications. For those uses which do show a sensitivity to error in the DTED, the error in the data must be described as completely as possible. The published evaluation of the DTED can be supplemented with information gleaned from internal statistical analysis of the data. This added error information would provide improved error estimates for DTED applications, and could be incorporated within each specific application's error budget. The results of Phase I were demonstrative, illustrating the potential of an approach to DTED evaluation. The major thrust of the Phase II research will be to design and develop a rule based system for the incorporation of DTED errors into numerical and graphical primitives that can be combined into tactical application specific numerical estimates, graphical decision making displays, and DTED error maps.

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Topic#: 90-252 ID#: 90CRD-064  
Office: CRDEC  
Contract #: DAAA15-92-C-0083  
PI: Dr. Graham Ramsay

Title: Natural marine adhesive-based electrochemical immunosensors for infield pathogen detection

## ARMY SBIR PHASE II AWARDS

Abstract: The project objectives are firstly, to utilize the marine adhesives investigated in Phase I for the development of a flow-based immunoassay system for the rapid detection of low pathogen concentrations. Secondly, anti-pathogen antibody immobilization efficiency will be determined on platinum, carbon, polytyramine, cellulose acetate, polypropylene, polystyrene and immobilon surfaces. Electrochemical microrimmunosenors will be developed using a sandwich assay principle and amperometric detection for a range of pathogens such as E. coli, anthracis and conotoxin. Anti-pathogen antibody will be efficiently immobilized on an electrode tip and protected against fouling by a thin, permselective membrane such as polytyramine or cellulose acetate. Thirdly, a piezoelectric sensor will be developed for a range of pathogens in the gaseous phase to be utilized in determination of aerosol contamination. All electroimmunosenors will be designed to give rapid, reproducible responses in environmental, food and clinical samples with no preincubation or pretreatment. The sensors will be developed into easy-to-use, hand-held instruments for in-field, low-level pathogen detection.

VECTOR RESEARCH, INC.  
P.O. Box 1506  
Ann Arbor, MI 48106  
Phone: (313) 973-9210

Topic#: 89-030 ID#: 89VAL-001  
Office: VAL  
Contract #: DAAL06-92-C-0015  
PI: W. Peter Cherry

Title: Analytic Methods for Electronic Warfare Vulnerability Assessments

Abstract: The proposed research will develop an analytic model to support the assessment of the vulnerability of Air Defense systems to Electronic Warfare and to evaluate appropriate ECCM concepts or systems. The development will be based on the methodology prototyped and demonstrated during Phase I. Namely, use of models based on Markov Renewal Processes, markov chains, and the theory of competitive risks to calculate probabilistic descriptions of the dynamic interactions between a raid composed of attack aircraft and escorts supported by on-board, escort, and stand-off jammers and other countermeasures (e.g., chaff and flares) and anti-radiation missiles, and an air defense system composed of gun, missile, sensor, and command and control subsystems. During Phase II, the basic methodology will be extended to include medium and high altitude systems such as CHAPARREL and PATRIOT. The first phase of the program provided evidence that it is possible to capture the technical characteristics of EW systems using the theory of competing risks. It also provided insight into the basic tactical and operational factors which govern the performance of the air defense system in an EW environment and thus focused attention on the opportunities presented to the gun and missile systems. How those opportunities are affected by threat tactics and use of EW, and the impact of air defense command and control. Phase II will thus complete an analytic model which represents technical and tactical EW vulnerability issues in the total ground based air defense system.

VEXCEL CORP.  
2477 55th St  
Boulder, CO 80301  
Phone: (303) 444-0094

Topic#: 90-167 ID#: 90ETL-002  
Office: TOP  
Contract #: DACA76-92-C-0015  
PI: Dr. W. Kober

Title: An Automated Software System for Updating Digital Terrain Data Bases from All-Source Imagery

Abstract: The Phase II development will result in a deliverable, prototype workstation for supporting long-term (6 months to 1 year) change detection and/or seasonal changes from all-source imagery. The system is intended to be supported on a SUN-4 platform operating under a UNIX/C/X Window software environment. This workstation will have interactive capabilities for both image-image registration and the display of cued possible changes. Included also will be a library of automated techniques for both coarse and sub-pixel registration of dissimilar and same sensor imagery, image interpolation and resampling, and change cueing. The interactive environment will be able to start, stop, interrupt, and correct these automated procedures.

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Topic#: 90-413 ID#: 90ETL-010  
Office: TOP  
Contract #: DACA-92-C-0031  
PI: Dr. Wolfgang Kober

Title: Symbolic Model-Based SAR Feature Analysis and Change Detection

Abstract: The Phase II effort will result in a deliverable prototype software system supporting automated and semi-automated classifications and change detection in hyperspectral and SAR imagery. The system will consist of an integrated geographical information system (GIS), image understanding library, and model-based classification and change detection modules. The

## ARMY SBIR PHASE II AWARDS

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software will be developed in C operating under the Unix/X Windows System environment. The classification and change detection modules will include an automated interface to the image understanding libraries and GIS. New techniques for the treatment of hyperspectral and SAR imagery will be investigated. The system will be designed so that it can be easily integrated with Vexcel's previously awarded precision registration and change cueing workstation. The architecture will provide for enhancements to include additional modules for classification of new feature types, and a more extensive interface to the GIS.

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Carlsbad, CA 92009  
Phone: (619) 438-8809

Topic#: 90-072  
Office: TACOM  
Contract #: 92-C-R042  
PI: Steven R. Hart

ID#: 90TAC-004

Title: Robotics Vehicle Communications Controller

Abstract: This proposal describes a Phase II SBIR program to develop a proof-of-concept Robotics Vehicle Intelligent Communications controller (RVICC). The objective is to build an RVICC providing a flexible and adaptable communications network linking a platoon of URVs and their command center. The proposed network provides connectivity from URV to command center as well as from URV to other URVs in the same platoon. The capability of direct communications between URVs allows URVs to share data easily for effective coordinated mission actions. The RVICC network enhances link reliability by relaying data between two network members if they can not communicate directly. The network uses intelligent control to maintain connectivity in changing battlefield conditions by continually monitoring link quality and network connectivity and adjusting routing accordingly. During Phase II ViaSat will perform detailed network protocol design and performance analysis for the RVICC networking approach presented in Phase I. ViaSat will then design, build, and test five proof-of-concept RVICCs. The proof-of-concept RVICC consists for a VME chassis with a network control processor card, and I/O card, a burst modem performance will be thoroughly tested in a lab environment, demonstrating all of the intelligent networking concepts presented in the Phase I report.

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Phone: (508) 359-7999

Topic#: 90-272  
Office: NATICK  
Contract #: 92C0037  
PI: Dr. Eric C. Guyer

ID#: 90NAT-010

Title: Diesel-Fueled Refrigeration for Non-powered Field Kitchens

Abstract: The Army has a current and future need for an improved means of food refrigeration in field situations that would utilize available diesel fuel resources. The proposed solution to this need is to utilize commercially-available heat-powered absorption refrigeration units that are operated with a new low-output, non-powered diesel fuel burner. The Phase I study of applicable burner technologies surveyed a wide range of options for meeting the particular technical requirements for the required diesel fuel burner. The concept of an advancing wick burner was found to have best potential of meeting the requirements of simplicity, cost, safety, cleanliness, and reliability. A proof of concept burner was designed, built, and operated. The proposed Phase II effort is for the design and test of a prototype field-trial advancing wick burner and the subsequent mating of the burner to several commercial absorption refrigeration units. The completed units will be tested by Yankee Scientific and delivered to the Army for further evaluation.

## NAVY SBIR PHASE II AWARDS

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### ACCURATE AUTOMATION

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Chattanooga, TN 37406  
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Topic#: 90-008 ID#: 90N07-083  
Office: MARCOR  
Contract #: N00600-93-C-0702  
PI: Mary L. Rich

Title: Neural Networks for Autonomous Motor Control

Abstract: Accurate Automation has examined the use of neural networks for enhancing amphibious command and control systems. A number of areas can benefit from neural networks. During Phase II we propose to develop these key areas: A multisource, multisensor data association and fusion (MMDAF) system using multilayer topological neural networks is proposed. This system includes a variation of a Kalman filter which uses neural networks to adaptively set weights for target tracking, and a hybrid network for target/object classification. The MMDAF system will be integrated with an object-oriented terrain database, allowing terrain considerations to influence the fusion, tracking and identification algorithms. An operational prototype will be developed and tested on real sensor data, including radar, IR and acoustic.

### ADVANCED COMMUNICATION SYSTEMS, INC.

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Alexandria, VA 22311  
Phone: (703) 486-2282

Topic#: 91-047 ID#: 91N47-372  
Office: SPAWAR  
Contract #: N00039-93-C-0034  
PI: Mr. Thomas Costello

Title: Non-developmental Item Software Application to Undersea Warfare Systems

Abstract: During Phase I ACS surveyed the assess Non-Developmental (NDI) C4I software for application to IUSS missions. ACS identified a Tactical Decision Aid (TDA) which provides a wide variety of surveillance data collection management functions. These functions include sensor coverage and availability analysis, sensor tasking, communication interfaces, message parsing, world maps and supporting data bases. The TDA is being developed under government sponsorship and will be operational in mid-FY92. ACS has also identified communication software which receives and filters non-organic surveillance data from existing tactical broadcasts. This communication software is planned for operational deployment 2nd QTR FY-92. During Phase II, ACS proposes to tailor, modify and integrate the above identified TDA and communication software into a UNIX based workstation (e.g., DTC-2) environment. This integrated workstation will permit IUSS to better receive, display, evaluate and manage non-organic surveillance data and will provide automated aids to direct non-organic surveillance resources. ACS will test the integrated workstation at the ISUS Development and Test Facility and then support its deployment and evaluation at an IUSS operational facility.

### ADVANCED ROTORCRAFT TECHNOLOGY, INC.

1804 N. Shoreline Blvd.  
Mountain View, CA 94043  
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Topic#: 91-216 ID#: 91N13-006  
Office: NAWCFTEG  
Contract #:  
PI: Hossein Saberi

Title: Real Time Helicopter Blade Element Tail Rotor and Interference Models

Abstract: Single rotor helicopters sometimes encounter an Unanticipated Right Yaw (URY) at low speed and in ground effect with relative wind from the left of the rear. Several mishaps involving tail rotor problems under URY prone conditions have been reported. The aerodynamic environment for URY involves interaction between main/tail rotors, fuselage/stabilizer/tail rotor, and ground effect. Despite the importance of understanding and solving the URY problem, no analytical model can be found in the literature. Only wind tunnel tests have been assembled to identify the basic physical phenomena. During the SBIR Phase I effort. Advanced Rotorcraft Technology (ART) has pursued analytical models for predicting the URY phenomena and has investigated real-time implementation of these models for piloted evaluation. As a result of this effort, ART has developed the essential modeling components and demonstrated that tail rotor thrust reduces in a URY prone condition. The Phase I development work includes a few vortex wake code for main rotor wake, a combined momentum theory and blade element model for tail rotor performance, and an vortex ring state prediction scheme integrated with the tail rotor blade element model. The Phase I results showed a promising methodology for predicting the URY phenomena numerically. Under Phase II, a real time implementation will be developed and piloted tests will be conducted to assess the value of piloting techniques and design modifications on reducing the severity of the URY response. Wind tables will be generated to identify URY prone wind corridors. In addition, a retrofit to fielded operational flight trainers will be developed to provide pilot training in avoiding and recovering from this phenomena. This work has significant implications to the Fleet in terms of flight safety. To maintain the continuity of the ongoing effort while this Phase II proposal is being evaluated, an interim work has been proposed to the Navy.

## NAVY SBIR PHASE II AWARDS

independent of the SBIR program, to continue the validation of the individual URY modeling components and to improve the simulation technique for interactional aerodynamics.

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Topic#: 90-385 ID#: 41825  
Office: NAWCFTEG  
Contract #:  
PI: OFER BRUHIS

Title: Helicopter Rotor Disk and Blade Element Comparisons

Abstract: Recent advances in computer technology have enabled real-time implementations of blade element rotor models on affordable computer systems. A definitive study of the relative cost and fidelity of blade element models relative to the rotor map models currently in use will provide essential guidelines for future helicopter trainer procurements. Under Phase I of the SBIR, Advanced Rotorcraft Technology utilized its FLIGHTLAB simulation system to develop a rotor map model of a UH-60 rotor from a blade element model of this rotor. Careful comparisons were made to assure that the rotor map model was generated and implemented in a totally consistent fashion with its parent blade element model. The isolated rotor models were then compared in a series of simulated wind tunnel runs. The impact of rotor model discrepancies on the total vehicle was determined by comparing trim and dynamic responses of UH-60 simulations utilizing both rotor models, with all other vehicle subsystems modeled identically. The results demonstrated that the hub moments generated by the rotor map model were significantly different from the blade element model at high collective settings in forward flight and that the dynamic response of the models only compared well for low bandwidth excitation. Under Phase II, the models will first be compared with flight test data and upgraded to provide the maximum possible fidelity prior to continuing the relative comparisons. Extensive off-line tests will then be performed to identify flight conditions where the differences are most noticeable. A real-time FLIGHTLAB system will then be interfaced to a piloted simulation facility at NATC and quantitative comparisons of the models will be made at these flight conditions to assess the pilot's perception of the relative fidelity of the models.

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Topic#: 91-040 ID#: 91N47-498  
Office: SPAWAR  
Contract #: N00039-93-C-0041  
PI: DR STEPHEN LANE

Title: Time-Frequency Representation Using an Improved Wigner Distribution

Abstract: The objective of the work proposed here is the development of a prototype system to calculate the joint time-frequency distribution of acoustic transients for detection and classification. Spectrographic methods, such as the current Lofargram, cannot discriminate among transients of duration less than or equal to a few integration periods because a transform length short enough to contain adequate signal power is too short to provide good frequency resolution. The Choi-Williams modification of the Wigner-Ville spectrum was shown in Phase I of the present work to overcome this limitation. It also provides a superior pre-filter for a signal detector optimized for transients. The Choi-Williams distribution is superior to other time-frequency representations such as the Wigner distribution in that it has the intuitive appeal of these distributions, does not display unwanted artifacts and is expected to have improved resolution in both time and frequency. The proposed tasks are system design, data collection, implementation of previously developed Choi-Williams code on an I860 based vector processor, signal detector development, OMI development, system integration, optimization on real data and performance estimation. A brief plan for transfer to the Surveillance Direction system as part of that system's P3I is presented.

APPLIED HYDRO-ACOUSTICS RESEARCH, INC.  
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Gaithersburg, MD 20878  
Phone: (301) 840-9722

Topic#: 91-050 ID#: 91N47-396  
Office: SPAWAR  
Contract #: N00039-93-C-0033  
PI: F.A. Ryder

Title: Survey and Evaluation of Techniques for Measurement of Acoustic Sensor Position in Long Towed Arrays, Using Internal or External Data

Abstract: This proposal deals with Phase II of a SBIR project for identification and implementation of a technique for estimation of acoustic sensor position in long sonar towed arrays. The proposed effort constitutes the application of results of Phase I performed under SBIR Contract No. N00039-91-C-0220, in order to implement, validate and disseminate the algorithms and

## NAVY SBIR PHASE II AWARDS

software for the recommended shape estimation method. For this purpose, an evaluation model, measures of effectiveness (MOEs), and baseline 3X-91 data set developed under Phase I will be applied to complete the evaluation of candidate methods and combinations thereof (hybrid methods). The preferred method will be determined from this and implemented in a processing system for validation with the baseline 3X-91 data set and for further evaluation using data and results from a planned 3X-92 experiment. System compatibility and utility of the preferred method will be examined. Possible applications to undersea exploration and to a twin-line array configuration will be analyzed and recommendations developed. The fully implemented shape estimation function will be demonstrated at sea during an FY-93 SURTASS sea test. Finally, the algorithms and software will be refined, finalized, documented and disseminated to Navy-designated interested parties.

APTEK, INC.  
1257 LAKE PLAZA DR  
COLORADO SPRINGS, CO 80906  
Phone: (719) 576-8100  
Title: Fiber Optic Weapons Sight

Topic#: 90-039 ID#: 40870  
Office: NSWCCRN  
Contract #: N00164-93-C-0050  
PI: KENNETH E SIEGENTHALER

Abstract: This proposal applies new technologies to combat weapons sights. The Siegenthaler and Rotge' (S&R) optical sight concept will be developed into a combat sight to meet the needs of the United States Marine Corps. The S&R optical sight concept is well suited for combat because it is rugged, compact, and lightweight. This user friendly sight requires very little training. The sight is compatible with the M16A2 rifle and will be tested by the U.S. Marines under quasi-operational conditions.

ATLANTIC AEROSPACE ELECTRONICS CORP.  
470 TOTTEN POND RD  
WALTHAM, MA 02154  
Phone: (617) 890-4200  
Title: Morphology-Based Detection Processing for Scanning IRST Sensor

Topic#: 90-200 ID#: 40979  
Office: NSWCCDDWO  
Contract #: N60921-93-C-0011  
PI: DR VICTOR T TOM

Abstract: This Phase II SBIR proposal continues the development of the morphological IRST processing technique. The proposed program builds directly on the results of Atlantic's Phase I work, in which a basic morphology-based intra-scan algorithm was demonstrated to be superior to a current state-of-the-art median approach and more importantly was shown to be implementable at relatively low computational cost and capable of supporting real-time IRST data processing. Our proposed work in Phase II is aimed at improving the basic algorithm, performing a detailed intra-scan performance characterization against extensive sets of IRST datasets containing background clutter, developing morphology-based inter-scan algorithms for further false alarm reduction and, as an option, developing a brassboard processor card to demonstrate the critical hardware for a morphology-based IRST processor. The morphology paradigm extends to allow efficient multi-scan processing across scan number. A major goal of our Phase II program will be to gain a thorough understanding of target detection and false alarm performance of the morphology-based algorithms on realistic simulated targets and real backgrounds in order to advance the development of a practical, real-time, morphology-based IRST processor.

AUTOMATIX, INC.  
755 MIDDLESEX TRUNPIKE  
BILLERICA, MA 01821  
Phone: (508) 667-7900  
Title: Automated Die Bond Inspection System Using Machine Vision

Topic#: 91-183 ID#: 91N2D-307  
Office: NSWCCDDWO  
Contract #: N60921-93-C-0037  
PI: SCOTT COLE

Abstract: The objective of the SBIR program is to develop automated visual inspection systems which utilize machine vision sensing and processing techniques to inspect high-reliability microelectronic assemblies (such as the NSWC UDSP Multichip Module). The proposed systems address visual inspection tasks which are now performed manually and are time consuming, expensive, and subject to human error. These include die presence, condition, placement, and orientation verification, die bond inspection, wire connectivity verification, wire bond inspection, etc. Automation of such tasks will result in higher consistency, reliability, and productivity. The main Phase II tasks include: contacts with the sponsor and potential users of the technology, coordination with other related DoD efforts, review & finalization of the proposed specifications, designs, and plans; design and prototyping of the inspection station hardware including the part fixturing and manipulation system, lighting, optics, sensors,

## NAVY SBIR PHASE II AWARDS

and displays; investigation and prototyping of the proposed automated inspection capabilities including necessary image processing/analysis algorithms and their hardware acceleration; design and prototyping of the overall system software including the proposed programming and run-time environments and approaches for integration of applicable MIL workmanship standards; system integration, testing, evaluation, and validation; planning future R&D and Phase III commercialization efforts; and reporting and demonstrations.

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Phone: (415) 653-2323

Topic#: 90-097 ID#: 40924  
Office: NAVAIR  
Contract #: N00019-92-C-0147  
PI: A R GANJI

Title: Transient Behavior Sensitivity Analysis of Aircraft Engines

Abstract: Maneuverability and safety of aircraft, specially military planes highly depend on transient power response of their propulsion engines. The rate and level of engine response will depend on many parameters including engine type, its internal design characteristics and its operational conditions. The methodology and approach for transient analysis of gas-turbine based propulsion systems, and a sample computer program for transient sensitivity analysis of a fixed geometry single spool turbojet was developed in Phase I of this research project. In Phase II research and development, a comprehensive, user friendly computer program for transient analysis of a wide variety of engines including turbojets, turbofans, and turboprops will be developed. The proposed program will have the capability to generate steady state running conditions of the user configured engines (as the initial conditions) or interface with Navy engine simulation programs to extract the necessary data.

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Topic#: 90-059 ID#: 40885  
Office: MRDC  
Contract #: N00014-91-C-0190  
PI: KENNETH J SCHLAGER

Title: Transcutaneous Analyte Measuring Methods (TAMM)

Abstract: A three-stage program for the development of two types of TAMM field instruments is proposed: 1. Clinical testing for database enlargement using the Biotronics BI-800 NIR Array Analyzer and BI-801 Fluorometric Array Analyzer for near infrared and fluorometric reflectance measurements coupled with electrolyte, BUN and glucose test profiles of at least 500 patients. 2. Clinical test analysis to verify TAMM accuracy, establish diagnostic procedures and develop analytical algorithms for field instruments assays. 3. Development and preliminary evaluation of two compact, portable TAMM field instruments, one instrument with transcutaneous near infrared and the other with transcutaneous, fluorescence measurement capabilities designed for a combat casualty care environment to include preliminary field testing under a simulated military environment.

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Topic#: 90-315 ID#: 41373  
Office: ONR  
Contract #: N00014-92-C-0049  
PI: J PAUL PEMSLER

Title: Oxidation Resistant Coating for Carbon-carbon Composites

Abstract: Protecting carbon-carbon composites in oxidizing atmospheres at 1600 C requires novel technology. The duplex system under development in this program consists of an inner layer of carbon fiber reinforced iridium (CAFRIB) which acts as an impervious barrier to the diffusion of carbon outward and of oxygen inward. The novel structure of the barrier layer serves to bear the stresses due to the thermal expansion mismatch between carbon-carbon and iridium. The outer layer of the coating is plasma sprayed lanthanum hafnate with a pyrochlore structure which melts at 2400 C and is highly resistant to vaporization. The outer coating restricts the access of oxygen to the inner layer and greatly reduces the vaporization losses of iridium oxide. During the Phase II program, we will optimize the CAFRIB configuration using carbon-carbon composite whose surface is specially prepared to form the novel barrier. Lanthanum hafnate plasma deposition techniques will be optimized so that the outer layer is both adherent and resistant to cracking by thermal cycling. Optimized coatings will be applied to carbon-carbon sections which will then be exposed to air at 1600-2000 C under conditions of thermal cycling.

NAVY SBIR PHASE II AWARDS

COMPUTERS AND CONCEPTS ASSOC.

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Topic#: 91-339 ID#: 91N32-024  
Office: NSWCWO  
Contract #: N60921-91-C-A358  
PI: Michael W. Evans

Title: Software Intensive Project Support Initiative (SIPSI)

Abstract: The SIPSI will implement a complete and integrated initiative to assist project personnel in the resolution of common and difficult software issues facing a project. The support provided is relevant for all Navy software maintenance and institutional programs. Phase II will build on the experience information collected and training materials developed during Phase I, building a complete project support package tailored to actual rather than perceived needs of project personnel. The SIPSI contains 2 basic tasks, tailoring of the current training course and conduct of the training course. The SIPSI also offers optional tasks that can be utilized; a suite of Navy Software Project Support Videos; a series of Guidebooks and Handbooks geared to assist project personnel in the development, maintenance and support of a Navy software application; and additional offerings of the Software Survival Skills Workshop. The overall goal of the SIPSI is to improve the Navy software process within a project and provide project personnel with sufficient support and expertise, early recognition of problems, action based on proven solutions that were successfully applied on similar projects.

COMPUTERS AND CONCEPTS ASSOC.

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Topic#: 91-339 ID#: 91N32-025  
Office: NSWCWO  
Contract #: N60921-92-C-A357  
PI: Michael W. Evans

Title: The Risk Assessment Support Tool (RAST)

Abstract: Objectives of the SBIR is to modify a set of questions and a methodology by which ASN (RDA) can assess the risks of the Navy's software engineering environment. A selected software intensive development and maintenance project will be evaluated to determine the risk of a software development and maintenance project when compared against a proven engineering model. The assessment will elicit information about the strengths and weaknesses of the Navy software engineering environment. Activities will also support in the definition and support of a Navy Software Support Group to share experiences, program strengths, risks, and lessons learned. Also a part of this SBIR is a lessons learned data base to capture historical project and organizational information to be accessed by functional project personnel.

CORTLAND CABLE CO

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Topic#: 90-305 ID#: 41034  
Office: NAWCFTEG  
Contract #:  
PI: DOUGLAS P BENTLEY

Title: Synthetic Rope for Helicopter Rescue Hoists

Abstract: Having established the technical feasibility of replacing the metallic wire rope rescue hoist cable with a synthetic fiber hoist rope during Phase I of our SBIR development project, we intend to proceed with cable optimization with respect to cable fatigue. During the course of our Phase II effort we will be addressing minor modifications to the hoist and recommending a cable specification that incorporates endurance test parameters that more closely parallel the dynamic requirements of the hoist system. As part of our cable optimization effort, we will be incorporating the necessary conductive polymers or textile elements to achieve the highly resistive electrical path required to allow controlled dissipation of electrostatic potential from the rotorcraft. We will be determining the actual fatigue life of our current cable design and improved versions in order to establish safe working life parameters for the synthetic fiber rescue hoist cable. As part of the test effort, we will be carefully inspecting the cable to correlate its appearance with the degree of degradation in serviceability. Based upon these data, a method of cable inspection, including retirement criteria for discontinuing the use of a cable, will be proposed as part of the hoist rope specification.

DEEGAN RESEARCH GROUP, INC.

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Topic#: 88-074 ID#: 88N2D-612  
Office: NSWCDDWO  
Contract #: N60921-93-C-0014  
PI: Thiarry Deegan

## NAVY SBIR PHASE II AWARDS

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**Title: Composite Material Components for Submarines**

**Abstract:** Composite materials offer a wide range of attributes that can improve the performance and reduce the cost of submarines. The work conducted in Phase I of this effort identified several composite materials that offer the strength, stiffness, toughness, high temperature stability, low flammability, and limited outgassing that are necessary for submarine structures. The Phase II effort proposed here takes the product of the Phase I analysis and demonstrates the viability of composite materials and the material systems that are recommended by Phase I in sample applications. It is proposed that six components be fabricated of the recommended materials and that these components be made available to undergo both laboratory and shipboard testing. These examples are selected to illustrate the capability of composite materials to address ranges of load, environment, material system, and manufacturing technique.

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Topic#: 91-052

ID#: 91N47-433

Office: SPAWAR

Contract #: N00039-93-C-0042

PI: Jeanne Secunda

**Title: Integrated Training System Architecture In Support of Active Sonar Systems**

**Abstract:** The Phase I effort reviewed and identified a variety of training technologies and the basic research in support of the training and which could be achieved by those technologies. A selection of candidate technologies for application to SURTASS training resulted from the Phase I effort. The Phase II effort, therefore, proposes to continue the training system design process by setting as a primary objective the prototype development, demonstration and evaluation of two classes of technology. These two classes of technology target (1) the training of background knowledge in active acoustic theory, and (2) operator training as it applies to active workstation console operations. The Phase II effort shall consist of developing curriculum in accordance with recent advances in cognition and instruction employing intelligent tutoring processes to be integrated and embedded in the operational hardware. The intelligent software processes shall diagnose student performance and build a model of the students knowledge of the to-be-learned theory and tasks. These student models are compared to ideal expert models resident in the training systems software. As a result of comparisons between the student model and the ideal model, decisions are made by the system to select the most appropriate exercise for any given individual. A variety of instructional strategies are automatically selected and applied to motivate successful performance on the part of the trainee. Instructional strategies will be developed and demonstrated which promote effective problem solving when determining how best to deploy the SURTASS sonar technology given an understanding of the complex relationships which define the acoustic equation in an undersea environment.

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Topic#: 90-192

ID#: 40968

Office: NSWCDDWO

Contract #: N60921-93-C-0022

PI: DR K M ABRAHAM

**Title: Active Mine Batteries with Long Shelf-life**

**Abstract:** The voltage delay and capacity loss, associated with the storage of L1/SOC12 cells, are two persistent problems precluding their widespread military applications. The work carried out in Phase I has revealed that these problems can be mitigated with the use of anode overlayers of Li conductive polymer electrolytes. The technology identified in Phase I will be further developed in Phase II, especially in the context of Li/SOCI2 mine batteries with long shelf-life. The Phase II work will involve the following tasks. Task I: Selection of MEEP-based Polymer Electrolytes as Li Anode Overlayers Task II: Optimization of Polymer Electrolyte Coating Thickness Task III: Identification of Polymer Electrolytes Other Than those Based on MEEP Task IV: Comparison of Polymer Electrolyte-Based Anode Overlayers with LiAl(SO3Cl)4 and Poly(vinyl chloride) Task V: Mechanism of Voltage Delay Mitigation by Polymer Electrolytes Task VI: Construction and Testing of Mine Batteries with Long Shelf-Life

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Topic#: 90-356

ID#: 90N07-085

Office: NAVAIR

Contract #: N00019-90-C-0283

PI:

**Title: Dynamic Lift Enhancement Using Oscillation Lead- and Trailing-edge Wing Flaps**

## NAVY SBIR PHASE II AWARDS

Abstract: The study indicates that it is feasible to use AOA limiting as a means of reducing average energy loss and therefore optimizing average agility throughout combat engagement. The use of bleed rate of Ps for outer loop control avoids the need for different AOA schedules depending on flight condition. Although the study concluded that the resultant control law should be part of the overall flight critical AFCS, the parameters required for its operation are already available in current and future generation full authority systems. The Phase I also discussed several options for the pilot interface in terms of engage/disengage and cueing approaches. The objective of this proposed follow-on effort is to develop an optimum system based on its combat effectiveness. Optimal AMS algorithms will be developed for the F/A-18 aircraft through the use of Eidetics AASPEM combat analysis tool (Piloted Agile AASPEM). At the same time the cockpit mechanization, cueing and displays issues will be addressed in the Eidetics Cockpit Design Simulator (CDS). Preferred candidates will then be exercised in the Langley DMS for selection of the optimum system. This system will be defined in sufficient detail to be ready for a Phase III full scale development.

### ENERGY COMPRESSION RESEARCH CORP.

6355 Nancy Ridge Dr.  
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Topic#: 90-243 ID#: 90N36-616  
Office: NUWC  
Contract #: N66604-93-C-0352  
PI: Dr. Iain A. McIntyre

Title: Fast Active Optical Switch for Periscope Laser Eye Protection

Abstract: ECR Corp. has developed to the proof-of-principle stage an electro-optic shutter for protecting the eyes of submariners from the threat of a laser beam directed through the periscope. The major distinction between this approach and other approaches is in the method used to detect the incoming laser radiation and activate the electro-optic shutter. The delay between the detection and shutter activation has to be kept to a minimum and in the Phase I program, it was shown experimentally that this delay was in the range 500-800 ps. Attenuation of the laser signal by a factor of up to around 10 cubed was demonstrated; it was also shown that attenuation of up to another two components. Advantages of the shutter include its small size, thus reducing the costs of retro-fitting, it does not require a focal plane, it can be made in a fail-safe configuration, and covers the full spectrum of interest. The shutter is useful against current and future laser threats. The Phase II program will further develop the electro-optic shutter to the stage ready for prototype testing.

### FERMIONICS CORP.

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Simi Valley, CA 93063  
Phone: (805) 582-0155

Topic#: 91-002 ID#: 91N40-019  
Office: NCCOSC  
Contract #: N66001-93-C-7000  
PI: Yet-zen Liu

Title: Millimeter-Wave Optical Waveguide Modulator

Abstract: An electro-absorption waveguide modulator, using the InGaAsP material system, is proposed here to achieve 40 GHz bandwidth. Both Franz-Keldysh (bulk) and Quantum Confined Stark Effect (quantum well) types of layers will be used and compared. Both liquid phase epitaxy (LPE) and metal-organic chemical vapor deposition (MOCVD) techniques will be used to prepare the material. A 20 GHz bandwidth modulator was delivered to the Navy at the end of the Phase I contract. The Phase II work will refine the rf device design, rf package design to increase the bandwidth. In addition, improvements in optical insertion loss, extinction ratio and switching voltage will be made by trading off among these parameters and modifying the waveguide structure. The key approaches are to reduce the device capacitance by reducing the device junction area but retaining the waveguide structure for optimum waveguide properties and new packaging schemes to reduce wire bonding inductance.

### FLAM & RUSSELL, INC.

PO BOX 999 - 506 PRUDENTIAL RD  
HORSHAM, PA 19044  
Phone: (215) 674-5100

Topic#: 90-368 ID#: 41537  
Office: NAWCCHLK  
Contract #: N60530-92-C-0246  
PI: JOHN F AUBIN

Title: Development of Mobile Surface Clutter Mapper

Abstract: The construction of a Clutter Mapper System is proposed. The implemented hardware will be a highly transportable, low-cost system mounted on a small flatbed trailer, 8 by 16 feet in size. The design is small enough to be towed by most vehicles. Stowed, it can be transported on regular US roads and most rough graded dirt roads. Deployed, it provides a 40 foot synthetic aperture with fine angular resolution. A stepped CW waveform provides range resolution finer than 100 feet.

NAVY SBIR PHASE II AWARDS

FORSS  
7 S 515 OAK TRAILS DR  
NAPERVILLE, IL 60540  
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Topic#: 90-069 ID#: 40900  
Office: NAVAIR  
Contract #: N00019-92-C-0082  
PI: R FARHADIEH

Title: Passive Fiber Optic Components for Severe Environments

Abstract: We propose to develop and demonstrate prototype of a multi-channel fiber optic interconnection device that can withstand the severe conditions of the military aircraft environment. The proposed interconnect device consists of an adapter and a connector for ribbon fibers or multi-channel cables. This developmental activity will focus on advanced technologies and advanced engineering materials. Specifically, we intend to use etched silicon chips, that can be fabricated with extremely tight tolerance, to position and optical fibers. We intend to extend the "floating contact" concept to a multi-channel connector. In addition, advanced polymeric composite materials that have excellent high temperature capabilities, such as filled liquid crystal polymers, will be used. Finally, novel bonding techniques that can withstand high temperatures and high vibration will be investigated. These advanced elements will generate a new class of fiber optic connectors. Smaller, lighter and compact, multi-channel fiber optic connectors will result from size reduction and from advanced composite materials. Decreased use of metal will reduce radar cross-sections. The "floating contact" concept will provide low insertion loss, improved temperature capability, and improved tolerance of high vibration environments.

HAWAII BIOTECHNOLOGY GROUP, INC.  
99-193 Aiea Heights Drive  
Aiea, HI 96701  
Phone: (808) 486-5333

Topic#: 91-063 ID#: 91N19-022  
Office: NAVMED  
Contract #: N00014-93-C-0019  
PI: John Marshall Ivy

Title: Immunological Reagents to Study Bacterial Enteropathogens

Abstract: Diarrheal diseases are a significant cause of morbidity in developed countries and of mortality, especially among infants and children, in developing nations worldwide. Enteropathogens also are a significant threat to closed communities, such as those aboard ships and at military installations. Antibodies against immunodominant and protective epitopes are very useful for understanding the pathophysiology of and for developing vaccines against enteric infections. In addition, rapid and inexpensive immunoassays would be well suited for epidemiological studies and diagnosis. It was not until the late 1970's that it was demonstrated that *Campylobacter jejuni* was a frequent cause of human diarrheal illness. During Phase I, we purified a 38 kilodalton *Campylobacter coli*-specific protein by SDS-PAGE and produced polyclonal murine antibodies exhibiting only weak cross reactivity with *C. jejuni* proteins. These *C. coli*-specific antibodies may be suitable for a *C. coli*-specific immunoassay and for isolating and for isolating cloned DNA encoding the 38 kD protein. During Phase II, we propose to shift the focus of our research to three other topics on bacterial enteropathogens. 1. Antigenic variation, a common mechanism for evading host immune responses, has been demonstrated for the immunodominant flagellar proteins of *C. coli*. For studies of antigenic variation of *C. coli* flagella and to identify protective flagellar epitopes, we will generate a panel of monoclonal antibodies that recognized surface epitopes of native *C. coli* flagella. 2. Recently, the ferret has been identified as an inexpensive, small mammal model for *C. jejuni* infection in man. As a research tool for studying pathogenesis in ferrets, we will produce anti-ferret IgA antisera. 3. A novel heat stable toxin, EAST1, of enteroaggregator *Escherichia coli* has recently been identified. To aid in its purification and to screen for its prevalence in human disease, we will develop anti-EAST1 antibodies and an ELISA.

INNOVATIVE DYNAMICS  
244 LANGMUIR LAB/CORNELL RSCH  
ITHACA, NY 14850  
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Topic#: 90-317 ID#: 41401  
Office: ONR  
Contract #: N00014-91-C-0094  
PI: GAIL A HICKMAN

Title: Demonstration of Neural Network Performance for On-line Health Monitoring and Inspection of Aircraft

Abstract: Work is currently in progress at Innovative Dynamics to develop a neural network based Structural Integrity Monitoring System for aircraft. Vibration signatures are used to determine mechanical properties and overall health of the structure. This system is based on the concept of smart structures which integrates sensory systems into the structure to serve as health monitors, analogous to a central nervous system. Small surface-mount sensor modules with integrated electronics are designed for retrofit to existing aircraft. The objective is to integrate these modules into vulnerable or inaccessible areas of the airframe to reduce or eliminate the need for whole aircraft NDE scans or tear downs. Using an active sensing technique and

NAVY SBIR PHASE II AWARDS

neural network signal processing software, structural abnormalities are determined by continuously monitoring the resultant structural vibration signatures. During the proposed Phase II program, a diagnostic system layout will be designed for a typical Naval aircraft platform such as the F/A-18 fighter. A hardware prototype demonstration will be performed on representative aircraft components.

ITERATED SYSTEMS, INC.  
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NORCROSS, GA 30092  
Phone: (404) 840-0310

Topic#: 91-016 ID#: 91N17-008  
Office: SPAWAR  
Contract #: N00039-93-C-0054  
PI: ALAN SLOAN / MICHAEL BARN

Title: Fractal Image Compression of Geophysical Data

Abstract: A proposal to apply the compression and data extraction technology developed and studied in Phase I to provide a compact data distribution product for geophysical data. Presently within the Navy, there is an increasing requirement for data, and the corresponding data distribution channels are limited in bandwidth and precious in number, and expensive to acquire. As a result of this pressure to grow in bandwidth capability and the limits of available capacity, a new approach must be taken. The new approach must include compression, but even more importantly, it should allow extraction of needed data from the available data pool in a fashion to meet the end user needs and reduce the volume of data transmitted. This system would become the interconnect point for the addition of future sophisticated software for pattern processing and recognition systems. The system conceived allows the application of pattern recognition schemes, expert systems, and other relevant technology to interact with an architecture that will manipulate supplied data products. These data products will be processed to extract and compress data that can be economically transmitted over existent communication lines. The objective of this effort is to produce a model (a subset) of the architecture which is to be defined that will allow testability of this concept in the COPERNICUS environment.

MEGADYNAL CORP.  
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Topic#: 90-469 ID#: 90N37-615  
Office: NAWCCHLK  
Contract #: N68936-93-C-0093  
PI: Marc Rody

Title: Electronic Safe and Arm for High Velocity/Acceleration Projectiles

Abstract: The Navy currently has several programs including JDAM, AIWs, AAAM, sidewinder and submunitions that are considering the use of electronic safe and arm (ESA) fuzing technology. Electronic fuzing would provide the Navy with a very small fuze that could be used to detonate insensitive munitions. The ESA would be highly reliable, safe, small low weight and vibration tolerant. The Phase I Objective demonstrated the feasibility of a micro-miniature fuze (Mini-fuze) that would meet the military needs for the next generation weapon systems. The overall requirements for the ESA was less than 1.25" diameter by 2" long, arms quickly, would meet the safety criteria and could be economically manufactured. The Phase I design of the Mini-fuze, include schematics, art work and mechanical details, is sufficient for a preliminary build plan for preproduction prototypes. Phase II would use the preliminary build plan to manufacture a Mini-fuze for testing. The Mini-fuze design has ten major subsystems, interconnection and housing. Each subsystem would be sequentially manufactured and tested. After each subsystem has passed testing, the entire Mini-fuze would be assembled and tested. Phase II would culminated in a completely manufactured Mini-fuze that would be applicable for Navy programs such as AIWS, JDAM, Sidewinder and AAAM programs. In addition, the fundamental components could be used for other Navy, Army and Air Force fuzing applications.

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Topic#: 91-144 ID#: 91N1A-342  
Office: NSWCDDWO  
Contract #: N60921-92-C-A379  
PI: RAYMOND L HARRIS

Title: Microwave Propagation

Abstract: The objective of this effort is to develop an electronic system to measure the microwave propagation characteristics of the maritime evaporation duct over the sea surface. The proposed propagation measurement system is unique in that it is capable of providing simultaneous measurements over 100 paths at frequencies of 2-18 GHz, with only ten transmitters and ten receivers. Data will be processed in real time and graphically displayed in color coded formats.

NAVY SBIR PHASE II AWARDS

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PRINCETON, NJ 08540  
Phone: (609) 987-1513

Topic#: 90-193 ID#: 40969  
Office: NSWCDDWO  
Contract #: N60921-93-C-0015  
PI: DR JOSEPH R BURNS

Title: BX1750-A Enhancements for Low-Power DSP

Abstract: The BX1750A is a high-performance CMOS microprocessor which implements the MIL-STD-1750A Instruction Set Architecture and is currently used in several military real-time applications. The results of the Phase I program show that the performance of BX1750A can be doubled by defining new instructions to perform common DSP operations such as multiply/accumulate, FFT and polynomial evaluation. The Phase II program proposes to implement the recommended new DSP instructions by adding additional control ROM and microprograms to the BX1750A chip. Other new features will be evaluated and added to the new BX1750AE chip to support periodic power-managed operation at low duty cycles for battery-based and other low-power systems.

MISSION RESEARCH CORP.  
8560 CINDERBED RD  
NEWINGTON, VA 22122  
Phone: (703) 339-6500

Topic#: 90-208 ID#: 40989  
Office: NSWCDDWO  
Contract #: N60921-93-C-0036  
PI: JOHN A PASOUR

Title: Design and Development of a Two-Stage Fel For the NSWC Thor Generator

Abstract: The goal of the proposed program is to develop a high-power free-electron laser (FEL) to be driven by a new electron accelerator at NSWC. This accelerator, called Thor, is capable of operation at 2.5 MV and 1 kA for a duration of 1 usec. The FEL, which we designed during Phase I, is an efficient, high-power device, with a projected millimeter-wave (50-100 GHz) output power of 100 MW to 1 GW and a pulse energy up to 1 kJ. This device will be built and operated during the Phase II program. The output from this millimeter-wave FEL can be used to drive a second-stage interaction to generate infrared radiation. The millimeter-wave FEL operation will be optimized and the Thor electron beam quality will be measured and maximized. The results of these experiments will be used to predict the potential operational capabilities of the second-stage interaction. The electron beam optics and the second-stage resonator will then be designed. Construction of the full two-stage FEL will be completed during Phase III. The millimeter-wave FEL will be fully transitioned to NSWC at the end of Phase II, and it can then be used by itself as a unique source for susceptibility testing, materials studies, or further development for the applications listed below.

NIELSEN ENGINEERING & RESEARCH, INC.  
510 Clyde Avenue  
Mountain View, CA 94043  
Phone: (415) 968-9457

Topic#: 90-239 ID#: 90N40-002  
Office: ONT  
Contract #: N00014-92-C-0221  
PI: Laura Rodman

Title: Drag Reduction on an Ejection Seat During High Speed Ejection

Abstract: There is considerable concern that a large part of the knowledge gained from basic research is not being used to develop or maintain high technology industries. It is proposed to build a knowledge-based system to transfer technology from basic research to overcome the difficulties of filtering large amounts of information and of poor communication between researchers and development engineers. They are also more widely available than human experts. In Phase I a prototype system was developed that proved to be promising for research transition. The objective of the Phase II work will be to complete the development of the approach and to deliver a successful system. An innovative knowledge acquisition technique will be used to elicit high technology information from experts. Studies of how engineers learn and the information they require will be used to guide the development of the system.

OMEGA INTERNATIONAL TECHNOLOGY, INC.  
1360 BUSCH PKWY  
BUFFALO GROVE, IL 60089  
Phone: (708) 520-5900

Topic#: 90-189 ID#: 40963  
Office: NSWCDDWO  
Contract #: N60921-93-C-A304  
PI: DR NAND K GUPTA

Title: Digital Tangential X-Ray Scanner for Loaded Rocket Motors

Abstract: At present, the loaded rocket motors at NSWC and motor manufacturers are examined by taking many selected

## NAVY SBIR PHASE II AWARDS

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tangential x-ray film exposures. These tangential exposure films are interpreted by an expert radiograph for unbonds, cracks, voids and inclusions. This procedure has poor flaw detectability, is slow and cumbersome and requires manual interpretation of film. Often only a limited x-ray exposures are taken and most of the fuel is not even filmed and problems are often missed. During Phase I, we investigated the feasibility of using a tangential scanner based on a solid state detector array. During Phase I, we designed a scanner, compiled expected signal/noise ratio for flaws. We also fabricated a test set-unit and collected scans from it. We also designed and investigated two software techniques to automatically detect flaws in the scan data. The Phase I work clearly shows that even very small flaws can be automatically detected by such scanner system. During Phase II, we propose to design and build a prototype scanner. We also propose to design and improve software methods for automatic flaw detection in rocket motors, warheads and explosives.

OPTICS I, INC.  
4035 E. Thousand Oaks Blvd., Suite 105  
Westlake Village, CA 91362  
Phone: (805) 373-9340

Topic#: 89-186 ID#: 89N33-604  
Office: NTSC  
Contract #: N61339-92-C-0060  
PI: Robert E. Fishcer

Title: Low Cost Night Vision Goggles (NVG) for Simulation

Abstract: There is a demonstrated need to develop a low cost display system for training purposes which will simulate an operational night vision goggle. The system to be prototyped in this Phase II program will provide similar functional performance to current NVG goggles, yet will be lower in cost. The system will be a valuable training aid, especially for pilots who need to become familiar with the devices before taking them into flight situations. In this program OPTICS I, Inc. will produce two prototype units, each utilizing a different display technology, one a cathode ray tube display, the other a liquid crystal display device. Both of these systems have their respective advantages, but it is the LCD display that shows the most promise for a small, lightweight, low cost simulation device.

PHYSICAL OPTICS CORP.  
2545 W 237TH ST - STE B  
TORRANCE, CA 90505  
Phone: (213) 320-3088

Topic#: 90-182 ID#: 40956  
Office: NSWCDDWO  
Contract #: N60921-92-C-0189  
PI: DR GAJENDRA SAVANT

Title: Adaptive Learning Optical Multilayer Neural Networks Based on Erasable Dye-polymer

Abstract: The goal of this Phase II program is to fabricate and demonstrate the first practical adaptive learning optical multilayer neural-net machine implementing the well known backward error propagation (BEP) learning algorithm for real-time pattern recognition. The proposed optical neural network is based on dynamic polarization holography using Physical Optics Corporation's (POC) newly developed Erasable Dye-Polymer (EDP) material. The Phase I program demonstrated that high efficiency polarization holograms in this material can be recorded, selectively enhanced, or erased in real time, so that dense, modifiable synaptic interconnections can be implemented. Extensive investigations have shown that the EDP material with its well controlled dynamical behavior is superior to other available dynamic holographic materials, such as photorefractive crystals, Polaroid DMP-128, DuPont Photopolymer, and Kodak Silverhalide. Furthermore, nonlinear bidirectional spatial light modulators and phase conjugating mirrors, two of the most important components in the BEP neural network, can be fabricated using POC's well-established coherently coupled holography and nonlinear optics technologies. Therefore, the proposed system holds strong promise for practical realization in Phase II and will serve as a potential solution to the Navy's real-time pattern recognition problems. Phase III will focus on building compact portable devices deployable on ships, Naval aircraft or satellites.

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7925 WESTPARK DRIVE  
MCLEAN, VA 22102  
Phone: (703) 734-3400

Topic#: 88-061 ID#: 92N07-071  
Office: NAVAIR  
Contract #: N00019-91-C-0232  
PI: Dr. Alan Friedman

Title: Low Frequency Transient Detection/Source Localization Processor for Sonobuoys

Abstract: The proposed effort will apply seismic migration techniques to the detection/localization of acoustic transients received at spatially separated sonobuoys. Acoustic transients are generally difficult to detect since transients are events of opportunity which occur sporadically. In addition, transients tend to be short in duration although they can be quite energetic. Conceptually, seismic migration is a generalized beamforming method that estimates not only the bearing to the source, but the range as well.

## NAVY SBIR PHASE II AWARDS

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In essence, seismic migration is a technique that estimates wavefront curvature, and maps that estimate of wavefront curvature into an estimate of range. Furthermore, estimates of time of arrival at each sonobuoy are not required. Instead, the time series data at each of the sonobuoys is "migrated" to produce a direct estimate of the source location. This method has the innate ability to perform multi-target tracking, and to correct for multipath, provided that we can adequately model the environment. The seismic migration approach is very efficient since it is based on wavenumber-frequency processing. Hence, it has the potential to process multiple sonobuoy data in real time. The proposed effort will construct a testbed that performs the end-to-end processing required, including pre-processing (such as pre-filtering), migration analysis, post-processing (detection/estimation, displays), and interpretation of the results.

PRAXIS TECHNOLOGIES CORP.  
17 S BROAD ST - STE 200  
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Phone: (609) 853-9499

Topic#: 90-107 ID#: 40931  
Office: NAVAIR  
Contract #: N00019-92-C-0047  
PI: KAYDON A STANZIONE

Title: Independent Assessment AH-1W Technologies Which Offer Cost Effectiveness for Increased ATA Combat Capability  
Abstract: Recently Praxis Technologies Corporation completed a Phase I study for the Naval Air Systems Command to independently examine the benefits of applying advanced technology developments to the existing USMC AH-1W SuperCobra ("Whickey") helicopter. Phase I study results illustrated those technologies which offer high payoff at low risk and potential cost. The successful integration of advanced technologies with the AH-1W was illustrated with the 4BW flight demonstration vehicle manufactured by Bell Helicopter. The 4BW demonstration vehicle paves the way for the development of a 4BW helicopter for USMC roles. While the performance effectiveness of the 4BW was illustrated in Phase I its cost benefits to the military must be presented before consideration of any 4BW full scale development program. As a complement to Phase I results the Phase II study shall reflect the cost-benefits of the selected technologies Phase II is intended to develop a Best Technical Approach for assessing the Life Cycle Costs (LCC) associated with improving the AW-1W helicopter and then applying this approach to the 4BW configuration.

PRINCETON SCIENTIFIC INSTRUMENTS, INC.  
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MONMOUTH JUNCTION, NJ 08852  
Phone: (201) 274-0774

Topic#: 90-316 ID#: 41375  
Office: ONR  
Contract #: N00014-92-C-0105  
PI: JOHN L LOWRANCE

Title: High Framing Rate Camera

Abstract: This proposal is for the development of very high frame rate television type camera capable of capturing images of rapid mechanical motion and transient photometric phenomena at framing rates up to a 1,000,000 frames per second. An image sensor and associated electronics will be designed, built and evaluated, having the capability to acquire and store a large number of images in the image sensor itself such that image readout can be at moderate data rates compatible with relatively inexpensive digital data acquisition systems.

RD INSTRUMENTS  
9855 BUSINESSPARK AVE  
SAN DIEGO, CA 92131  
Phone: (619) 693-1178

Topic#: 90-313 ID#: 41370  
Office: ONR  
Contract #: N00014-90-C-0054  
PI: STEVE BRADLEY

Title: 4D Velocity Sensor Development

Abstract: The purpose of Phase II of this project is to design, fabricate and test a 4D velocity sensor for navigational use in a wide range of oceanographic application. The sensor will use acoustic correlation technology to determine the true "earth frame" vertical and horizontal components of sensor velocity as a function of time by correlating the echoes returned from the seabed. RD Instruments (RDI) is in a good position to accomplish this using the extremely encouraging results of Phase I of this project, our recent design and fabrication of the wideband coded pulse sequence 75 KHz correlation sonar ocean current profiler as well as experience in developing a pulse-to-pulse coherent Acoustic Doppler Current Profiler (ADCP) using wideband coded pulse techniques and key wideband transducer technology. The novel approach proposed is the use of a dual frequency CVL to achieve high accuracy over a wide range of operational altitudes. A controlled test using the dual frequency long range CVL will be conducted to validate the theoretical predictions.

## NAVY SBIR PHASE II AWARDS

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RESEARCH OPPORTUNITIES, INC.  
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TORRANCE, CA 90501  
Phone: (213) 533-5149

Topic#: 90-015 ID#: 40832  
Office: ONT  
Contract #: N00014-93-C-0017  
PI: WILLIAM C RILEY

Title: Advanced Materials for Electronic Packaging Applications

Abstract: The Phase I research showed that the thermal expansion of the chip carrier, printed wiring board, and thermal plane could be tailored of that of a silicon chip. The high thermal conductivity components selected will provide significantly enhanced heat removal from the device. It is estimated that for high power devices, this improved thermal management concept will provide an order of magnitude decrease in failure rate per unit time. Moreover in using optimized composite materials, weight savings of approximately one pound per module appears feasible. The Phase II work is aimed at sem E qualification of composite components that are optimized with respect to thermal expansion matching to Si and GaAs, improved thermal conductance and maximum weight savings. Graphite fiber technology being developed in the navy manufacturing technology program will be heavily utilized. The final step in qualification will be the operation of sem e devices that incorporate selected composite components. Impact of this technology on future systems will be assessed. The Phase II program requires a team effort led by ROI that will include material suppliers, component fabrications, navy laboratories, and navy system primes. This work will define a Phase III program directed at cost reduction, Productibility demonstration, and system integration of these components.

SAT-CON TECHNOLOGY CORP.  
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CAMBRIDGE, MA 02139  
Phone: (617) 661-0540

Topic#: 90-311 ID#: 41364  
Office: ONR  
Contract #: N00014-92-C-0092  
PI: DR RALPH C FENN

Title: Microfabrication of Tunneling Tip Magnetometers

Abstract: The proposed magnetometer utilizes the large change in Young's modulus of the amorphous alloy Metglas. Changes in applied magnetic field cause resonant frequency changes of a microfabricated Metglas cantilever, which are measured by a microfabricated tunneling-tip displacement sensor. A phase-locked loop measures the resonant frequency, and the external field is inferred from that frequency. The "Q" of the Metglas cantilever is increased to very high levels using closed loop control of cantilever dynamics, producing extraordinary resolution. An electrostatic actuator excites the Metglas cantilever resonance. Phase II tasks include: 1. Construction of a deliverable sensor built with discrete components, 2. Optimization of Metglass sputtering and sensor micromachining, 3. Thermal insulation fabrication, and 4. Construction and testing of the deliverable microfabricated magnetometer. Predicted resolution if  $2 \times 10^{-11}$  Oe/Hz  $1/2$ . This design has resolution similar to SQUIDs but is smaller and requires no cryogens. The microfabricated version will be inexpensive to manufacture and will fill many new, price sensitive applications. The sensor can be used for biomagnetic measurements, where its compactness will allow greater image resolution than existing SQUID units. The magnetometer's lack of cryogens also facilitates application to geophysics exploration and defense related magnetic anomaly detection. 1. "Metglas" is a registered trademark of the Allied Corp.

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TORRANCE, CA 90503  
Phone: (310) 542-9302

Topic#: 90-304 ID#: 41211  
Office: NAWCFTEG  
Contract #:  
PI: SCOTT R ANDERSON

Title: Solid State Digital Voice/Data Recorder

Abstract: SEAKR Engineering, Inc. and Spectrum Sciences, Inc. have teamed to perform the Phase II development of an aircraft Solid State Flight Data/Voice Recorder (SSFD/VR). This recorder will have a non-volatile Flash EPROM memory encased in a stainless steel crash survivable ball. As an option, this same memory can be installed in a remote unit which is deployed in the event of a crash. The SSFD/VR will have the capability to record both Flight Data and cockpit voice. The SSFD/VR design will be modular so that features such as data encryption or additional sensor inputs or voice channels can be provided simply by adding more modules. Tests will be performed to demonstrate capability for qualifying for both military and commercial requirements. A preproduction SSFD/R will be delivered to the Navy for flight testing.

## NAVY SBIR PHASE II AWARDS

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SENSIS CORP.  
5793 WIDEWATERS PKWY  
DeWITT, NY 13214  
Phone: (315) 445-0550  
Title: Phased Array Antenna

Topic#: 90-175 ID#: 40948  
Office: NSWCDDWO  
Contract #: N60921-93-C-A208  
PI: RICHARD R KINSEY

Abstract: The weight and high cost of fixed phased arrays precludes their deployment on many ships that currently have inadequate radar capability. An alternative approach that could satisfy the requirements in many cases is a back-to-back, rotating phased array radar with dual-plane monopulse and electronic scan in elevation. Such a radar could provide the data rate required for weapon support, surface search, and short range surveillance. In the past, conventional slotted-waveguide arrays with row phase shifters have been employed to provide electronic scanning and monopulse in the elevation plane. They are attractive because of their lightweight and low cost compared to a fully phased array. However, no satisfactory means for obtaining azimuth monopulse in this type array has yet been developed. The usual technique of azimuth beam splitting on multiple hits is not an acceptable alternative because of the conflict with data rate and susceptibility to ECM. A novel antenna concept was investigated during Phase I of this SBIR which offers the required azimuth monopulse capability while retaining the basic simplicity of a conventional waveguide array. The objective of the proposed Phase 2 program is to demonstrate dual-plane monopulse performance by the fabrication and test of a development model antenna.

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Topic#: 90-303 ID#: 41031  
Office: NAVSEA  
Contract #: N00024-92-C-4252  
PI: JOHN P CHISHOLM

Title: Use of Satellite Based Mobil Communication System for Over the Horizon Control of Seaborne Powered Targets  
Abstract: The Phase I SBIR effort demonstrated GPS based autonomous waypoint navigation of an Unmanned Surface Vehicle (USV) used as a target in live firing exercises. Waypoints were inserted via an Over The Horizon (OTH) satellite based communication link. Another endeavor indicates that a USV can also serve as a tactical target to divert incoming missiles, i.e., act as a decoy. All these target functions would benefit from the use of a common, ship deployable USV, configured as discussed herein. This Phase II effort will provide a retrofit kit to configure existing Target USVs with an autonomous navigational capability. This retrofit kit, with minor additions, can also convert the workboat currently deployed on modern American/Canadian warships into a USV suitable for tactical, at sea training, and live firing exercises.

SIGNAL CORP.  
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Alexandria, VA 22312  
Phone: (703) 354-6706

Topic#: 91-033 ID#: 91N47-165  
Office: SPAWAR  
Contract #: N00039-93-C-0029  
PI: William R. Hahn

Title: High-Resolution Waveform LFAA Acousto-Optic Sonar Processor  
Abstract: The Phase II task proposed is to develop a new proprietary, high throughput, two dimensional (2D) acousto-optic (AO) Signal Processor (SP) that will enhance the Navy's future warfare capabilities in Undersea Surveillance and ASW. The 2DAOSP will provide about 50 GFLOPS of Doppler channel correlation search power at low cost, small size, and low power. It will out perform current AO processors and any digital signal processors projected for the near future by about two orders of magnitude. This new 2DAOSP will make it practical to use waveforms with high resolution in both range and Doppler for SURTASS/LFA and other low frequency active search sonars, and therefore lead to improvements in ASW target detection, localization and tracking. In Phase I we developed a preliminary design for the 2DAOSP that satisfied SURTASS/LFA throughput and dynamic range requirements. In Phase II we will refine the design, build and test the 2DAOSP hardware, and install the 2DAOSP in the NOSC Surveillance Test and Integration Center (STIC), where the 2DAOSP can be used and the throughput and dynamic range validated by processing simulated and real SURTASS/LFA data. The installation of the 2DAOSP at STIC will allow quantitative evaluation of the benefits of using complex waveforms (with high resolution in both range and Doppler) for SURTASS/LFA type systems.

NAVY SBIR PHASE II AWARDS

STRATEGIC ANALYSIS, INC.  
1213 Jefferson Davis Highway, Suite 1100  
Arlington, VA 22202  
Phone: (703) 527-5410

Topic#: 88-010 ID#: 88N40-001  
Office: ONT  
Contract #: N00014-92-C-0002  
PI: Richard A. Johnson

Title: Intelligent RDT&E Management Information Systems

Abstract: This Phase II SBIR project is designed to realize the potential of the novel Object-Oriented Environment identified and prototyped in Phase I for use in an Intelligent RDT&E Management System. The Phase II effort will significantly extend the size and scope of the Phase I software developmental tool to include multiple applications, ties to off-the-shelf software packages, and creation of ONT RDT&E "beta" applications. This Phase II SBIR project is designed to realize the potential of the novel Object-Oriented Environment identified and prototyped in Phase I for use in an Intelligent RDT&E Management System. The Phase II effort will significantly extend the size and scope of the Phase I software developmental tool to include multiple applications, ties to off-the-shelf software packages, and creation of ONT RDT&E "beta" applications.

SUMMIT RESEARCH CORP.  
1-W Deer Park Drive  
Gaithersburg, MD 20877  
Phone: (301) 840-1707

Topic#: 88-060 ID#: 92N07-070  
Office: NAVAIR  
Contract #: N00019-91-C-0250  
PI: Monte Blacksberg

Title: Air ASW Acoustic Processor Operator Decision Aids

Abstract: The P3C AN/AQA-7 (V) 10/11-SASP Acoustic processors provide almost unlimited selection of base band and multi-vernier settings by the acoustic operator. However, environmental conditions, processor capabilities and threat characteristics must all be considered in making selection decisions by the operator. The objective of this project is to research and develop a Proof-Of-Concept (POC) level design of an On-Board Mode Selection Computer Program for the P3C U III SASP acoustic operator base on previous Phase I results. This effort will include the development of an object-oriented Acoustic Threat Target OBMS Data Base; expansion, up-dating, testing and modification of OBMS MOE, operator interface, display interface, display interface, Raymode interface and output software and algorithms; data entry and programming of all OBMS algorithms, software routines and data storage/recall software; OBMS System testing, validation and further research and development; delivery of a Proof-Of-Concept level of design prototype system; POC System field testing, evaluation and modification; and delivery of a POC System will full OBMS documentation and an Operators Manual to support future USN development and evaluation.

TE TECHNOLOGY, INC.  
10345 Cherry Bend Road  
Traverse City, MI 49684  
Phone: (010) 929-3066

Topic#: 90-135 ID#: 91N1A-521  
Office: NAVSEA  
Contract #: N00024-93-C-4061  
PI: Richard J Buist

Title: Bridge Proposal - High Efficiency Thermoelectric Material

Abstract: Special thermoelectric (TE) material ingots have been produced which have exhibited sufficient Seebeck coefficient variance needed to demonstrate TE cooling performance by virtue of an "Extrinsic Thompson Effect" (ETE). Test couples were fabricated from sections of selected ingots which clearly established the feasibility of this approach. The ETE couple out-performed the test couples fabricated from all other combinations of these same materials by 16.7%, 28.5%, respectively. Although the feasibility has been established, it is certainly not optimized. Even greater enhancements are anticipated and the technical directions have been clearly established by these initial experiments. In fact, the tasks proposed herein are expected to establish and even greater performance level for the ETE device and generate an analytical framework for correlating the results obtained. A thermal model will be developed and used to optimize the ETE device design and to project "cooling efficiency" enhancements possible with these unique devices.

TECHNICAL RESEARCH ASSOCS, INC.  
410 CHIPETA WY - STE 222  
SALT LAKE CITY, UT 84108  
Phone: (801) 582-8080

Topic#: 90-184 ID#: 40958  
Office: NSWCDDWO  
Contract #: N60921-93-C-0005  
PI: DR M TAYLOR ABEGG

Title: Eutectic Combinations of Hydroxylammonium Perchlorate (HAP) and Oxidizers

## NAVY SBIR PHASE II AWARDS

Abstract: The objectives of the Phase II effort are: 1. The development of techniques for extracting dry HAP from aqueous solutions. 2. The development of melt-cast methodology for HAP/Sodium Perchlorate (SP). 3. The development of methodology for the admixing of particulate aluminum into the HAP/SP molten matrix. 4. The evaluation of explosive sensitivity and performance characteristics. 5. The development of methodology for uniformly mixing and casting void free HAP/SP/Al charges. 6. The comparison of an HAP/SP/Al charge with PBXN-103 in underwater performance.

TRIDENT SYSTEMS, INC.  
3554 CHAIN BRIDGE RD  
FAIRFAX, VA 22030  
Phone: (703) 273-1012

Topic#: 90-045 ID#: 40878  
Office: SPAWAR  
Contract #: N00039-93-C-0025  
PI: DAVID BRITTON

Title: Prototype Computer Aided Tool for C3I Architecture Design

Abstract: The continuing evolution of large-scale complex Naval C4I systems has remained ahead of the available computer architecture design and modeling tool capabilities. Naval systems engineers require a tool which allows them to examine very large candidate C4I system designs proposed for real-time distributed architectures. This project will support full-scale development of an advanced hierarchical multi-domain C4I system design, capture, and analysis environment based upon the highly successful CASCADE prototype constructed and demonstrated during Phase I. The full-scale implementation of CASCADE will include multi-user and multi-workstation features allowing high fidelity simulation of complex C4I systems: a task which far exceeds the capabilities of CASE tools running on a single computer. A library of reusable Naval C4I system modules will be developed to facilitate large-scale C4I architecture analysis, and a systems engineering model of the Copernicus concept will be constructed and analyzed as a final demonstration of the project.

VERITAY TECHNOLOGY, INC.  
4845 Millersport Highway, PO Box 305  
East Amherst, NY 14051  
Phone: (716) 689-0177

Topic#: 89-094 ID#: 91N4F-525  
Office: NOSIH  
Contract #: N00174-92-C-0112  
PI: James T. Barnes

Title: Development of Ignition System Design Criteria for Low Vulnerability (LOVA) Propellants.

Abstract: Low vulnerability ammunition (LOVA) propellants are formulated to resist ignition by various thermal threats and to burn poorly at atmospheric pressure. These features also make reliable ignition in gun systems a difficult problem. The proposed program is designed to develop experimental and analytical procedures by which the physical and chemical environments that foster ignition might be identified, characterized, and incorporated into ignition system design for specific gun system applications. The proposed approach involves tailoring an igniter formulation to be chemically with LOVA propellant decomposition species. By quantifying the product species, phase, action time and heat of combustion for candidate igniter concepts, and by determining the chemical constituents of LOVA propellant decomposition products with and in the absence of an igniter, tendencies toward favorable chemical reactivity can be identified. Finally, performing flamespread analyses and factorial ignition experiments, the physical and chemical factors can be ranked according to igniter formulations and geometrical design parameter.

VIASAT, INC.  
6120 Paseo Del Norte, J2  
Carlsbad, CA 92009  
Phone: (619) 438-8099

Topic#: 91-017 ID#: 91N47-027  
Office: SPAWAR  
Contract #: N00039-93-C-0083  
PI: Mark D. Dankberg

Title: Mission Area Subnets

Abstract: Objective: Perform a real-time demonstration of the benefits of separating NTDS track data into Mission Area Subnets (MAS), when combined with true multiuser, multimedia communications. Description: The ViaSat Phase I program developed techniques & algorithms for separating NTDS track data into MAS so each MAS can be assigned a different priority, speed of delivery, and destinations. A MAS address is typically a subset of the entire battle group (i.e., multicast vs. broadcast). This Phase II program will implement these algorithms, and integrate them with the advanced communications networks being developed to support the Copernicus architecture. This integrated demonstration will include the Distributed Handoff Adaptive Multiple Access (DHAMA) software, the Multiuser UHF Satcom for TDMA-1 (MUST) software, and the Enhanced Standard Communications Architecture (SCE+).

NAVY SBIR PHASE II AWARDS

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VISTA RESEARCH, INC.  
P O BOX 998  
MOUNTAIN VIEW, CA 94042  
Phone: (415) 966-1171

Topic#: 91-165 ID#: 91N2D-132  
Office: NSWCDDWO  
Contract #: N00024-93-C-A312  
PI: DR ALAN A BURNS

Title: Infrared Propagation Near the Air-Sea Interface

Abstract: In Phase I, a breadboard design was produced of an experimental system capable of measuring infrared propagation effects near the air-sea interface. Here, the implementation of this experimental approach is proposed. The necessary equipment will be built, the required control and analysis software will be written, and a field test will be conducted. The approach is to measure changes in the positions, spreads and intensities of the images of a distant, vertically disposed set of IR point sources. CO<sub>2</sub> lasers with moderately diverging beams will be used for the sources in order to provide high radiance. A fairly long focal length telescope coupled to a pyroelectric vidicon detector will be used as the receiver. The heart of the data acquisition system is a PC-based frame grabber. A maximum level of real-time data processing will be employed. An aggressive 12-month-duration effort is proposed with the goal of fielding equipment within the half-way point. This is possible because the proposed approach was selected to use off-the-shelf equipment with low technical risk.

W.W. GAERTNER RESEARCH, INC.  
140 Water Street  
Norwalk, CT 06854  
Phone: (203) 866-3200

Topic#: 89-185 ID#: 89N33-603  
Office: NTSC  
Contract #: N61339-92-C-0060  
PI: Christopher Gaertner

Title: Low Cost NVG Visual System

Abstract: Advancements in hardware architecture, software algorithms and integrated circuit performance, have enabled W.W. Gaertner Research, Inc. to develop a new generation of advanced display generators. Furthermore, they will accommodate Silicon Graphics software libraries and development tools, hence, facilitating model and database development. Through incorporation of the hypercube architecture into W.W. Gaertner Research, Inc.'s proprietary parallel graphics design, great strides have been made toward an easy to use, photorealistic, real-time "workstation". With the potential of 5,000,000 polygons per frame, its performance is beyond any system currently designed, planned or even anticipated. Incorporation of both custom and commercially available VLSI circuitry is a key element of the system. While the concept of the hypercube or photorealism are not new, it is only within the past year that circuits and algorithms have been available to maximize their utility in a single design. Aside from the great power of the system, it will have the added benefit of compatibility with current silicon Graphics software. Instead of having to learn a new system, developers will simply program on the ultimate "workstation". This effort is not only attractive because it advances the state-of-the-art, but also because of its wide acceptance into the aerospace and commercial market.

AIR FORCE SBIR PHASE II AWARDS

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AB-TECH CORP.  
700 HARRIS ST  
CHARLOTTESVILLE, VA 22901  
Phone: (804) 977-0686

Topic#: 90-070 ID#: 39826  
Office: XRX  
Contract #: F33657-92-C-2035  
PI: KEITH C DRAKE

Title: Abductive Networks for Complex Aeronautical Systems Development

Abstract: ASAAT Phase I demonstrated the feasibility of applying abductive modeling - an innovative and practical technology - to air borne and ground target recognition. Phase II will use Phase I results and concept to produce and innovative solutions to relocatable target recognition problems. The major objective of ASAAT Phase II is to achieve and demonstrate substantial advances in relocatable target recognition systems by integrating the advantages of abductive modeling and model-based vision pattern recognition. An additional objective is to produce a design methodology to develop operational RT and other target recognition systems with this integrated technology. This proposal summarizes Phase I approaches and results, and outlines ASAAT Phase II. It discusses the advantages and limitations of bottom-up statistical and top-down model-based pattern recognition methodologies. It also presents the integration of these techniques for robust RT recognition. Phase II will be heavily based on the concepts and technology developed during Phase I, specifically information fusion, hierarchical modeling, and algorithm development. Phase II will show a high degree of technological innovation beyond Phase I, and will lead to the development of advanced military and commercial image pattern recognition systems.

ADAPTIVE SENSORS, INC.  
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Topic#: 91-087 ID#: 91WAA-051  
Office: WL2  
Contract #: F33615-92-C-1082  
PI: Mr. John D. Mallett

Title: X-Band, Air-To-Air Radar Sidelobe Clutter Mitigation Through Adaptive Processing

Abstract: Because of the success of several programs delivered to WRDC during the ASI Phase I effort (X-Band, Air-to-Air Radar Sidelobe Clutter Mitigation Through Adaptive Processing), and at the suggestion of the WRDC project manager, the major emphasis in the Phase II proposal effort will be on further development of the computer programs. While ASI will continue to address space-time adaptive processing (STAP) for the future forward- and side-mounted array radar system as described in this proposal, the initial thrust will be toward packaging and delivering software and PC computer hardware that can be used for the "high level" design and test of sophisticated future radars. Software that has already proven useful to the customer in the Phase I study will be improved in extent and "user friendliness" with the feedback and help from users at WRDC. During a Phase III SBIR it is proposed that ASI further develop these programs (perhaps in conjunction with an established commercial software firm) into a marketable product for use in the radar industry.

ADVANCED TECHNOLOGY MATERIALS, INC.  
7 Commerce Drive  
Danbury, CT 06810  
Phone: (203) 794-1100

Topic#: 91-118 ID#: 92WL5-306  
Office: WL5  
Contract #: F33615-92-C-5986  
PI: Charles P. Beetz, Jr.

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

Abstract: Silicon carbide is one of the most promising semiconductor materials now under development. It's wide band gap, high voltage breakdown, radiation resistance, etc. make it a premier material for high power, high frequency and high temperature applications. Most importantly, it's processing shares many common features with well-established silicon processing. While many pieces of the silicon carbide puzzle are now falling into place, the lack of commercial, semiconductor grade substrates is still frustrating device and systems engineers. In Phase I of this proposal ATM demonstrated the feasibility of a novel commercially viable approach to the growth of bulk single crystal 6H-SiC ingots. In this Phase II effort we propose full scale development of this approach. Through control of novel starting materials, specification of reactor materials of construction, and instrumented process control, elemental impurities and structural defects will be dramatically reduced. ATM fully expects to be supplying high quality silicon carbide wafers to both the Air Force and its systems contractors at the conclusion of this program.

## AIR FORCE SBIR PHASE II AWARDS

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### ADVANCED TECHNOLOGY MATERIALS, INC.

7 Commerce Drive  
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Phone: (203) 794-1100

Topic#: 91-192

ID#: 91OSR-357

Office: AFOSR

Contract #: F49620-92-C-0065

PI: Dr Phillip S Chen

Title: Novel Molecular Sources for Dispensing Boron in Carbon-Carbon Composites

Abstract: Carbon fibers and carbon-carbon composites are attractive materials for use in applications requiring strength, light weight, and toughness at high temperatures. Since carbon oxidizes in air at temperatures above 400C, platforms require protection against both oxygen and water at high temperature. The use of particulate which form boron-based glasses upon oxidation have been the major emphasis of the matrix inhibition work. No less than 40% particulate by weight are typically required to achieve oxidation protection and these additions render the composites susceptible to moisture pick-up. The phase I program investigated the feasibility of a molecular dispersion strategy to provide oxidation protection more uniformly throughout the matrix. Using this strategy it was found that an addition of less than 10% by weight provided comparable oxidation protection. The Phase II program will demonstrate that molecular dispersion can be successfully and economically used in a production process without detrimental effects on composite mechanical properties. Phase I results, showing the strategy could also be applied to reduce moisture pick-up, will be refined and incorporated in the production process. Working with Kaiser Aerotech, ATM will exploit the technology developed in Phase I and deliver coupons for Air Force evaluation.

### ALPHATECH, INC.

Executive Place III, 50 Mall Road  
Burlington, MA 01803  
Phone: (617) 273-3388

Topic#: 91-195

ID#: 91OSR-358

Office: AFOSR

Contract #: F49620-92-C-0068

PI: Dr. Robert R. Tenney

Title: MultiResolution Image Fusion, Phase II

Abstract: Phase I of this effort demonstrated the technical feasibility of using multi-scale models of two-dimensional random processes as the basis for fast and accurate algorithms that combine image data from diverse sources. This proposal presents four technical tasks necessary to reduce those algorithms to practice. The first specializes the algorithms to specific problems to gain additional efficiency. The second implements a small software testbed to evaluate the algorithms' performance. The third develops model identification algorithms so that estimators used for reconstruction or identification can be trained directly from real data. The fourth applies the testbed algorithms to real data from reconnaissance, clutter estimation, and oil reservoir reconstruction problems. The products of this effort will benefit several Air Force reconnaissance and surveillance image processing programs, as well as presenting new approaches to global environmental monitoring.

### AMERICAN GNC CORP.

9131 MASON AVENUE  
CHATSWORTH, CA 91311  
Phone: (818) 407-0092

Topic#: 91-001

ID#: 91MNP003

Office: WLO

Contract #: FO8630-92-C-0060

PI: MR CHING-FANG LIN

Title: Integrated Estimation, Guidance, and Control Systems Design for BTT Missiles

Abstract: Advanced research and algorithmic development are proposed for Phase II study concerning target state estimation and integrated guidance and control for air-to-air missile applications. The systems integration approach is proposed to develop individual estimation, guidance and control subsystems and to exploit the favorable synergistic effects among these subsystems. The payoff of this systems integration is the missile system effectiveness improvement in the encounter with high speed and high agility targets in an ECM intensive, cluttered and multitarget environment. The systems integration exploits the multimode seeker technology, paralleled computing, miniaturized electronics, intelligent decision-making, and advanced estimation, guidance, and control algorithms. The functions of target state estimation, multimode guidance, robust control, and predictive fuze are integrated to fully exploit the advanced seeker technology. The deliverables of Phase II include (1) advanced maneuvering target tracking algorithms and a target state estimation specific software package, (2) a target aimpoint selection and recognition algorithm, (3) a sensor data fusion scheme for target estimation, multimode guidance and fuze, (4) an integrated guidance and control for reduced miss distance and favorable approach attitude, (5) a nonlinear robust integrated guidance and control design for intercepting high agility targets, (5) an integration of guidance, fuzing, and control for maximum warhead effectiveness, (7) a software integration that features all the navigation, estimation, guidance, control, and fuze algorithms, and (8) a performance demonstration using hardware-in-the-loop simulation and dual-mode seeker hardware. The systems integration and performance demonstration are closely tied with an existing Phase II robust autopilot design contract and together they will

## AIR FORCE SBIR PHASE II AWARDS

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significantly enhance the capability of the Air Force in designing, analyzing, developing, prototyping, and testing of next-generation air-to-air missile estimation, guidance, and control systems.

AMHERST SYSTEMS, INC.  
30 Wilson Road  
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Phone: (716) 631-0610

Topic#: 91-081 ID#: 91ASD-743  
Office: XRX  
Contract #: F33657-92-C-2207  
PI: DR. CESAR BANDERA, Ph.D.

Title: Advanced AI Techniques for Multiacuity ATR

Abstract: The FLASER system engineering program, scheduled for commencement at WPAFB in FY93, integrates a forward looking IR (FLIR) sensor and a laser radar (ladar) for improved airborne targeting. In the FLASER, regions of interest (ROIs) are defined by FLIR data and interrogated by the ladar to reduced the false alarm rate and improve recognition confidence. The measurement rate of a ladar is several orders of magnitude slower than a FLIR, and the ladar may not be able to interrogate the ROIs in a cluttered environment with platform and target motion before line-of-sight is lost or the platform becomes vulnerable to detection or attack. A context sensitive gaze controller for the pointing of the ladar is required to optimally allocate ladar resources. A major obstacle to FLASER algorithm development is the lack of a closed-loop synthetic imagery model to support FLASER concept evaluation before proceeding to bench testing. The proposed effort will develop a non-realtime portable FLASER scenario model software system for the closed-loop simulation of correlated FLIR and ladar imagery and a FLASER system, including the multisensor data from a kinematic scenario in which the ladar is dynamically steered by gaze control.

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

Topic#: 91-001 ID#: 91MNP006  
Office: WLO  
Contract #: FO8630-92-C-0056  
PI: DR W. T. BOORD

Title: Solid State Laser Scanner for Laser Ordnance Initiator

Abstract: We propose to build, test, and deliver a solid state laser scanner for use by the Air Force in development of a Ladar based seeker. A solid state laser scanner with no moving parts will enable a more compact, and higher resolution, reliable Ladar System. APA Optics' solid state laser scanner utilized integrated optic waveguides of AlGaAs and electro-optic activated Bragg transmission gratings. Feasibility of the solid state laser scanner was demonstrated by APA Optics in a NASA SBIR program. The Phase I effort of this Air Force SBIR program established the compatibility of the solid state laser scanner with the laser ordnance initiation system based on the use of a light triggered bulk avalanche semiconductor switch. Also, the Phase I studies demonstrated a modified Bragg grating design which will reduce the light level scattered into directions other than the desired scan direction. For the Phase II program, we will develop and fabricate a packaged prototype laser scanner which can be evaluated by the Air Force, in a laboratory environment, as component of the Ladar seeker.

APPLIED MODERN TECHNOLOGIES CORP.  
6232 MALAGA COURT  
LONG BEACH, CA 90803  
Phone: (310) 494-0472

Topic#: 91-067 ID#: 91ARM-503  
Office: AL  
Contract #: F41624-92-C-6006  
PI: HORWITZ, LARRY

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

Abstract: During the Phase II effort of the Ocular Vergence and Accommodation Sensor (OVAS) program Applied Modern Technologies (AMT) will develop and deliver two prototypes of a helmet-mounted OVAS systems in the twelfth month of the program. In addition to the combined optometer and eye tracker in one helmet system, AMT will integrate into the OVAS a visor display. Thus, the OVAS will be capable of determining the vergence and accommodation of the pilot's eyes while he is looking either into real space (far and near fields) or at his visor display.

APPLIED RESEARCH ASSOC, INC.  
4300 SAN MATEO BLVD., NE, SUITE A220  
ALBUQUERQUE, NM 87110

Topic#: 91-001 ID#: 91MNP007  
Office: WLO  
Contract #: F08630-92-C-0064

## AIR FORCE SBIR PHASE II AWARDS

Phone: (505) 883-3636

PI: MR BARRY L. BINGHAM

Title: Impact Characterization for Improved Penetrator Performance and Survivability

Abstract: The central postulate of the proposed work effort is that weapons will sense their impact condition; i.e. trajectory angle, impact velocity, spin orientation and distance in relation to the target surface. If those conditions are less than beneficial for weapon survivability or penetration performance, the weapon will adjust its orientation of prescribed conditions. The research from the Phase I work effort determined the optimum impact conditions in terms of impact AOA and initial rotation rate for the Air Force TRIPACK weapon impacting concrete targets (1,3,10, and 15 feet thick) at 1,800 and 2,200 ft/s, and five different trajectories (70, 75, 80, 85, and 90 degrees). The Phase II effort will determine Optimum-Impact-Logic Algorithms (OILA's) for the Air Force GBU-28 and related these with output form an in-Flight-Orientation-Sensing (IFOS) system under development at Mororia. Scaled tests of an IFOS system will be conducted in order to validate its design. Necessary mathematical modelling to extrapolate sensor test results to system requirements will be performed.

ATMOSPHERIC & ENVIRONMENTAL RSCH., INC.

Topic#: 91-144

ID#: 93PL1-025

840 Memorial Dr.

Office: PL5

Cambridge, MA 02139

Contract #: F19628-93-C-0005

Phone: (617) 547-6207

PI: RONALD G. ISAACS

Title: Retrieval of Visibility Over Land Using Two Dimensional Spatial Frequency Analysis of High Resolution Imager Data - Phase II (Software Development & Validation)

Abstract: We propose to develop and test software to quantitatively measure visibility over land based on the prototype algorithm developed in Phase I. The computer code will be based on the technique of analyzing the two dimensional spatial frequency power spectrum obtained from subregions of high resolution visible imagery data. To insure computational efficiency, spatial power spectra will be evaluated employing standard fast Fourier transform (FFT) techniques. The software will be tested and evaluated using NOAA TIROS AVHRR and DMSP OLS LF data imported to the Air Force Geophysics Laboratory (AFGL) Interactive Meteorological System (AIMS) which is an effective testbed for tactical terminal imagery manipulation (Gustafson et al., 1987). A technology transition plan will also be developed to support interfacing the visibility algorithm with existing tactical environmental support programs such as Mark IVB and STT.

ATMOSPHERIC & ENVIRONMENTAL RSCH., INC.

Topic#: 89-196

ID#: 31814

840 MEMORIAL DR

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CAMBRIDGE, MA 02139

Contract #: F19628-91-C-0167

Phone: (617) 547-6207

PI: R G ISAACS/S A CLOUGH

Title: Development of Remote Sensing Algorithm for Atmospheric Path Variables From Radiometric Data

Abstract: In Phase II we propose to implement the generalized path characterization (GPC) approach in a deliverable code to test the approach using both simulated data and actual sensor data where applicable, and to provide complete documentation of the general approach. The generalized path characterization algorithm will be capable of retrieving arbitrary path variables related to atmospheric thermodynamic structure, composition, and NLTE properties. We will investigate amplification of the GPC for multisensor data fusion studies including determination of spectral and spatial information content. The GPC will interface with and utilize appropriate advanced spectral modeling algorithms such as FASCODE. Simulation and real data applications of the GPC will focus on special sensors such as the MSX sensor suite.

AEDC, INC.

Topic#: 90-024

ID#: 93AED-016

PO BOX 5487

Office: AEDC

SAN BERNARDINO, CA 92412

Contract #: F40600-92-C-

Phone: ( )

PI:

Title: High Temperature Rake Probe for Arc-Jet Tests

Abstract: The objective of the program is to design, fabricate and deliver to AEDC probes that can accurately measure and map arc-jet exit plane flow quantities. Two rake probes shall be delivered, that can map out the aerodynamic properties of the test section in high-enthalpy/high-pressure arc-jets. The first probe shall be a dual-sonic nozzle enthalpy probe that can dwell in the arc-jet test section and measure directly the gas total enthalpy. The second probe is a rake with axi-symmetric probes to characterize the stagnation pressure, flow angularity and static pressure (three-dimensional flow behavior) of the test section.

## AIR FORCE SBIR PHASE II AWARDS

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AURORA ASSOC.  
3350 Scott Blvd, Bldg 30  
Santa Clara, CA 95054  
Phone: (408) 748-0867

Topic#: 91-099 ID#: 91WL3-047  
Office: WL3  
Contract #: F33615-92-C-1103  
PI: I. C. Chang

Title: Multiplexing for Fiber-Optic Sensors

Abstract: In Phase I effort of this SBIR program the feasibility of a high speed multiplexing technique for fiber optic sensors was demonstrated. The proposed approach utilizes the Wavelength Division Multiplexing (WDM) capability of the acousto-optic tunable filter (AOTF) to provide monitoring and data links to serial array of fiber optic Bragg sensors. System analysis shows that using this technique a large number of "in fiber" sensors can be interrogated to provide accurate information at high data rate. A new AOTF design concept was also developed that predicts more than one order of magnitude increase in diffraction efficiency. The low drive power and high resolution of the new AOTF makes the implementation of the WDM well suited to smart structure applications. In Phase II it is proposed to implement the proposed approach in the design, build, test and evaluation of a multiplexing fiber optic sensor system (MFOSS) breadboard. The objective of this effort is to verify that system will be capable of measuring strain responses from one hundred or more in-line Bragg sensors. A dynamical system test simulating realistic environmental conditions will be conducted. The results will be evaluated to determine applicability of the MFOSS for supporting structure health monitoring systems.

BAKHTAR ASSOC.  
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Topic#: 91-001 ID#: 91MNP-012  
Office: WL0  
Contract #: F08630-92-C-0078  
PI: DR KHOSROW BAKHTAR

Title: Development of Safety Criteria for Explosive Storage Structures

Abstract: Application of physical modeling will be extended to verify the Bakhtar's Explosive Safety Criteria formulated in the Phase I study. Similitude conditions will be employed to cast the large scale test specimens representing crustal blocks with defined geology and associated model structures, i.e. access tunnel and attached chamber. The main theme of the proposed study will be centered on the evaluation of the hazardous effects of the fragments resulting from accidental detonation of an underground explosive storage structure. The verification approach will be done in such a way that the properties of the geologic system (rock mass with the associated discontinuities) hosting the underground facility, and the engineering system (structural components of the tunnel and attached chamber) are decouple in the material characterization, modeling, testing, and analysis. Therefore, once the formulated criteria is verified, it can be used for safety assessment of the existing facilities, safe design of the future facilities, and by neglecting the geologic terms, for hardness assessment of the aircraft shelters.

BIO-TECHNICAL RESOURCES  
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Topic#: 91-112 ID#: 92WL5-307  
Office: WL5  
Contract #: F33615-92-C-5984  
PI: Alan D. Grund, Ph.D.

Title: Biological Production of 4-Hydroxybenzocyclobutene

Abstract: The development of benzocyclobutene (BCB) based polymers for aerospace applications requires a more economical means for the production of 4-hydroxybenzocyclobutene. Technical feasibility for the microbial bioconversion of benzocyclobutene was successfully demonstrated in the Phase I program. The objective of the Phase II program is to develop a commercial process for this specialty chemical, based on work done with the microorganism isolated during the Phase I work. The research necessary to achieve this goal includes the following: 1) Microbial strain improvement utilizing both classical genetics and molecular biology techniques; 2) Development of optimized fermentation and immobilized whole cell bioreactor process for economical production of this compound; 3) An economic analysis of the production costs for this bioconversion; 4) A feasibility study dealing with the biological production of benzocyclobutene; 5) Synthesis and characterization of 4-OH BCB-based resins. Upon completion of the program, a process suitable for the large scale production of this key specialty chemical should be developed. Commercial production using this process will allow further development of BCB polymer technology for Air Force and aerospace applications. The anticipated generic nature of this bioconversion process will allow flexibility for the production of a wide range of hydroxylated specialty chemicals.

AIR FORCE SBIR PHASE II AWARDS

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Westerville, OH 45433  
Phone: (614) 882-2231

Topic#: 91-139 ID#: 91WL6-08  
Office: WL6  
Contract #: F33615-92-C-2286  
PI: W. N. Lawless

Title: Thermal Stabilization of Ceramic Superconductors for Aerospace Pulsed Power

Abstract: A 24-month Phase II program is proposed to identify the optimum dielectric insulation material for thermal stabilization of the "powder-in-tube" YBCO/Ni HTSC conductor, 20-90 K. Candidate insulation materials identified/recommended in Phase I will be progressively narrowed through measurements of thermal conductivity, specific heat, thermal expansion, adherence compatibility with Ni metal, and thermal boundary resistance at the insulation/Ni interface. Oxygen transport through the insulation, needed in the oxygen-anneal of the YBCO, will also be measured. The experimental research is highly interactive with theoretical modeling of thermal stabilization; the thermal properties of the HTSC conductor will be measured (20-90 K and in magnetic fields up to 3 Tesla) for incorporation in the modeling code. Short samples of the HTSC conductor will be coated with the optimum insulation and delivered to WPAFB. Plans for coating long lengths of the HTSC conductor in Phase III will be developed. An \$513,165 Phase II program is proposed. Battelle Memorial Institute (Columbus, Ohio) will be subcontracted for the preparations and diagnoses of powders and samples. A Consultant, Dr M. K. Chyu (Carnegie Mellon Univ.), will perform computer-modeling of thermal stabilization using experimental data measured in the program.

CFD RESEARCH CORP.  
3325-D Triana Blvd  
Huntsville, AL 35805  
Phone: (205) 526-6576

Topic#: 91-131 ID#: 91WL6-15  
Office: WL6  
Contract #: F33615-92-C-2288  
PI: Clifford E. Smith

Title: Advanced Demonstration of Fuel Injector/Flameholder for High Speed Ramburners

Abstract: Recent studies of turbojet propulsion systems have identified the need for advanced, in-stream fuel injector/flameholder schemes for high speed ramburners. This project proposes to demonstrate a new, field injector flameholder prototype configuration that enhances fuel-air mixing and combustion efficiency. The increased mixing is accomplished by large-scale vortical structures generated by the flameholder surface. In Phase I, one baseline Integral Fuel Injector Flameholder (IFF) and two advanced concepts were numerically analyzed using a validated, 3D body-fitted coordinate CFD code. Turbulent, gaseous combustion simulations were used to show the potential performance improvement of the advanced concepts compared to the original IFF design. In Phase II, a combined experimental/numerical approach is proposed. After parametric CFD studies for optimization, advanced prototype configurations and the baseline IFF will be designed, fabricated and tested. In the first year, isothermal mixing tests will be performed, injecting liquid and gaseous fuels into the airstream. CFD computations will be compared to the experimental data to validate the CFD model and understand the flowfield physics. In the second year, selected configurations will be designed and tested at hot combustion conditions typical of a high speed ramburner environment. If successfully demonstrated, the best configuration will be tested and evaluated in a combined cycle engine demonstrator in Phase III under non-SBIR funding.

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Topic#: 91-196 ID#: 91OSR-311  
Office: AFOSR  
Contract #: F-9620-91-C-0042  
PI: Dr H. O. Yang

Title: Pressure-Based High Order TVD Methodology for Dynamic Stall Control

Abstract: The design of future generation combat aircraft for post-stall maneuvering requires detailed knowledge, exploitation and control of the highly unsteady vortical flow field in the vicinity of the vehicle. This project proposes advancement and application of a pressure-based Navier-Stokes equation solver to analyze the unsteady separated flow around 3-D wing bodies. In Phase I, an existing CFD code, REFLEQS, was adapted by implementing the proposed new techniques: high order TVD schemes, Newton's iteration, and hyperbolic pressure correction. The modified code was applied to five 2-D airfoil and five 3-D wing problems. Validation and demonstration studies showed the feasibility of using pressure based TVD methodology for analyzing complicated flow structures and for revealing fluid physics associated with dynamic stall. In Phase II, the code will be further enhanced in terms of turbulence modeling and convergence rate, and will be further validated against benchmark 3-D experimental data for dynamic maneuvering wing geometries. Several dynamic stall control concepts, including both wing body and forebody with mechanical devices (vortex flap, forebody strake) and pneumatic techniques (blowing and suction), will be

## AIR FORCE SBIR PHASE II AWARDS

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assessed with the CFD tools. Advanced computational graphics such as volumetric rendering of dynamic flow fields, image comparison, and dynamic display of critical points, lines, and surfaces, will be adapted and used to study 3-D unsteady separating flows.

CHARLES RIVER ANALYTICS, INC.  
55 WHEELER STREET  
CAMBRIDGE, MA 02138  
Phone: (513) 255-8726

Topic#: 91-067 ID#: 91ARM-405  
Office: AL  
Contract #: FY8990-92-C-0547  
PI: WARREN, RIK

Title: Passive Sensor Altitude and Terrain Awareness System

Abstract: The objective of the Phase II effort is to develop and demonstrate a flight prototype version of a passive sensor altitude and terrain awareness system (ATAS). The basic design concept, which was implemented in hardware and demonstrated in real-time under the Phase I effort, uses the feature-free optical flow-field present in all passively-imaged dynamic scenes, to generate changing estimates of self-motion and terrain shape. ATAS is based on several computational vision models of low-level piloted flight, and because it is passive, it has the potential to significantly enhance covert operations, reduce countermeasure sensitivity, and operate robustly in combat. System architecture includes an imaging sensor driving an image processor, which generates measurements for a downstream vehicle state and terrain shape estimator. Phase I achieved real-time ground-based operation with flight-recorded imagery driving a VME-bus system; Phase II will transition the design to the flight environment with an onboard imager driving an ISA/1553-bus system. Three tasks are planned: 1) upgrade the ground-based version and test in a visual flight simulator; 2) develop the flight prototype and demonstrate in flight; and 3) develop design requirements for a production system.

COGENTEX, INC.  
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Topic#: 91-032 ID#: 92ES3-197  
Office: ES3  
Contract #: F30602-92-C-0163  
PI: Dr. Tanya Korelsky

Title: Text Generation Technology for Advanced Software Engineering Environments

Abstract: Natural language text generation techniques will be applied to provide project management reports for Rome Laboratory's Software Life Cycle Support Environment (SLCSE) by accessing its E-R database. SLCSE is an advanced software engineering environment which supports the development and life cycle of software according to DoD-STD-2167A. Phase I research has proven the feasibility of such report generation through a working demonstration prototype based on the CoGenTex generator shell which was adapted to the SLCSE Project Management subschema. Phase II will incrementally build a full-scale Intelligent Report Generator (IRG), integrated with the SLCSE Project Management System, to cover a broad range of project management reporting topics, including project events governed by the 2167A standard, and by the MIL-STD-1521 review activities standard. Particular attention will be paid to the reporting of problem situations, as well as to configuring reports of various types according to user needs through a convenient interface. Users will be given options for generating explanations of summary statements, for automatic inclusion of tables and graphs which complement the text, and for integrating the output with the existing DOCGEN capabilities of SLCSE.

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Topic#: 91-120 ID#: 91WL5-308  
Office: WL/ML  
Contract #: F33615-91C-5627  
PI: Randy Simon

Title: Infrared Detection By BKB Thin Films

Abstract: The goal of this program is to develop a Ba<sub>1-x</sub>KxBiO<sub>3</sub> (BKB) long-wavelength infrared (LWIR) detector system which is composed of a thin-film detector element, a low-noise superconducting quantum interference device (SQUID) amplifier fabricated in yttrium-barium-copper-oxide (YBCO) technology, and a YBCO analog-to-digital converter. A key element of the program will be to develop a BKB thin-film detector with optimized response. The complete detector subsystem proposed has fundamental advantages over semiconductor IR technology in that it can provide wide-band response from 2-25 $\mu$ , low power consumption, and high sensitivity. The successful demonstration of an integrated superconducting chain of low-power high-performance components could open the door to full implementation of this technology to focal plane arrays. Such focal

AIR FORCE SBIR PHASE II AWARDS

plane arrays will be suitable for a variety of DoD LWIR missions covering the IR span from 2-25u.

COUSINO METAL PRODUCTS, INC.  
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Phone: ( ) -

Topic#: 90-001 ID#: 39673  
Office: WLO  
Contract #: F08630-92-C-0061  
PI:

Title: Cold-flowed Warhead Liners

Abstract: Previous research efforts that have investigated the cold-flowing process have resulted in findings of consistent, refined metallurgy radially through the part. This Phase II effort proposes to further investigate various cold-flowing techniques of tantalum material acquired in a variety of conditions. This effort should allow for testing results to be obtained which identify in more detail the cold-flowing process parameters that enable this process to nullify the inconsistent metallurgical characteristics of incoming material thereby create a more refined, consistent microstructure. The proposed Phase II test matrix outlined in this proposal will examine the thermo-mechanical components of the cold-flowing process from raw material receipt to finished part formation. These components will be characterized thoroughly by metallurgical and mechanical tests on the tantalum material with the implementation of grain size analysis, x-ray diffraction analysis, and both low and high strain rate mechanical behavior testing.

CRYSTAL ASSOC., INC.  
15 Industrial Park  
Waldwick, NJ 07463  
Phone: (201) 612-0060

Topic#: 91-119 ID#: 92WLS-305  
Office: WL5  
Contract #: F33615-93-C-5306  
PI: G.M. Loiacono

Title: Improved Growth of KTP and KTA Crystals

Abstract: The grey track effect in KTP was shown to be related to the presence of Ti<sup>3+</sup>. The susceptibility of CTP crystals to grey track formation was maximum in KTP crystals grown from the tungsten based solvents. The incorporation of W<sup>6+</sup> in the KTP was expected to increase the [Ti<sup>3+</sup>] and the observed increase in susceptibility is explained. The data show that no correlations exist between the grey track threshold with either ionic conductivity or crystal growth temperature. There is a possibility that [OH] may be important. The similarity of the grey tracks in KTP and photorefractive damage in LiNbO<sub>3</sub> suggests that the effect can be eliminated. Charge compensation methods are suggested for the stabilization of Ti<sup>4+</sup>. The establishment of a compensation method will result in the elimination of the grey track damage effect in both KTP and KTA.

CYBERNET SYSTEMS CORP.  
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Phone: (313) 668-2567

Topic#: 91-025 ID#: 92ES3-207  
Office: ES3  
Contract #: F30602-93-C-0023  
PI: Dr Brian T Mitchell

Title: Parallel Accelerators for Real-Time Applications

Abstract: This proposal outlines a plan to develop and deliver parallel image and signal processing accelerators for integration into a development workstation and additional tools for transitioning algorithms developed using these accelerators into real-time production systems. The increased computational capabilities provided through this approach will enable more thorough exploration of candidate image and signal processing algorithms, and the consolidation and standardization of the computationally critical modules found in the accelerators will facilitate transition of laboratory prototypes into real-time applications. The combined higher performance and more efficient migration offers a significant cost savings to the Air Force. Additionally, the overall algorithm development methodology that will result from this work will reduce the time required to implement robust image and signal processing solutions, and thus enable more timely problem solution.

DAEDALUS ENTERPRISES, INC.  
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Phone: (313) 769-5649  
Title: Doppler Imaging Photometer

Topic#: 91-157 ID#: 91PAA-804  
Office: PL4  
Contract #: F19628-91-C-0097  
PI: Randall W. Zywicki

## AIR FORCE SBIR PHASE II AWARDS

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Abstract: During the Phase I effort an innovative electro-optical system design was developed for the purpose of studying the velocity of ionospheric winds. The proposed Phase II effort will produce a prototype instrument based on this design. The design system will measure the Doppler shift impacted upon ionic emissions at 630 nm over the full sky. Winds of up to 1 km/s will be measured with resolution as low as 10 m/s, with a spatial resolution of 40 km. The designed system integrates wide field telecentric optics, a novel Fabry-Perot interferometer, a high precision cooled CCD camera and a controlling personal computer. The key innovation in this design is the use of a Fabry-Perot etalon as an imaging device. Previous techniques of imaging through a Fabry-Perot are limited to a partial resolution of tens of pixels, whereas this technique allows in excess of 2500 pixels. The proposed development includes a limited set of software tools developed for image processing and data extraction.

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Topic#: 91-020 ID#: 93AED-014  
Office: AEDC  
Contract #: F40600-92-C-0014  
PI: Dr. Anthony O'Keefe

Title: Laser Remote Sensor for Hypersonic Engine Inlet Testing

Abstract: We have developed and demonstrated in our labs two techniques which can be used for non-intrusive sensing of air flow temperature and density in the ASTF test facility at AEDC. The signal levels realized in the laser induced fluorescence sensing of molecular oxygen are approximately 5 to 7 times weaker than the predicted levels, due to errors in either the published absorption cross sections, the published predissociation rates, or both. It is shown that these signal levels can be increased by a factor of 100 to 200 through optical amplification. Estimates of performance in the ASTF facility are derived here.

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Topic#: 91-040 ID#: 92ES3-210  
Office: ES3  
Contract #: F19628-92-C-0188  
PI: Dr. Virgil Elings

Title: Scanning Probe Microscopy for Nanometric Surface Preparation

Abstract: a. Objective: The objective of this project is to apply the techniques of Scanning Probe Microscopy (SPM) to Nanometric Surface Preparation (NSP) of silicon for electro-optical applications. SPM methods will be applied to characterize the state of the prepared surface and to provide feedback and control at very high rates during surface preparation. b. Brief Description of Project I. Surface Characterization: The recently introduced NanoScope Large-Sample SPM provides the capability of carrying out AFM scans anywhere on a 6 inch silicon wafer with scan areas ranging from a few nanometers up to a 100 x 100 micron field. Wafers of 8 inch diameter can be mounted and studied. However, the standard instrument has limitations which limit its ability to characterize certain nanometric surface properties. Full travel over an 8 inch wafer is desirable. High aspect ratio probe tips are needed to scan high aspect ratio features such as near vertical walls. II. Feedback and Control during surface preparation: Feedback and control techniques will be developed. A commercially available fixed sample AFM head can be mounted on surface preparation equipment to provide feedback. The AFM probe is supported by a cylindrical piezoelectric transducer that can be used either to provide scanned data of a small surface area, or to accurately position the AFM probe. AFM Feedback bandwidth is limited by the mechanical response of the AFM cantilever assembly to approximately 20 KHz. In the commercial design, the AFM cantilever is monitored by a compact laser interferometer. The bandwidth of the laser interferometer is greater than 10 MHz. In the preferred embodiment, this interferometer will be used to directly monitor the height of a polished surface to provide the needed control.

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Topic#: 89-165 ID#: 89WL1-220  
Office: XRX  
Contract #: F33657-92-C-2036  
PI: Charles Hopkins

Title: Advanced Aircraft Cost Forecasting Model

Abstract: Phase II of this project expands and deepens a top-down aircraft cost model whose feasibility was demonstrated in Phase I of the program. "Top-down" implies that the model emphasizes total systems cost. This model produces valid cost estimates of complete aeronautical systems, given the sparse system definition that is usually available in the Conceptual Phase.

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The objective of Phase II is an end product designated as the Advanced Aircraft Forecasting Model (AAFM). This tool predicts acquisition costs by forecasting technology growth; it does this by extrapolating growth trends in aircraft complexity parameters over time. The model is integrally packaged with a condensed historical database, which is the source of the technology-forecasting trends. The model is designed for use by advanced mission planners who apply cost as a criterion in high-level tradeoffs and feasibility studies. Such users typically lack the expertise or the money to run sophisticated parametric models such as GE PRICE. Instead, AAFM offers the capability for novice-friendly estimation of advanced aircraft concepts using IBM and compatible microcomputers.

EHRlich ASSOC.  
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Lexington, MA 02173  
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Topic#: 90-189 ID#: 39810  
Office: AFOSR  
Contract #: F49620-93-C-0008  
PI: Daniel Ehrlich

Title: Laser Microchemical Processing Instrument

Abstract: The Program will prototype a commercial laser microchemical instrument. The prototype will be used to confirm the operating performance of the machine design and serve as a tool to transition the technology.

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Phone: (310) 326-8228

Topic#: 90-069 ID#: 91WL4-103  
Office: WL4  
Contract #: F33615-92-C-3615  
PI: Steven M. Mosher

Title: "ARENA II. Man-In-The-Loop, Multi-Mission Air Combat Simulation"

Abstract: The objective of this contract is to develop and test ARENA 2.0, a real time man in the loop multi-mission air combat simulator that can be used to 1)define new weapon system requirements, 2)perform design evaluations, 3)develop new tactics prior to Aircraft IOC, 4)fly avionics hardware in a realistic simulated combat, 5)train combat pilots. Phase I of this contract exceeded its goal of defining, developing and demonstrating a real time, multiple participant. Beyond Visual Range and Within Visual Range air-to-air combat simulator. Pilots testing the simulator were able to fly extended, many-on-many, realistic Close-in-Combat without the use of a dome. The hardware/software architecture defined in Phase I will be matured and tailored in Phase II to include essential Surface-to-Air and Air-to-Ground capabilities. The result will be a multi-mission simulator capable of evaluating aircraft designs across a broad range of missions. The system maintains a very low-cost through the application of the off-the-shelf hardware, efficient software design and allocation, and through the integration of other SBIR developed technologies that eliminated the need of dome technologies and cost.

ELECTRIC PROPULSION LABORATORY, INC.  
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Topic#: 91-148 ID#: 91PAC-743  
Office: PL3  
Contract #: F29601-92-C-0067  
PI: DR. GRAEME ASTON

Title: HIGH PERFORMANCE, VARIABLE POWER ARCJET

Abstract: An arcjet development and performance optimization program is proposed. Program goals are a specific impulse of 950 sec. or greater, at an efficiency of at least 35%, for a variable input power range of 6 - 14 kw using space storable ammonia propellant. Based on Phase I results which examined 18 exotic arcjet configurations, several key design parameters were identified which have a direct effect on arcjet frozen flow losses and subsequent arcjet performance. During Phase II, these key parameters will be integrated into a performance optimized arcjet which will be operated for long test durations of up to 100 hours.

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Phone: (201) 808-9033

Topic#: 91-079 ID#: 91ASD-556  
Office: ASD  
Contract #: F33657-93-C-2013  
PI: Murray W. Rosen

Title: High Temperature Superconductivity (HTSC) ESM Augmentation System

AIR FORCE SBIR PHASE II AWARDS

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Abstract: This Phase II project will demonstrate and evaluate a HTSC filter bank. Current ESM and RWR systems have difficulty with diverse threat environments and/or interfering signals. High power, low duty cycle pulse signals require a staring wideband receiver; conversely, low power, high duty cycle PD and CW signals require a scanning narrowband receiver. A receiver facing both types of signals is typically a hybrid of the two types which must comprise performance for one or both signal categories. High power interfering signals can corrupt any type receiver. YIG filters can solve fixed frequency interference, but are too slow for RF switching or RF agile signal sources. A HTSC device enables PD/CW signals to be sorted from pulse signals at direct RF. By isolating these signals, they can be handled by simple superhet and wideband receivers, respectively, with no compromise in performance. Additionally, high power RF agile interfering signals can be stripped without impacting receiver performance.

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Topic#: 91-058 ID#: 91CEL-121  
Office: AFCESA  
Contract #: F08635-93-C-0014  
PI: BRIAN R. FOLSON

Title: Liquid-Phase Bioreactor for Degradation of Trichloroethylene and Benzene

Abstract: The overall objective of this project is to use the successful results from Phase I work to design and operate a pilot scale, two-stage biological treatment system. The proposed system will be 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 successive degradation of both contaminants by a selected organism(s) in a dual phase reactor configuration. The bioreactor(s) will operate under controlled conditions using microbial cultures with well defined grouch degradation characteristics. To achieve the project objectives in the first state, organisms that can degrade benzene while maintaining activity in the presence of TCE will be used. In the second stage, organisms that can degrade TCE will be used. In addition, a pilot scale reactor system for the degradation of a mixed waste stream containing TCE and benzene (JP-4) will be designed, fabricated, and field tested. The result will be a field demonstrated system that is ready to cost effectively remediate DoD and other US Government and commercial sites.

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Topic#: 91-004 ID#: 91MNP073  
Office: WLO  
Contract #: F08630-92-C-0055  
PI: MR PETER T. TOULIOS

Title: Electronically Scanned, Reconfigurable MMW Radar Antenna

Abstract: The Air Force Armament Directorate has identified the need for a high resolution surveillance sensor which can operate day or night and in poor weather conditions. A passive sensor limits ability for unfriendly detection or jamming. A sensor operating in the millimeter W-band offers unique advantages over optical or infrared sensors, but suffers from limited resolution, large size and high cost. An improved, high resolution focal plane array concept is proposed as an innovation to overcome previous limitations. In addition, resolution enhancement is proposed using high speed, multiple image frames combined with using special computer algorithms developed for this purpose. An experimental sensor will be designed, barricaded and tested such that several parameters in the sensor control and its algorithms can be adjusted to seek optimum image enhancement. By this method the sensor promises to demonstrate imagery superior to previous systems operating in this wavelength.

FORWARD VISION  
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Topic#: 91-059 ID#: 91AL-064  
Office: AL  
Contract #: F41624-92-C-9004  
PI: ALBANESE, R

Title: Development of an "Intelligent" Remote Identification System

Abstract: A novel remote detection system has been devised which will determine the three-dimensional shape of a distant target when it is illuminated by microwaves, sonar, etc. The system images without focussing and uses a detector which is resistant to input overload. Other systems now used (like most radars) do not image except at a crude level. Only a single blip is displayed, whose brightness is related (ambiguously) to reflectivity and size, or very large objects, like weather systems, are

AIR FORCE SBIR PHASE II AWARDS

delineated, but in detail no smaller than a beam width, by timing the return. Analysis can sometimes be applied (such as in tomography), but that requires copious amounts of data taken from many directions and is computationally intensive and slow. Our system is self-contained, automated, and may require less input information. The Phase II project will determine the parameters necessary to construct a working system, predominantly by computer simulation. Feasibility was demonstrated for the case when radiation has the form of scalar waves (like sound) and impinges on perfect reflectors. Investigation will now consider the use of vector waves (like microwaves) as the illuminating source and will also extend our capability to include partial reflectors as identifiable targets. Then, it will be possible to image objects behind and within multiple layers. Particular emphasis will be placed on determining optimal (and minimal) detector/collector configuration and in improvement of artificial intelligence routines which are used to discern shape. Finally, realistic considerations like sensitivity to noise will be investigated. The end result will be taken to industrial facilities for construction and marketing.

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Topic#: 91-045 ID#: 92ES3-204  
Office: ES3  
Contract #: F30602-92-C-0167  
PI: Dr. Lawrence H. Domash

Title: Active Holographic Interconnects for Interfacing Optical Volume Storage

Abstract: Emerging holographic data storage systems will require several types of electrically programmed optical interconnect devices. Phase I research demonstrated the feasibility of a new family of electrically controlled diffractive optical elements based on liquid crystal infused photopolymer holograms. Electrically switching the diffractive power of holographic elements in 3D stack geometries provides a unified approach to interconnect devices such as laser beamlet array generators, dynamic lenses and fiber optic switches. High diffraction efficiency combined with electrical control opens a range of performance not possible with traditional fixed holograms or spatial light modulators. Phase II research will improve the polymer/liquid crystal interface chemistry to improve optical throughput, increase switching speed, and lower the operating voltage. Cycle life, temperature dependence and environmental stability will also be determined. At the end of Phase II, premanufacturing prototypes will be available for three major classes of optical interconnect devices.

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Topic#: 91-113 ID#: 92WLS-302  
Office: WL5  
Contract #: F33615-92-C-5982  
PI: Dr. Mark A Drury

Title: In-Situ Fiber Optic FTIR Process Monitor for Advanced Composites

Abstract: Foster-Miller proposes to perfect in Phase II a fiber optic based Fourier Transform Infrared (FTIR) process monitor for carbon-carbon and high temperature polyamide composite structures. A dedicated system capable of monitoring low temperature autoclave cure and high temperature furnace pyrolysis will be designed, fabricated, tested and delivered to the Air Force. The system will be capable of acquiring spectra, analyzing data, and communicating results to another computer in real time. This system will be capable of being used by the Air Force to assist in the development of a Smart Manufacturing System (SMS) for carbon-carbon structures which will be capable of producing carbon-carbon structures with greatly shortened processing times, higher yields and greater reproductibility. The feasibility program just completed in Phase I indicates that it is possible to develop this Smart Manufacturing System.

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Topic#: 91-166 ID#: 91XPX-863  
Office: PL1  
Contract #: F29601-92-C-0035  
PI: DR. WAYNE S. HILL

Title: Measurement of Fluid Quality in Microgravity Using Ultrasound

Abstract: While two-phase flow systems will be used increasingly in military and civilian spacecraft, their use is hampered by the difficulty of determining the quality of determining the quality of the flow with existing measurement techniques. The Phase I effort demonstrated the feasibility of determining the quality of a two-phase flow using ultrasonic film thickness measurement. The proposed Phase II effort will examine the technical issues that must be addressed before a practical ultrasonic two-phase flow instrument can be developed. These issues include refinement of the choice of ultrasonic hardware, transducer placement,

## AIR FORCE SBIR PHASE II AWARDS

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and method of data analysis. Ultrasonic thickness data will be obtained in ground and KC-135 flight testing using a flight system developed by Foster-Miller in a previous Phase II SBIR program. The resulting data will be used to correlate two-phase flow behaviors with ultrasonic thickness measurement data for a variety of system acceleration environments, including a demonstration of rapid data analysis. Potential Phase III application of the resulting technology will be pursued throughout the Phase II effort at no cost to the program.

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Topic#: 91-198 ID#: 91ASD-699  
Office: WL9  
Contract #: F33657-92-C-2179  
PI: JOSEPH S. BOYCE

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

Abstract: In the Phase I program, Foster-Miller demonstrated a brazed joint concept for 2-D ACC-4 carbon/carbon (C/C) composites that appears to be uniquely suited for the requirements of actively cooled leading edge structures. The attachment scheme involves a refractory metal brazed joint that is integrally reinforced by transverse (z-direction) pins. The z-direction pins reinforce both the joint interface and the adjacent 2-D C/C material. Phase I highlights included joint that exhibited shear strengths 3X greater than the strength of the parent 2-D ACC-4 C/C. In a parallel C/C program (Contract F33657-90-C-2050), Foster-Miller has demonstrated the use of high thermal conductivity z-direction fibers to increase the through-thickness conductivity of 2-D C/C by 50%. Therefore, the joining process is an "enabling technology" for actively cooled hypersonic vehicle structures - it simultaneously addresses the need for high temperature strength while compensating for the fundamental liabilities of 2-D C/C, i.e., low transverse strength and thermal conductivity. In the Phase II program, after further refinement, the process will be demonstrated on a sub-scale actively cooled skin panel comprised of Mo-Re alloy tubing on a 2-D ACC-4 C/C plate. The panel will be subjected to an aggressive thermal cycling test in a custom cryogenically cooled radiant heating test cell.

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BEAVERCREEK, OH 45433  
Phone: (513) 429-3302

Topic#: 90-073 ID#: 39830  
Office: XRX  
Contract #:  
PI: RUSS CRAMER

Title: Innovative Vulnerability Assessment Techniques for Conceptual Aircraft

Abstract: The overall technical objective is to further evolve the Phase I software design and to develop tools to rapidly estimate the vulnerabilities of conceptual aircraft for a range of non-nuclear weapons. This includes continued development of these tools and implementation of the design. The work plan consists of three tasks. Each task contains subtasks that focus on the software development of the individual assessment tools defined in Phase I. The technical approach for the software development follows the waterfall model. Beginning with the product design, each assessment tool utilizes the same approach, stepping through the detailed design, code, unit testing, integration testing, implementation, demonstration, training and documentation. The tools to be developed focus on various portions of the vulnerability analysis process. These areas are 1) automating the manual vulnerability analysis steps for kinetic energy and high explosive projectiles, 2) automating the building of target descriptions for the vulnerability simulations, 3) develop databases for Pk/h, blast, ABDR and thrust data and develop the tools necessary to manipulate the databases and 4) evaluating critical components including FMEAs and DMEAs. All of the tools to be developed will be compatible with existing simulations within ASC/XRM and represent an integrated tool set that an analyst can use to rapidly estimate the vulnerability of conceptual aircraft designs and evaluate these designs consistently and to a level of fidelity they are sensitive to key features of this design.

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

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

Abstract: The proposed Phase II project will provide both a design and an implementation plan for a cost analysis methodology automated within a user-friendly computer workstation environment. The tools available will be capable of assessing the impact

## AIR FORCE SBIR PHASE II AWARDS

that DoD budgets and force structure decisions have on system costs and system affordability. At the opposite end of the spectrum tools will be available that can generate detailed unit costs with a complete component cost build-up when provided various levels of system design data. The costing capability will also enable the design engineer 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 cost associated with innovating new technologies into advance weapon systems. Completion of Phase II ensures that all aspects of the problem have been designed and prototyped to minimize risk, so that a Phase III system implementation can be expected.

GILLIAM-MCKINLEY ENGINEERING CONSULTANTS  
5737 BELLEVUE AVENUE  
LA JOLLA, CA 92037  
Phone: (619) 459-7624

Topic#: 91-184 ID#: 91BMO-004  
Office: PL6  
Contract #: F04704-93-C-  
PI: THOMAS K. MCKINLEY

Title: Icbm Design Options for the Future

Abstract: With the apparent end of the cold war, new questions regarding ICBM requirements, missions and designs have arisen. The present ICBM threat consists of a decaying former Soviet force with an uncertain future. Concerns for the future include the possibility of a revitalized Russian nuclear force as well as a potential threat from emerging members of the nuclear weapons community. In light of these developments, U.S. ICBM research and development activities should be re-focused on evaluating the existing ICBM force for future missions, on establishing the cost effectiveness of upgrading existing missile systems, and on assessing new concepts to deal with future missions. The ICBM design methodology required to explore these new issues was developed and refined in the Phase I program. The methodology will be used in this second phase to evaluate alternative ICBM concepts for delivering both nuclear and non-nuclear payloads. Design considerations will include post cold war missions, new missile concepts, modifications of existing missiles, mission flexibility, cost effectiveness, reliability, maintainability and survivability. The Minuteman III ICBM will serve as the point-of-departure for the investigation. The end product will be a spectrum of ICBM preliminary designs of varying cost and mission capability that will display to system planners, engineers and designers the options that are available.

GINER, INC.  
14 SPRING STREET  
WALTHAM, MA 02254  
Phone: (617) 899-7270

Topic#: 91-143 ID#: 91PAH-687  
Office: PL5  
Contract #: F29601-93-C-0020  
PI: JOHN A. KOSEK, PH.D.

Title: Development of a Novel Electrochemical Hydrazine Sensor

Abstract: The feasibility of detecting 10ppb of hydrazine species with an anion-exchange solid polymer electrolyte membrane electrochemical sensor cell operating in a unique potentiodynamic mode was established in a Phase I program. A breadboard sensor cell and the necessary electronic circuitry has demonstrated a linear response to hydrazine species in air, with sufficient sensitivity to detect 10-ppb hydrazine. The time required to achieve the maximum response was 2 to 3 minutes, well within the desired 10 minute period. A cost analysis also demonstrated the feasibility of the sensor cell for use in an inexpensive, lightweight, compact instrument for monitoring personal exposure to Hz; the manufacturing cost of the sensor including a microprocessor for sensor cell operation and data storage is projected to be less than \$200. During the proposed Phase II program, the sensor cell design and potentiodynamic operating parameters will be optimized for detection of Hz species. Complete instruments will be designed, built, evaluated and delivered to the Air Force for field testing. The instruments, specific for Hz species, will be fully temperature compensated, portable, lightweight and low cost.

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Topic#: 91-003 ID#: 91MNP-071  
Office: WLO  
Contract #: F08630-92-C-0051  
PI: MR LEONARD REYNOLDS

Title: Microwave Monolithic Integrated Circuit Technology for Air Target Fuzing

Abstract: The MMIC technology provides means of reducing size and cost of microwave sensors and, thus, allows the flexibility of sensor configurations hitherto deemed impractical and/or unaffordable. In Phase I of this program, Hittite Microwave

## AIR FORCE SBIR PHASE II AWARDS

corporation analyzed the concept of using MMIC-based sensors for autonomous direction sensing, and showed the feasibility of the concept. Based on the analysis of established encounter scenario, system requirements are defined in terms of specifications for the MMIC specifications for the MMIC chip, antenna, and the signal processor. These requirements are, then, translated into a practical approach to the design of demonstration hardware. This Phase II proposal outlines an approach to demonstrate the effectiveness of the autonomous quadrant target detection device (TDD). Each quadrant contains its own FR transmit/receive chip, one antenna and a dedicated processor. Design approaches for these components of the sensor are presented and the proposed demonstration vehicle is described. The test plan includes laboratory test of ranging functions, and assessment of the mutual interference effects unique to thesis sensor approach. The MMIC - based sensor concept proposes for this application will lead to demonstration of the size/cost /reliability advantages of the technology and the practicality of the autonomous multi-sensor TDD concept. Option tasks are proposed for (1) custom design of an antenna for their application, (2) testing of the TDD demonstration model in a simulated range facility and (3) a demonstration of an interference rejection technique for FM-CW fuze sensor.

### HITTITE MICROWAVE CORP.

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Phone: (617) 933-7267

Topic#: 91-035 ID#: 92ES3-203

Office: ES3  
Contract #: F19628-91-C-0137  
PI: Peter J. Katzin

#### Title: Active Programmable Microwave Directional Coupler

Abstract: In the phased-array radars, it is often desirable to generate two channels with independently controllable weight to obtain monopulse operation. Also there is a need to minimize T/R module size, power dissipation, and the complexity of the rf feed network. This latter objective can be accomplished by incorporating a programmable directional coupler into the T/R module so that the monopulse sum channel output can also be used for feeding the transmitter signal to the T/R module. Our Phase I study has shown that a programmable S-band directional coupler function, with better than 20 dB directivity, 30 dB of gain control range, and less than 1.5 phase distortion can be implemented in compact MMIC form, using novel planar transformer layout and phase compensation circuit configuration. As part of our proposed Phase II effort, we will fabricate and evaluate monolithic programmable coupler and attenuator circuits based on our Phase I studies. As an option to this Phase II effort, we propose to demonstrate a self-adjusting, dynamic matching circuit concept using available IC components. This circuit would be designed to compensate automatically for antenna element impedance variations as the array's scan angle and/or operating frequency is changed, thereby reducing losses due to rf power reflected from the antenna. High power operation will be obtained by using a stacked-FET switch configuration developed at Hittite. FETs allow broader operating bandwidth and can be controlled by simpler driver circuitry than that required for a high-power PIN-based circuit.

### INRAD, INC.

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

Topic#: 91-058 ID#: 91CEL-131

Office: AFCESA  
Contract #: F08635-92-C-0101  
PI: DR. ZHENYU ZHANG

#### Title: Photocatalytic Degradation of Chlorinated and Nonchlorinated Organics in Water

Abstract: In Phase I, a novel TiO<sub>2</sub> membrane was developed that exhibited high photochemical conversion of TCE and benzene to innocuous, non-contaminating products. A Phase II program is proposed to (1) optimize the membrane composition with respect to photochemical conversion efficiency, stability, and strength; (2) design, construct, and test, a prototype photochemical reactor using the optimized membrane composition and configuration; (3) based on experimental results obtained with the prototype reactor to design and build a pilot plant to process 30 to 50 gallons per minute of typical contaminated groundwater; and (4) to test the pilot plant at a selected Air Force contaminated groundwater site to demonstrate effective removal of TCE and benzene contaminants.

### INTEGRATED SENSORS, INC.

255 GENESEE STREET  
UTICA, NY 13501  
Phone: (315) 798-1377

Topic#: 91-012 ID#: 91MNP-146

Office: WL0  
Contract #: F08630-92-C-0052  
PI: MR JEFFREY C. BRANDSTADT

#### Title: Infrared/radio Frequency Sensor Data Fusion

## AIR FORCE SBIR PHASE II AWARDS

**Abstract:** The proposed Phase II program will provide a deeper understand of raw data fusion mechanisms through both analysis and real data demonstrations. The analysis will quantify under what conditions fusion is beneficial, estimate performance improvements, and investigate the effects of non optimal sensor suite configurations. The program will take advantage of a multisensor suite, such as the one in the tower at Eglin AFB or similar, for the collection of raw data necessary for fusion evaluation. A demonstration of the algorithm with raw data is proposed to confirm the analytical predictions, and to plan an eventual Phase II operational evaluation.

INTELLIGENT MACHINE TECH. CORP.  
2110 VALLEYCREST DRIVE  
ARLINGTON, TX 76013  
Phone: (817) 429-3615

Topic#: 91-001 ID#: 91MNP-035  
Office: WLO  
Contract #: FO8630-92-C-0062  
PI: MR JAMES D. BILLINGSLEY

**Title:** Smart Autonomous Guidance Technology Study

**Abstract:** There is a growing need form smart autonomous air delivery of conventional munitions. Precision all-weather autonomous guidance is a fundamental building block for such systems. This project will develop an integrated imaging-inertial guidance concept that combines imagine 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 help avoid detection and interception. 1. Passive millimeter wave imaging sensor components 2. Low-cost inertial navigation components 3. A multi-processor computer with and object-oriented operating system and realtime software for signal processing, navigation and mission management 4. Binocular and quadocular scene tracking, ranging and mapping algorithms 5. An earth model containing a special sea level reference, local terrain election data, gravity vector, calendar time and time of day.

L & W RESEARCH, INC.  
Unit J, 121 North Plains Industrial Rd.  
Wallingford, CT 06492  
Phone: (203) 949-0142

Topic#: 91-116 ID#: 91WL5-311  
Office: WL/ML  
Contract #: F33615-91C-5629  
PI: Paul H. Leek PhD.

**Title:** One MeV Precision X-Ray Generator

**Abstract:** This proposal will build a prototype high energy x-ray generator. The output will be Constant Potential (CP) at a variable energy up to one million volts (1 MeV). The anode will be removable and will be at ground potential. This will permit the use of different styles of anode. This generator will fill a gap in the range of currently available X-ray generators. This unit will have considerably greater power and energy than a 420 kV generator and a constant output, unlike the pulses from a linear accelerator. The X-ray output will be suitable for more powerful CT scanners, Backscatter imageries and general fluoroscopic imaging. The unit will also be capable of using a much finer electron beam focal spot. This will enable more accurate "Microfocus" operation at much higher energies than are currently available.

LASER PHOTONICS TECHNOLOGY, INC.  
1576 Sweet Home Rd  
Amherst, NY 14228  
Phone: (716) 688-8251

Topic#: 91-190 ID#: 91OSR-355  
Office: AFOSR  
Contract #: F49620-92-C-0061  
PI: Ryszard Burzynski

**Title:** Photorefractive Inorganic/Organic Materials Prepared by a Novel Sol-Gel Process

**Abstract:** The present proposal offers to develop an inexpensive, wavelength tunable and easily processed photorefractive material that is a composite of inorganic glasses and organic molecules. These composites will be prepared using a unique moderate temperature sol-gel process developed by the proposing firm in Phase I. These types of composites have been previously shown to have excellent optical quality, mechanical properties superior to all-organic systems, and an ability to be easily processed into thin films, bulk materials and even fibers. Present photorefractive materials are almost exclusively inorganic crystals which are not easily processed, are normally expensive and have restricted operational properties. It is the goal of this effort to combine the unique properties of selected components including: (1) compounds having second order NLO behavior, (2) sensitizer (for wavelength selectibility), (3) charge transporters and traps. The ability to select particular components based upon their solid-state properties is an enormous advantage in creating a customized material. These preparative methods will be evaluated with respect to increasing the scale of production. These materials will be prepared and

## AIR FORCE SBIR PHASE II AWARDS

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tested in an iterative approach culminating in one or more optimized systems that will be prepared for military and commercial applications.

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111 EAST 27TH STREET, SUITE 204  
BRYAN, TX 77803  
Phone: (409) 822-3149

Topic#: 91-058 ID#: 91CEL-111  
Office: AFCESA  
Contract #: F08635-92-C-0086  
PI: OLIVER J. MURPHY

Title: A Novel Advanced Zonation Process for the Destruction of Chlorinated and Non-Chlorinated Organics

Abstract: An electrochemical ozone generation/UV oxidation process was successfully used for decomposing hazardous organics in contaminated water. Lynntech, Inc., has developed and demonstrated that an innovative electrochemical process can be employed to produce high concentrations of ozone using water as the source material. Water samples containing 50ppm benzene and trichloroethylene were effectively treated, volatile organic release was minimized and highly favorable oxidation kinetics were obtained during laboratory tests. Using a bench-scale electrochemical reactor, a well-documented technical foundation was established for membrane and electrode assemblies, electrocatalyst deposition, electrode/solid electrolyte interfaces, current efficiency and other key reactor parameters. By combining ozone and UV radiation, the resulting Advanced Oxidation Process has the potential for being highly cost-competitive when compared with conventional air-feed corona-discharge systems. Using the broad-based positive results of the Phase I research, Lynntech has prepared a Phase II proposal for: (i) scale-up of the electrochemical ozone generator; (ii) modelling, design and scale-up of an advanced (packed bed) UV reactor; (iii) integration and testing of the scaled-up electrochemical ozone generator/advanced UV reactor, and (iv) assembly and testing of a pilot-scale demonstration unit at a field test site.

M. L. ENERGIA, INC.  
P.O. BOX 1468  
PRINCETON, NJ 08542  
Phone: (609) 799-7970

Topic#: 91-057 ID#: 91CEL-103  
Office: AFCESA  
Contract #: F08635-92-C-0085  
PI: DR MOSHE LAVID

Title: Disposal of Chlorofluorocarbons and Halons

Abstract: Chlorofluorocarbons (CFCs) 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. To date, no suitable destruction or disposal technology has been developed. Under a Phase I feasibility study ENERGIA has pioneered a unique technology to the disposal problem. CFCs and Halons are treated by an innovative process, designated Photo-Thermal Hydrodehalogenation (PTH). Products of the treatment are hydrofluorocarbons (HFCs), hydrochlorofluorocarbons (HCFCs), and per-fluorocarbons (FCs). They all have much reduced or zero Ozone Depletion Potential (ODP) and are of high value as alternatives to CFCs and Halons. Phase II is a comprehensive R&D effort with the ultimate goal to develop the PTH technology into a pilot-scale prototype unit. This prototype unit will be available for on-site demonstration, testing and follow-on commercialization under a joint venture with a major chemical company.

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KING OF PRUSSIA, PA 19406  
Phone: (215) 279-2340

Topic#: 91-013 ID#: 91MNP-152  
Office: WLO  
Contract #: F08630-92-C-0058  
PI: MR ROBERT TAYLOR

Title: Surfactant for PBX & TNT Based Systems

Abstract: The primary objective of this Phase II project is to develop emulsifiers for composition D-2 Mill-c-1816 A Wax, desensitizing to replace nitrocellulose. Composition D-2 will then no longer have to be classed and handled as an explosive. This will eliminate a number of problems experienced with Composition D-2 because of nitrocellulose. These include gross nonuniformity of nitrocellulose in the wax, resulting to varying viscosity and casting defects, and plating out on the mix kettle wall which is difficult to remove. Recently, nitrocellulose has been found to be responsible for gassing. Emulsifiers of at least two different chemical types will be developed for three types of waxed microcrystalline, synthetic polyethylene waxes and montan waxes. A second objective is to develop a reasonable priced desensitizing substitute that would provide a more

AIR FORCE SBIR PHASE II AWARDS

consisted quality and reliable long term supply than wax.

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READING, MA 01867  
Phone: (617) 942-2666

Topic#: 91-156 ID#: 91PAA-793  
Office: PL4  
Contract #: F29601-92-C-0104  
PI: TRIVENI N. UPADHYAY

Title: Reconfigurable GPS Receiver for Space Application

Abstract: The role of GPS in developing a low-cost spacecraft navigation and pointing system for orbit determination, surveillance, and rendezvous and docking is now being recognized within the DoD. However, the high cost and limited capability of the current GPS receivers have discouraged broad incorporation of the GPS technology in space missions. This trend must be reversed in order to make this technology accessible to both military and civilian applications. The Phase II GPS receiver demonstration, proposed herein, enlarges the performance envelope of a space GPS receiver by providing a real-time reconfiguration capability to address different missions and contingencies. This approach, by delegating application specific features to software, permits realization of a high performance receiver, optimized for the specific application, at low cost. This approach was shown to be applicable to several Air Force missions analyzed in the Phase I study. The performance of the attitude estimation algorithms and software reconfiguration methodology will be evaluated and validated in the Phase II program using the demonstration hardware/software and real GPS data.

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Phone: (415) 328-2228

Topic#: 91-057 ID#: 91CEL-092  
Office: AFCESA  
Contract #: F08635-92-C-0087  
PI: JURGEN KASCHEMEKAT

Title: Recovery of CFCs and Halons

Abstract: Halon 1301 is used as a fire extinguishing agent in a number of critical Air Force applications. However, since halons are ozone depleters, production is being rapidly phased out under the Montreal Protocol. The Air Force can reduce halon emissions and extend the useful life of its current Halon 1301 stocks by using a recycle and reuse program. This requires the development of an efficient, low-cost Halon 1301 transfer system. The principal problem hindering the development of this type of system is the need to efficiently separate Halon 1301 from the nitrogen used to pressurize Halon 1301 extinguishers. This proposal describes the design, development, construction, and delivery of a precommercial system based on a nitrogen/halon 1301 separating membrane. Membranes that are 25 times more permeable to nitrogen than Halon 1301 have been developed. The membrane will be used in a Halon 1301 recycle and recovery unit able to eliminate loss of halon with the nitrogen vent stream. The ability of the system to recover Halon 1211 and the new materials being considered as replacements for Halon 1301 and Halon 1211 will also be determined. Because of the urgency of the Air Force's halon control problems, a 10-month accelerated program is proposed.

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Topic#: 91-187 ID#: 91BMO-023  
Office: PL6  
Contract #: F04704-92-C-0018  
PI: Dr. Hans Wijmans

Title: Cleaning Equipment Vapor Emission Control System

Abstract: The construction of a prototype membrane-based solvent vapor recovery system, to be used with cleaning equipment such as spray booths and ultrasonic cleaners, is proposed. The work focuses on a novel class of cleaning solvents: fluorocarbons. Fluorocarbons are environmentally safe cleaning solvents that could find wide use in the production of micromechanical devices such as inertial-guidance system gyros. However, for the use of these very expensive (\$10-\$60/lb) solvents to be economically feasible, an effective means to reduce solvent losses must be developed. Almost all solvent losses during cleaning operations occur as vapor emissions to the atmosphere. The Phase I work showed that membrane vapor recovery systems efficiently remove and recover fluorocarbon emissions from air. The membrane systems are extremely economical, with an operating cost per pound of recovered solvent of only 1 - 5% of the value of the solvent. The proposed prototype system will be operated in the laboratory in conjunction with a spray-booth cleaning machine. Using the experience obtained, a final system design will be developed and demonstration systems will be built and delivered to the Air Force for the purpose of field testing by the ASCONS

## AIR FORCE SBIR PHASE II AWARDS

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and AGMC. The problem of solvent losses during cleaning operations is not only of concern to the DoD but is also common throughout U.S. industry. A system to control solvent emission and to recover expensive solvents will be widely adopted because the system will be effective for a range of solvents, as well as the fluorocarbons.

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Topic#: 89-252 ID#: 89WL9-003  
Office: WL9  
Contract #: F33657-92-C-2129  
PI:

Title: A Holographic Interferometer Spectrometer for Hypersonic Flow Diagnostics

Abstract: Ground testing of the National Aerospace Plane is encountering serious obstacles because of the inability of existing instrumentation to fulfill the diagnostics requirement. This is a Phase II proposal to develop an advanced holographic diagnostics system that will provide important support for such testing by improving sensitivity and information content in holography data by orders of magnitude over current systems. The resulting system will become a powerful diagnostic tool for locating shock waves, observing mixing, analyzing flow in the boundary layers, and measuring gas density. The Phase I research produced and demonstrated new and innovative techniques that significantly extend the sensitivity and data collecting power of holography in ways that are critical for hypersonic testing such as that required by the National Aerospace Plane (NASP) program. NASP testing requires the use of pulsed facilities with little time allowed for collecting data. Innovations include methods for recording more data per test so that many parameters can be recorded simultaneously. Additionally, the potential is shown for simultaneously recording spectroscopic properties of the gas holographically in a way that may be superior to laser induced fluorescence methods.

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Topic#: 91-009 ID#: 91MNP-117  
Office: WLO  
Contract #: F08630-92-C-0081  
PI: DR CECIL F. HESS

Title: Miniaturized Particle Characterization System

Abstract: This proposal describes a Phase II SBIR program to develop a system to measure the spatial and temporal distributions of particle size, liquid water content, and velocity at the inlet of advanced aircraft. The system would consist of a miniaturized and regged probe up to about 300 m/s, and liquid water content up to 10 mg/m. This extended particle size range will be possible for the first time because of an innovative particle sizing concept which measures the refraction and reflection peaks of droplets crossing a very thin probe volume. Analytical and experimental research conducted during Phase I demonstrated the feasibility of this new concept as well as the ability to implement it in a miniaturized fiber optic probe. In Phase II we will address the issues of window wetting and low temperature environment, and will design, build and test a miniaturized particle sizing probe. The algorithms associated with the new particle sizing concept will be implemented in high speed electronic systems. The program will culminate with the installation and demonstration of a system prototype at the Climatic Lab of Eglin AFB, as well as the availability of a system prototype for commercial application.

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Topic#: 91-015 ID#: 91MNP-159  
Office: WLO  
Contract #:  
PI: DR JAMES D. TROLINGER

Title: Development OF AN INTERFEROMETRY/TOMOGRAPHY DATA REDUCTION SYSTEM

Abstract: This is a Phase II proposal to design, construct, and deliver an interferogram reduction system which allows the comparison and integration of three-dimensional experimental interferometric data with that derived from CFC 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 are needed to extract data from the interferograms faster and more accurately and to determine three-dimensional quantities using tomography. This project will build upon the phase I effort which evaluated available algorithms, software and hardware. The Phase I study has evaluated available algorithms, software and hardware, the Phase I study has evaluated the specific optical diagnostics requirement for the Eglin AFB Aeroballistics range and has shown a clear path for satisfying them. A versatile

## AIR FORCE SBIR PHASE II AWARDS

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model of anticipated flow fields was developed and used to test tomography codes. This led to a preliminary specification of the tomography recording and reduction requirements.

### METROLASER

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Phone: (714) 553-0688

Title: Optically Smart Surfaces for Wind Tunnel Measurements

Abstract: This is a Phase II proposal to develop optically smart surfaces for aerodynamic measurement application. The Phase I research established the feasibility of incorporating an optical sensor in a thin holographic coating placed on an arbitrary metallic surface. These initial sensor coatings which comprise a layer of photoresist and an overlayer of aluminum are used to holographically store a complex optical instrument which is actuated by an impinging "address" beam. Information on model strain, temperature, pressure, flow field velocity, skin friction, and turbulence can be impressed by the sensor upon the address beam before it is returned to a receiver. The Phase I study established theoretical feasibility for optically smart surfaces through a detailed analysis. This was followed by the development of manufacturing techniques, the construction, and successful experimental testing of a variety of smart surfaces. The Phase II effort will move these sensors from the basic research laboratory to a wind tunnel environment. Holographic sensors to measure velocity and strain/expansion will be designed, constructed and tested in a transonic wind tunnel which is located in the University of California at Irvine Department of Mechanical Engineering. Efforts will be made to improve the sensor ruggedness by developing techniques to etch the sensor into the model surface itself as opposed to using thin coatings.

Topic#: 91-101

ID#: 91WL4-020

Office: WL4

Contract #:

PI: Dr James D. Trolinger

### MISSION RESEARCH CORP.

8560 Cinderbed Road, Suite 700

Newington, VA 22122

Phone: (703) 339-6500

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

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/cm<sup>2</sup> 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. A prototype sensor with performance exceeding these specifications was designed, fabricated, and tested during Phase I. During Phase II, we will develop the Phase I prototype into a fieldable unit and design and fabricate electronics modules for the sensor. The complete, self-contained monitor system will be tested in our laboratory and in field tests at a government site. The test results and a market survey will be used to design an optimized system which will be commercialized during Phase III. The monitor can be configured to provide a variety of information, e.g., an audible warning when a threshold level is exceeded or a measure of the average and peak current levels detected over a given period of time.

Topic#: 91-064

ID#: 93AL -001

Office: AL

Contract #: F41624-92-C-9005

PI: Pasour, John

### MTL SYSTEMS, INC.

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Phone: (513) 426-3111

Title: MULTI-THREAT ENGAGEMENT SIMULATOR (MTES)

Abstract: The objective of the MTES Phase II effort is to design, implement, test, and validate a Multi-Threat Engagement Simulator (MTES). The MTES is to be capable of simulating medium-fidelity threat/Countermeasure (CM) interactions involving up to 500 simulated players, at a maximum update rate of 100 Hz. Feasibility was established in Phase I through quantified analysis, simulation, and demonstration of preliminary design concepts. Phase I design concepts focused upon a

Topic#: 91-093

ID#: 91WAA-054

Office: WL2

Contract #: F33615-93-C-1200

PI: Deborah K. Park

AIR FORCE SBIR PHASE II AWARDS

distributed processing architecture, general purpose interfaces with specific interface modules for particular integrations, and the use of CM Characterization, a robust and proven threat/CM modeling technique. The Phase II program will include: (1) final design, (2) distributed, processing system procurement, (3) implementation as a stand-alone system, (4) implementation as an integrated component of the Integrated Defensive Avionics Laboratory (IDAL), and (5) system testing, validation, and demonstration both as a stand-alone and integrated system.

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Topic#: 91-110 ID#: 91WKT-024  
Office: WL4  
Contract #: F33615-92-C-3614  
PI: John H. Harshbarger

Title: Rapid Flight Line Detection of Degraded Electronic Cockpit Instruments

Abstract: The Phase I effort resulted in definition of a concept for detection of gradual degradation in electronic cockpit displays. This concept was validated by laboratory experimentation. Specific hardware design was addressed. Phase II effort is to encompass the final design, construction, test and evaluation of the devices as envisioned. This includes equipment in two categories: Type A configured for easy, convenient assessment of cockpit displays while in the aircraft, at the flightline, and Type B for very complete analysis of display performance for design, manufacturing, procurement, and maintenance of any technology. These devices will be fabricated from advanced but readily available commercial componentry, and will employ standard digital techniques and software. The techniques developed can serve as the basis for an industry wide standard for evaluation of display performance.

NAVSYS CORP.  
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Topic#: 91-156 ID#: 91PAA-800  
Office: PL4  
Contract #: F19628-92-C-0167  
PI: Alison K. Brown

Title: Advanced GPS Receiver for Space Applications

Abstract: An innovative GPS receiver architecture is described in this proposal for an Advanced GPS Receiver (AGR) suitable for space applications. The AGR design provides high rate data for guidance, high precision navigation and attitude determination. The AGR can be reconfigured through software changes to serve a variety of applications. The AGR design improves the receiver performance and reliability through the use of a Digital Front-End (DFE) which directly samples the L-band signals. This eliminates the inter-channel non-linearities and phase variations that have to be calibrated in conventional receiver designs. The DFE digitally filters the sampled broadband signals to provide L1 and L2 digital data for processing. The DFE can be reprogrammed to track other frequencies, and can even be designed to provide GPS and GLONASS measurements by changing the DFE front-end filter specification. The remainder of the GPS signal processing is performed in software using a high speed DSP microcomputer assisted by a special purpose Correlation Accelerator chip developed by NAVSYS. Enhanced signal processing algorithms will be implemented in the AGR that provide C/A pseudo-ranges to a precision of 0.1 meters and carrier phase to better than 1mm. Under the Phase II contract, two prototype AGRs will be fabricated and tested.

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Topic#: 91-173 ID#: 91WSM-888  
Office: PL1  
Contract #: F04684-92-C-0025  
PI: ALISON K. BROWN

Title: GPS Rawinsonde Development

Abstract: The Meteorological Sounding System (MSS) used by the National Ranges uses a ground transmitting ranging system for space positioning location of the radiosondes instrument. Since these radiosondes use a broad band receiver, multiple radiosondes deployment and operation in a given area is not feasible. These ranging radiosondes are also highly 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 operations 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, the TIDGET.

AIR FORCE SBIR PHASE II AWARDS

The TIDGET sensor was developed with in-house funds for low-cost tracking applications and can be packaged in the current radiosonde housing. The GPS data from the TIDGET is relayed to the GPS Environmental Sounding Station data, that is, pressure, temperature, humidity, and winds, is processed in the normal manner. The proposed GPS rawinsonde system has the capability of tracking six radiosondes simultaneously. The GESS ground station size and cost has been significantly reduced over existing equipment, providing the capability for a portable system.

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Topic#: 91-169 ID#: 91XP-878  
Office: PL1  
Contract #: F29601-92-C-0083  
PI: DR. RICHARD J. ADLER

Title: Multi-Wave Cerenkov Generator Development

Abstract: We propose to perform a detailed investigation of multi-wave Cerenkov (MWC) microwave generators with parameters suitable for Air Force missions in this Phase II experiment. This program utilizes the understanding of multi-wave generators which we gained in Phase I. In Phase I we demonstrated that the distance between the two slow wave structures is critical to the performance of the overall device and can be used to tune the frequency, and that there exist modes which span the combined structure which provide for optimum interaction. There are three elements in this program: a major experiment with the objective of generating 5 GW of 7 to 10 GHz radiation for up to 0.5 microseconds, a theoretical program to support the experiment, and further experiments in the first 6 months of the program designed to develop more detailed experimental data on multi-wave structures. We have limited the pulse power system voltage to less than 600KV due to weight and shielding considerations, and we find that within this constraint, the optimum design for 7 to 10 GHz radiation utilizes a 30cm diameter, 1.5 cm thick, 30 KA annular beam in a nominal 37 cm diameter structure. The large beam size make this high current feasible at a field of only 2 kG, minimizing the field energy required. We will investigate both Cerenkov and Diffracted wave generators and we will test structures with higher order modes (TM 02) in a cylindrical waveguide, and lower order modes (TM 02) in a coaxial waveguide. Our objectives will be to optimize this system for peak power, while measuring the frequency output and spatial microwave energy dependence. The spacing between the two structures will be externally variable for rapid data acquisition. We believe that this program will lead to significant experimental progress on the multi-wave concept.

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Topic#: 91-046 ID#: 92FS3-205  
Office: FS3  
Contract #: F30602-92-C-0178  
PI: Robert F. Kalman

Title: Optical Interconnections using Semiconductor Optical Amplifiers

Abstract: This proposal addresses the integration, packaging, and system integration of optical interconnects based on space division switches using semiconductor optical amplifiers (SOAs). Low cost, compact optical interconnects are needed at all levels of the interconnection hierarchy, from computer-to-computer to board-to-board to chip-to-chip. The proposed program includes multi-phased development of a monolithic switch chip, development of a package for the switch chip, packaging of several chips, development of a closed-loop polarization controller, and evaluation of the completed system with a variety of digital and analog signals. The anticipated result of this program will be a compact, low cost optical interconnect switch module of size 4x4 or 8x8 operating at 860 nm which includes a monolithically-integrated SOA crossbar switch chip and a rugged package incorporating low-loss, multi-fiber interfaces to the monolithic chip. The Phase II program extends the Phase I effort, which demonstrated the feasibility of a low-cost, flexible packaging technique for prototype discrete devices. The resulting switch module will demonstrate a higher level of integration, greatly improved system performance, an order of magnitude reduction in cost, and over two orders of magnitude reduction in size compared to existing switches.

OPTO-KNOWLEDGE SYSTEMS, INC.  
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Topic#: 91-001 ID#: 91MNP043  
Office: W10  
Contract #: FO8630-92-C-0057  
PI: DR NAHUM GAT

Title: Intelligent Missile Seeker

Abstract: A feasibility assessment for the development of an electro-optical Intelligent Missile Seeker (IMS) using state-of-the-art

AIR FORCE SBIR PHASE II AWARDS

technology was conducted under a Phase I study. The concept which evolved is based on three major elements. These are: (a) the sensor; and imaging spectrometer consisting of an all-reflective optics telescope, a medium resolution grating spectrometer, and a visible/IR hybrid focal plane array, (b) the control system; a real-time, interrupt-drive, asynchronous rule-based expert-system operating with concurrent tasking, and (c) the discrimination algorithms which operate in the hyper-spectral transform domain and provide target/decoy discrimination and terminal aim-point selection. A conceptual design of the sensor, and the architecture of the control system were developed. The hyperspectral discrimination algorithms have been formulated and tested with 'synthetic' signature data.

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Topic#: 91-025 ID#: 91ESD-610  
Office: ESD  
Contract #: F19628-93-C-0021  
PI: THOMAS HORSKY

Title: High Definition Membrane Projection Display

Abstract: Large screen projection display systems for command, control, communications, and intelligence applications share many requirements with commercial-market high definition display systems (such as HDTV). In this Phase II program we will develop a new deformable-membrane-mirror-based high definition projection display technology that offers high contrast, high brightness, and high modulation depth in images delivered to a 52 inch or larger diagonal screen. Building on our successful Phase I proof-of-concept program, we expect our Phase II membrane projection display system to provide: 1280x1024 pixels, 2000 modulated on-screen lumens at greater than 20% modulation depth, and a contrast ratio of 300:1. The prototype device that will result from the Phase II program will be 60 Hz frame rate compatible with a 15 Hz update rate that can be readily increased to 60 Hz by employing a higher-current electron gun. The specific device improvements that will be implemented to reach these performance goals include (1) increasing the light valve diameter to 75 mm, (2) improving schlieren readout performance, (3) increasing the pixel density of the light valve, (4) and increasing the electron-gun current to a near-term higher value.

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Topic#: 91-033 ID#: 92ES3-202  
Office: ES3  
Contract #: F30602-92-C-0168  
PI: Dr. Joel Paslaski

Title: High Power Microwave Photodiodes

Abstract: In order to improve system performance, many fiber optic transmission applications are turning to using high optical power (10 mW and more) to reduce noise. High speed photodiodes are rarely used with these powers and usually suffer strong nonlinearity or catastrophic failure if they are. We propose a program to study the mechanisms of failure for three photodiode structures (mesa, planar and waveguide) in order to elucidate design improvements which will permit operation at high power. The goal objective of this program is a packaged photodiode suitable for use up to 20 GHz and for optical powers >40 mW with a quantum efficiency >90%.

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Topic#: 91-147 ID#: 91PAH-732  
Office: PL5  
Contract #: F29601-92-C-0127  
PI: MICHELE HINNRICHS

Title: Infrared Clutter Rejection and Target Identification Sensor System

Abstract: The objective of the Phase I portion of this program was to determine if "Point Multi-Spectral Sensing"(PMSS).could be used to improve sensor clutter rejection performance and target identification for the space surveillance mission. The purpose of the study was to: Determine if a system could be built using the PMSS concept to measure fine infrared and visible spectral structure of known ballistic missiles and reentry vehicle with sufficient signal to noise performs to enable background clutter rejection and target rejection. The proposed Phase I study was: 1)evaluate the surveillance mission scenarios, 2)determine what propagation effects are of concern, 3)evaluate second order effects and artifacts caused by the diffraction lens, 4)and model signal to noise performance for strategic missile defense systems. The objectives of this Phase I program have been accomplished and it has been determined that PMSS can successfully measure the fine spectral signature of ballistic missiles and RV at realistic

## AIR FORCE SBIR PHASE II AWARDS

ranges for clutter rejection and target identification. A brief look at PMSS for the tactical mission was also investigated, for both seeker applications and infrared search and track systems applications. And again it was demonstrated that the PMSS approach will work for the tactical application as well.

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Topic#: 91-186 ID#: 91BMO-016  
Office: PL6  
Contract #: F04704-92-C-0017  
PI: PAULA M. GALLAGHER

Title: Precision Parts Cleaning: freon replacement technology

Abstract: In light of the upcoming deadlines for phaseout of CFCs, safe and environmentally acceptable alternatives are being evaluated. In response to the need for replacement technology, a two-stage cleaning process utilizing supercritical carbon dioxide for removal of oils/fill fluids coupled with fluorocarbon/surfactant detachment of particulates was proposed. The Phase I study concentrated on gyroscope end-housings and the results demonstrated the combined process was at least as effective as CFCs. The Phase II effort focuses on optimization of process parameters and involves a study of the physical and mechanical integrity of the cleaned components and associated materials. Additionally, design and assembly of prototype units for on-site testing and evaluation at the associated contractors' (ASCONS) locations will be carried out for both parts of the cleaning process. It is proposed that the Phase II study be conducted on an accelerated time scale in order to accommodate the ASCONS' schedules; the availability of a prototype unit would assist them in their decision to integrate this technology into the freon replacement program. Based on the results developed in the Phase I effort, it is felt that an accelerated Phase II program is realistic and would be a timely benefit to the aerospace community.

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Topic#: 91-007 ID#: 91MNP-108  
Office: WLO  
Contract #: F08630-92-C-0050  
PI: MR ROGER K. BUNTING

Title: Interpenetrating Polymer Network Capacitors

Abstract: High energy density capacitors based on organic polymeric electrode and electrolyte will be developed. Electronically conductive polymers will be developed for electrode use and ionically conductive polymers for electrolyte. Conditions for material preparation and capacitor fabrication for optimum capacitor performance and stability will be defined.

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Topic#: 91-161 ID#: 91PAA-812  
Office: PL4  
Contract #: F19628-92-C-0196  
PI: DR. WARREN P. MOSKOWITZ

Title: A Transportable Lidar for Density and Temperature Measurements to 110 KM

Abstract: PhotoMetrics proposes to augment the capability of the Phillips Laboratory GPI Mobile Lidar Trailer to measure atmospheric density and temperature profiles to 110 km. The present Rayleigh lidar is capable of measurement to 85km. We will add a sodium fluorescence lidar which will directly measure the temperature of the sodium layer which resides between 80 and 110 km. Starting from the top of the density profile provided by the Rayleigh lidar, the density profile through the sodium layer can be extracted from the temperature profile provided by the sodium fluorescence lidar, resulting in an atmospheric density profile to an altitude for 110 km. The conceptual design for this enhancement follows from our SBIR Phase I research project. The sodium fluorescence lidar transmitter, using a frequency - summed Nd:YAG laser, will be under computer control, and will be designed to operate for many hours of uninterrupted data acquisition.

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Topic#: 91-027 ID#: 91ESD-649  
Office: ES2  
Contract #: F19628-92-C-0186  
PI: ROBERT LIEBERMAN

Title: A Highly-Survivable Rapid Deployment Hybrid Remote Sensor Reporting System

## AIR FORCE SBIR PHASE II AWARDS

Abstract: A rapidly deployable network for collecting information from chemical sensors is needed for field tests and eventual operational deployment of a Survivable Base Recovery After Attack Control System (SBCS). The hybrid (fiber optic/radio) multi-subnetwork scheme proposed here will meet the requirements of such a system by providing a field-installable, fault-tolerant system designed to interface directly with SCBS. Additional Phase II efforts will assure that the proposed networking system will be capable of accommodating the new-generation chemical sensors being developed at government and private facilities. During Phase I, POC demonstrated that signals from both optical and electronic chemical sensors can easily be transmitted on optical fiber networks, with data from each individual associated with a different optical wavelength. This wavelength division multiplexing approach forms the basis for the Phase II designs, and will be used to carry signals to concentrator units that are linked to SBCS Survival Recovery Centers by military radios. In addition to providing a field-test unit, POC proposes to investigate advanced optical sensor networking schemes, providing for pre-planned improvement of the sensing network as new and better types of chemical (and biological) sensors become available.

### PHYSICAL OPTICS CORP.

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Topic#: 91-038

ID#: 92ES3-209

Office: ES3

Contract #: F19628-92-C-0187

PI: Tin Aye, Ph.D.

Title: Ternary and Quaternary Spatial Light Modulators Based on Polarization Holographic Fabry-Perot Switching

Abstract: In Phase I of this program, Physical Optics Corporation (POC) fabricated and demonstrated a novel 2-D phase dominant spatial light modulator (SLM) based on holographic Fabry-Perot switching with liquid crystal modulation. The demonstration SLMs satisfied all the Phase I objectives: they are electrically addressable, phase dominant, polarization modulated, and have 3- and 4-state architecture. The development of this device will be continued in Phase II with emphasis on near term commercialization. The three prototype SLMs to be delivered at various stages of Phase II are expected to advance the state-of-the-art smart filter technology for compact optical correlation systems. The technology which allows the practical realization of the proposed SLM is the tunable holographic Fabry-Perot (HFP) technology originated and developed at POC. This unique technology has opened up a new frontier in interferometric modulator device technology which was previously prohibitively costly and difficult because of the stringent requirements for super flatness. The Phase II prototypes of the 3- and 4-state SLMs will have high resolution (20- 50 nm), large size (220 x 320), small depth (<10 mm), high contrast (>50:1), and high frame rate (15 kHz).

### PHYSICAL OPTICS CORP.

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Topic#: 89-088

ID#: 32812

Office: WL2

Contract #: F33615-92-C-3801

PI: Ray T. Chen, PhD

Title: Large Field-Size Holographic Lithography for Flat Panel Fabrication

Abstract: A 1 in 2 0.5 um image was successfully demonstrated in Phase I of this program. The experimental results of that research led us to believe that either submicron lithography for microelectronics or fabrication of large flat panel display screens is feasible using the proposed technology. The Phase II program will focus on the fabrication of large flat panel display screens. Field sizes as large as 3 inches x 3 inches (a 50% size increase over those produced by existing state-of-the-art machines) will be demonstrated using the total internal reflection (TIR) setup. Aspects of image quality, such as resolution, resist profile and 2-D image fidelity, will be further investigated in this program. Exposure dosage will be optimized by examining the sidewall profile of the developed photoresist. Also, a curved channel waveguide array using the proposed holographic lithography will be fabricated. This device will be extremely useful for intra- and inter-multichip module optical interconnections.

### PHYSICAL SCIENCES, INC.

20 New England Business Center  
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Topic#: 89-025

ID#: 93AED-015

Office: AEDC

Contract #: F40600-92-C-0008

PI:

Title: Non-Intrusive Flow Turbulence Measurement System

Abstract: We have developed an innovative, non-intrusive flow diagnostic for measuring velocity and turbulence in high temperature flows. The technique employs Doppler-shifted laser-induced fluorescence of Cu atom impurities in the flow to

## AIR FORCE SBIR PHASE II AWARDS

measure both average and instantaneous fluctuations in the velocity. A pulsed UV laser is used to make the measurements instantaneously and at a high sampling rate. The technique is based on observing variations in total Cu atoms seeded in He. A frequency-doubled CW ring dye laser system was used to characterize the expansion via measurements of the mean velocity and velocity spread (temperature). A pulsed laser was then used to measure the Doppler velocity in the same flowfield. These measurements agreed to within 5 percent at a velocity of  $2 \times 10^5 \text{ cm s}^{-1}$ . A model of the H<sub>2</sub> arc driven facility at AEDC showed that turbulent intensities at the level of 4 percent were measurable with this technique. We propose to develop, deliver, and optimize a velocity/turbulence measurement system in Phase II.

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Topic#: 91-200 ID#: 91ASD-701  
Office: WL9  
Contract #: F33657-92-C-2178  
PI: TERENCE E. PARKER

Title: Optical Diagnostics and Fuel Mixing Studies for Supersonic Combustors

Abstract: Continued development of SASP SCRAMJET engines requires in-situ measurements of the computer ion product H<sub>2</sub>O concentrations in the combustor exit flows and correlations of the product yields with fuel injector configurations and mixing characteristics. Physical Sciences Inc. prognoses to develop the exit plane diagnostic concept whose feasibility was demonstrated in a successful Phase I program. The instrument detects the infrared thermal emission from H<sub>2</sub>O and measures the H<sub>2</sub>O concentration and exhaust temperatures at the combustor exit plane. The prognoses measurements and diagnostic validation will be performed on PSI's reacting flow shock tunnel facility at combustor flows of Mach 3 to 5 for flight equivalent Mach numbers ranging from 7 to 12. The Phase II products will include a prototype instrument package for H<sub>2</sub>O detection, a fully validated comprehensive optical diagnostic method for NASP combustor testing, and a unique data base containing some 200 systematic high enthalpy tests of hydrogen fuel injection, mixing, and combustion dynamics for a variety of injector configurations that are directly relevant to the National Aerospace Plane effort.

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Topic#: 91-196 ID#: 91OSR-318  
Office: AFOSR  
Contract #: F49620-92-C-0069  
PI: C. Paul Christensen

Title: Compact, Self-contained ArF Lasers

Abstract: Phase II development of a small 193nm ArF laser is proposed. The laser would be excited by a microwave discharge, and would have a miniature, self-contained gas supply. Development issues include reduction of microwave loss in the discharge section, removal of oxygen and other impurities in the gas supply, development of miniature gas supply components, and accelerated life testing.

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Topic#: 91-128 ID#: 91WL6-37  
Office: WL6  
Contract #: F33615-92-C-2294  
PI: Dr Pradeep K. Gupta

Title: Animated Computer Graphics Modeling of Rolling Bearing Dynamics

Abstract: Development of an animated computer graphics model, AGORE (Animated Graphics of Rolling Elements), for ball, cylindrical and tapered roller bearings is proposed. Graphics imaging is based on the PHIGS international standard, while the transformations applied on the bearing elements to produce animated motion are based on the bearing dynamics computer code, ADORE. Both two and three dimensional views to show animated bearing motion, key performance parameters and thermal mappings shall be displayed. A graphic input interface shall permit change in view angles, selection of program options, and zoom and pan functions to examine selected areas of the image in detail. An integrated prototype system for rolling bearing dynamics analysis and design shall be developed where both the graphics code AGORE, and the bearing dynamics code ADORE shall operate in an integrated fashion. While the PHIGS methodology provides easy portability of the code, the relationship with ADORE makes the model immediately useful for piratical bearing design, and it therefore, contributes to a significant potential for commercial applications in Phase III.

AIR FORCE SBIR PHASE II AWARDS

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Topic#: 90-027 ID#: 39698  
Office: ES2  
Contract #: F19628-92-C-0047  
PI: Alexander J. Kersis

Title: Defense Battle Planning System (DBPS)

Abstract: Defensive air planning within the Tactical Air Control System (TACS) suffers from a lack of objective analysis tools and inefficient methods of gathering and integrating situational information. In many cases only subjective judgement is used for placement and employment of radar sensors and air defense weapons systems. There is no automated process to consider all the variables for rapid evaluation, planning, and comparison for quick modification during changing situations. The Air Component Commander and force level planners need the option of evaluating the merits of defensive counter air and air defense plans, displaying their effectiveness against selected scenarios, and quickly modifying plans without undue or unknown exposure at other locations. Air defense planners should also have the capability to present the results of their analysis on competing plans to others within the Tactical Air Control Center (or its overseas equivalent) and to operational control and surveillance radar elements in the field. The Defensive Battle Planning System is an automated decision support system that can analyze options based on stored data and information available from external sources for optimum placement and employment of control and surveillance radar elements, and air defense weapon systems.

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Topic#: 91-197 ID#: 91ASD-698  
Office: WL9  
Contract #: F33657-92-C-2167  
PI: SAMUEL K. CLARK

Title: Aircraft Tire Wear Prediction Techniques

Abstract: Aircraft tire wear on future high performance aircraft will be severe, involving primarily abrasion mechanisms. This type of wear can be predicted prior to actual aircraft operation by careful measurement of tire contact pressure and slip in the tire contact patch. The test instrumentation constructed under phase I of this work will be modified to allow for the measurement of larger values of slip associated with tire operation under combined yaw and braking. A complete pattern of contact pressure and slip in the tire contact patch will be obtained for two sizes of modern high pressure aircraft tires. These sizes will be those that are to be used by NASA Langley Research Center in an extensive series of wear measurements to be conducted on runway surfaces in the summer and fall of 1992. Data from these measured contact pressures and slips will be compared with the wear rates obtained on actual airfield surfaces in the NASA program. Predictive methods will be developed for defining aircraft tire wear rates using pressure and slip data.

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Topic#: 91-023 ID#: 93AED-013  
Office: AEDC  
Contract #: F40600-92-C-0013  
PI: Dr. Alan C. Mueller

Title: Dynamic Stress Analysis for Projectiles

Abstract: Projectiles launched at hypervelocities at the ballistic ranges of Arnold Engineering Development Center are subject to extreme loads of over 100,000 g's and occasionally fail. The ultimate material strength, in practice, limits the maximum speed to which the projectiles can be launched by the two-stage light-gas guns and still remain intact. The projectiles are constructed from a variety of materials, including metals, plastics, and composites, and may undergo large plastic deformations. An understanding of the dynamics of a projectile and its interaction with the light gas and barrel wall could lead to improved projectile designs and operational procedures to reduce the possibility of model failure without degrading the overall performance of the gas gun. This proposal addresses the need for an analytical tool to accurately simulate the projectile dynamic stresses. In the Phase I effort, we developed several submodels (elements) pertinent to the realism of the dynamical simulations and demonstrated the feasibility of the finite element analysis of accelerated projectiles. Under Phase II, our efforts will focus more on developing a software system that can easily be integrated into the AEDC engineering design environment. The overall technical objective of Phase II will be to provide AEDC with an integrated, computer-aided system to analyze and design projectiles launched by the two-stage light-gas guns. This system will include state-of-the art software for pre- and postprocessing of analysis results, transition software to aid the designer to move from AUTOCAD drawings all the way to viewing and interpreting analysis results, a computer platform sized for good turnaround, and new and expanded analysis capabilities. QUEST

## AIR FORCE SBIR PHASE II AWARDS

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will implement this computer system on site at AEDC and will accompany the system with user's guides, tutorials, and personal instruction to minimize the learning curve. In addition, QUEST will extensively compare the analysis predictions to high-g, high-strain-rate experimental tests.

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Topic#: 91-052 ID#: 91CEL-017  
Office: AFCESA  
Contract #: F08635-92-C-0088  
PI: ROJER F. JOHNSON

Title: Sensor Technology for Rolling Deflection Measurements to Assess the Repair Quality of Bomb-Damaged Runways  
Abstract: A noncontact measurement system for obtaining the stiffness and profile of pavements is proposed. The device will optically measure both the profile of the pavement and the dynamic shape of the depression basin as a test load is rolled along the surface, and it will not require the closure of any roads or runways. The system is inherently self-calibrating and represents a methods of nondestructive testing that is superior to tocher techniques, such ass the Benkelman Beam and vibrators. Knowledge of depression basin parameters can yield information about pavement and subpavement elastic constants. The system is comprised of a trailer load vehicle, a data acquisition system, and self-calibration hardware. Its essential elements consist of a horizontally transported beam; strategically placed optical sensors, which measure the distance to the pavement; a beam straightness sensor; a laser height sensor; a data acquisition computer, and a software package, which calculates the pavement deflections.

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Topic#: 91-037 ID#: 92ES3-195  
Office: ES3  
Contract #: F19628-91-C-0163  
PI: Herbert E. Bates

Title: Rare Earth Perovskite Single Crystal Ribbon

Abstract: The objective of the Proposed Program is to develop the application of the Edge-defined, Film-fed Growth Process (EFG) to Production of rare earth, gallium oxide compounds in single crystal sheet form for use as a substrate for thin film, epitaxial devices of the superconducting material, YBA<sub>2</sub>Cu<sub>3</sub>O. Work will be directed to establishing the conditions required to grow good quality single crystal ribbons of the rare earth gallates, NdGaO<sub>3</sub> and PrGaO<sub>3</sub>. Growth of small diameter fibers and thin, flexible tapes of these materials will also be investigated. The latter shaped crystals are intended as a basis for the study of formation of superconducting "wires". This work will provide the foundation from which a scaled-up process may be expected to produce economical, high-quality, large area substrates of these materials. The substrates produced by this method will find extensive application in the fabrication of superconducting and hybrid superconducting-semiconducting electronic devices.

SCHWARTZ ELECTRO-OPTICS, INC.  
Research Division, 45 Winthrop Street  
Concord, MA 01742  
Phone: (508) 371-2299

Topic#: 91-160 ID#: 91PAA-810  
Office: PL4  
Contract #: F19628-91-C-0101  
PI: John H. Flint

Title: The Development of a Diode-Laser-Pumped Holmium Laser for Rocket-Borne Lidar

Abstract: We propose to develop a diode-laser-pumped holmium-laser transmitter sized to be launched by asounding rocket. The mission objectives would be to measure water vapor concentrations or to study clouds and aerosols as the platform descends through the upper atmosphere. The laser output could be used directly, or it could be used to pump an optical parametric oscillator (OPO). The proposed Phase II effort consists of the design and construction of a prototype single-frequency pulsed holmium laser that can operate within the space and power restrictions of a rocket-launched payload. The minimum specifications of the prototype laser to be delivered to the Air Force are 100 ml at 40 Hz in a 200-ns pulse. We have demonstrated that useful levels of optical gain can be generated in Tm,Ho:YAG and Tm,Ho:YLF if the laser crystals are cooled with liquid nitrogen. This is not a severe constraint for a sub-orbital flight. The technology that is developed will be applicable to future space-based systems since the problems of low gain cross section and up-conversion are common to all 2-um lasers, and operating near 77K simply reduces their impact to the point that a compact holmium laser can be powered with today's laser diodes.

AIR FORCE SBIR PHASE II AWARDS

SCIENCE AND APPLIED TECHNOLOGY, INC.  
6540 Lusk Blvd. Ste C-250  
SAN DIEGO, CA 92121  
Phone: (619) 453-6544

Topic#: 91-090 ID#: 91WAA-061  
Office: WL2  
Contract #: F33615-92-C-1099  
PI: C.F. BUMAN & L.K.SHERMAN

Title: Air-To-Air Anti-Radiation Missile (ARM) Electronic Counter-Countermeasure (ECCM)

Abstract: This program expands upon the Phase-I efforts which focuses on the ARMECCM issues as they apply to techniques and radar designs for improving radar survivability against the current and advanced ARM threats. Emphasis shall be on a baseline airborne radar, exemplified by the APG-70, as analyzed in Phase-I study. However, advanced radar configurations will also be considered for application of the ARM ECCM concepts with the Air Force's evaluation of Multi-Function Radar Technology (EMRT). Based on the results of this Phase-II ARM ECCM project an Advanced Technology Development plan be prepared consisting of requirements for hardware/software development and fabrication for modifications and integration with a test bed airborne radar. The technical approach will consist of performing detailed analysis, modeling and assessment of selected ARM ECCM techniques defined in Phase-I study. This procedure allows the down selection from candidate concepts as the data flows from the concept analysis, detailed assessment, and design activities.

SCIENTIFIC RESEARCH ASSOC., INC.  
50 Nye Road, P.O. Box 1058  
Glastonbury, CT 06033  
Phone: (203) 659-0333

Topic#: 91-135 ID#: 91WL6-001  
Office: WL6  
Contract #: F33615-92-C-2289  
PI: David V. Roscoe

Title: Advanced Secondary Gas Path Methodology

Abstract: An innovative approach is proposed for the development of an axisymmetric/three-dimensional secondary gas path design methodology based upon a state-of-the-art Navier-Stokes solver and a workstation input/output interface directed specifically at the design engineer. The proposed effort would be pursued by Scientific Research Associates, Inc. as a prime contractor with Pratt & Whitney as a subcontractor. Under the Phase I effort a workstation based Navier-Stokes user interface would continue to be developed to allow access of the Navier-Stokes code to the design/analysis community. This development would include development of interface for the grid generation package which would allow direct use of CAD files in the coordinate generation process. The interface would be developed so as to be compatible with a wide variety of grid generators and computational procedures. The methodology would be tested via comparison with experimental data taken by Pratt & Whitney for an IHPTET (XTC66-1) rear compressor cavity and possibly for the XTC66-1 turbine TOBI cavity. The methodology would be delivered to the Air Force for use of Wright Laboratory personnel in assessing existing and new secondary flow system designs.

SOHAR, INC.  
8421 WILSHIRE BLVD, SUITE 201  
BEVERLY HILLS, CA 90211  
Phone: (213) 653-4716

Topic#: 91-085 ID#: 91WAA-033  
Office: WL2  
Contract #: F33615-92-C-1117  
PI: DR KAM SING TSO

Title: Complexity Metrics for Avionics Software

Abstract: The proposed research is a continuation and expansion of our successful Phase I effort which demonstrated that traditional software metrics which were enhanced to account for the Ada multitasking and realtime (AMR) properties of avionics software, are significantly better predictors of complexity. In the Phase II research, we will define new metrics oriented to the early phases of the software life cycle, conduct studies to validate the effectiveness of the enhanced metrics, and develop QMAS (Quality Measurement for Avionics Software), an integrated tool for software quality measurement. QMAS will include parsers for analyzing Ada code and Ada/PDL design specifications, capabilities and semi-automatically extracting additional metrics from English requirements documents, interfacing with CASE tools and project management software, a graphical user interface, a database of historical metrics data, and statistical analysis ability. All developed software will be implemented in Ada. QMAS will be portable to any system that supports the OSF/Motif windowing system.

SPACE RESEARCH TECHNOLOGY, INC.  
4950 FM 1960 West, Suite C3190  
Houston, TX 77069

Topic#: 90-026 ID#: 39696  
Office: ES2  
Contract #: F19628-92-C-0069

## AIR FORCE SBIR PHASE II AWARDS

Phone: (818) 991-0693

PI: Lawrence J. Rennie

Title: VLSI Chip and Board Level Implementations of a new Automatic Link Establishment (ALE) Protocol to Enhance MF and HF Radio Interoperability

Abstract: The objectives of the Phase II work is to implement prototypes of several standard, off-the-shelf components for embedded and stand-alone ALE controller implementations. The first standard component proposed is the implementation of the tone encoder/decoder ASIC studied and described in the Phase I report. In addition, a standard board level component implementing the complete FEC front-end functions and a board level component implementing the complete ALE protocol function are proposed. The tone encoder/decoder ASIC will be implemented first followed by the ALE front-end board and the ALE controller board. The software for the ALE controller board will be written in the DoD and government mandated Ada programming language.

SPECTRAL SCIENCES, INC.

Topic#: 91-022

ID#: 93AED012

99 South Bedford Street

Office: AEDC

Burlington, MA 01803

Contract #: F40600-92-C-

Phone: (617) 273-4770

PI: Dr. Steve Adler-Golden

Title: Raman Hydrogen Sensor (RHS) for Process Air Ducting

Abstract: A fast-response gaseous hydrogen (H<sub>2</sub>) sensor is required for operation in wind tunnel exhaust ducting at AEDC, to ensure safety in testing of engines for the National Aerospace Plane. Good sensitivity, fast response, and the ability to handle wide ranges of sample pressures, temperatures, and humidities are required. Spectral Sciences, Inc. (SSI) proposes to develop a laser Raman Hydrogen Sensor (RHS) for AEDC's air ducting applications. RHS represents an extension of new, patented technology developed by SSI for NASA's space shuttle program. Advantages of Raman detection include linearity, good selectivity, and insensitivity to temperature, flow rate, and background gas composition. The feasibility of the RHS concept was demonstrated in the Phase I program. The goal in Phase II is to design, construct and test breadboard and brassboard prototype instruments and deliver the brassboard for field testing at AEDC. This RHS would be produced commercially in Phase III. The RHS operates by passing laser light through the gas sample, collecting the hydrogen Raman-scattered light through a selective filter, and converting the optical signal into the desired output. The duct air would be sampled through a several-meter-long intake pipe and water separator.

SPIRE CORP.

Topic#: 91-028

ID#: 91ESD-656

One Patriots Park

Office: ES2

Bedford, MA 01730

Contract #: F10628-82-C-0178

Phone: (617) 275-6000

PI: Steven J. Hogan

Title: Commercialization of New MOCVD Reactor Technology (Revision)

Abstract: Spire proposes a Phase II program to develop a commercial single-wafer MOCVD reactor based on a patented Mass. Institute of Technology Lincoln Lab (MITLL) design. The MITLL prototype reactor has exhibited exceptional uniformity of film growth on two-inch diameter wafers. Its capabilities make the reactor useful for a wide variety of research and development and prototype work in electronics (e.g. MIMIC) and optoelectronics (lasers, solar cells). During Phase I, Spire conducted extensive discussions with MOCVD equipment users, and found a trend towards substrate sizes larger than two inches (three-inch and greater diameter); this trend requires that the existing technology be appropriately scaled up in size if it is to achieve its true market potential. The proposed Phase II program will develop and build an MOCVD reactor capable of depositing epitaxial GaAs films on three-inch substrates. Following the fabrication of this reaction chamber, films will be grown to demonstrate GaAs growth characteristics similar in quality to that presently achieved in the MITLL two-inch reaction chamber. Spire Corporation is firmly committed to commercialization and sale of MOCVD systems; addition of this new reactor, with its superior performance, will augment the large area multiple substrate line of machines currently manufactured by Spire. Spire and MIT have recently signed a license agreement to cover development and marketing of the new three-inch reactor, in addition to the two-inch reaction chamber.

SRS TECHNOLOGIES

Topic#: 91-031

ID#: 92ES3-199

990 Explorer Blvd., NW Cumming

Office: ES3

Huntsville, AL 35806

Contract #: F30602-92-C-0147

AIR FORCE SBIR PHASE II AWARDS

Phone: (205) 971-7821

PI: G. Steve Wakefield

Title: Software Fault Tolerance Tool (SWFT Tool) Development

Abstract: The proposed Phase II effort will build on existing SRS capabilities and Phase I research results to produce an automated tool for conducting Software Fault Tolerance (SWFT) design and analysis. The resulting product, called SWFTTool, will provide a relatively low cost commercial tool which can be used to support the insertion of SWFT techniques into complex system designs. The SWFTTool product will be based on enhancing the SWFT capabilities, increasing the portability, and reducing the supporting software requirements of the Automated Fault Tolerance Evaluator (AFTE). The Phase II technical approach involves porting and enhancing existing simulation, graphics support, and SWFT template software from AFTE and SeeNex (an SRS simulation tool), based on design requirements identified in Phase I. SWFT techniques identified during Phase I research will then be implemented as templates within SWFTTool. This will provide a rapid method of incorporating SWFT techniques into system designs and will support analysis of the cost/benefit trade-offs of using SWFT. The completed SWFTTool will directly address the DoD need for real-time/fault tolerant software for mission critical systems.

SRS TECHNOLOGIES

990 EXPLORER BLVD., N.W.

HUNTSVILLE, AL 35806

Phone: (205) 971-7087

Title: Concentrator Technology

Abstract: Development of a solar powered rocket depends heavily on demonstrating the technology for lightweight space-deployable solar concentrators. Large parabolic shaped thin film reflectors can be packaged with other solar powered propulsion elements and deployed in low Earth orbit. The Solar Powered Pocket Engine is expected to produce specific impulses of 1000 to 1200 seconds. This is over two to three times that of conventional liquid hydrogen/oxygen engines. This performance would significantly improve travel from low earth orbit to geostationary earth orbit. A significant step in demonstrating the feasibility of large lightweight deployable concentrators has been done in Phase I research. An inflatable thin film off-axis paraboloidal concentrator of a single chamber was designed to provide high concentration ratios and ease of deployment. The feasibility of the concept has been demonstrated in Phase I, as to configurations, and manufacturing techniques. The single chamber design does not require a torus support. The design has features which are improvements over the conventional torus supported concentrator while still allowing for similar structural attachment to the vehicle.

Topic#: 91-154

ID#: 91PAC-790

Office: PL3

Contract #: F29601-92-C-0076

PI: PAUL A. GIEROW

SUPERCONDUCTOR TECHNOLOGIES, INC.

460 WARD DRIVE, SUITE 7

SANTA BARBARA, CA 93111

Phone: (805) 683-7646

Title: HTSC Delay Lines and Filter Banks: Development of Flight Hardware

Abstract: STI has demonstrated feasibility of HTSC delay lines in the Phase I SBIR (Contract F33659-90-C-2201). The results show that long delays at low IF frequencies (<1 GHz, 450 ns) and short delays at higher IF frequencies (10+ GHz, 50-100 ns) are possible. In other work at STI, partially supported by DARPA, the Army, the Navy and SDIO, we have demonstrated feasibility of HTSC thin-film filters. Also, we have demonstrated an innovative, optically triggered switch for superconductors on IR&D funding, which will allow fabrication of switchable band reject filter banks. This proposal contains two advance hardware. STI believes that there are several aspects of the program that, executed as proposed, offer synergistic benefit because much of the engineering development is applicable to all the proposed subassemblies. The computer models development, component design and fabrication, packaging and cooling are also applicable to any of these subassemblies.

Topic#: 90-069

ID#: 39825

Office: XRX

Contract #: F33657-91-C-2238

PI: Roger J. Forse

SUPERIOR VACUUM TECHNOLOGY, INC.

7388 Washington Ave

Eden Prairie, MN 55436

Phone: (612) 941-1898

Title: Automated MBE Process with Real Time Sensor Control

Abstract: Molecular Beam Epitaxy (MBE) has become the preferred epitaxial growth technique in research environments because of its ability to achieve atomic level control over device structures. To be a highly reliable and reproducible manufacturing

Topic#: 91-097

ID#: 91WL3-039

Office: WL3

Contract #: F33615-92-C-1104

PI: Dr Peter P. Chow

## AIR FORCE SBIR PHASE II AWARDS

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process, however, the entire growth sequence must be automated to coordinate and interpret sensor signals and control the experimental parameters. We propose to build an intelligent MBE operating system that manages in-situ sensor input information for precise process control. It shall consist of a complete software and hardware Laboratory Information Management System (LIMS) package that allows a PC to interface with various sensors on the system to accurately monitor and control MBE growth. We shall investigate various process monitors for this application.

### SYNCHRONECTICS

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Topic#: 91-025 ID# 92I53-201  
Office: ES3  
Contract #: F30602-92-C-0162  
PI: Edwin R. Addison

Title: Document Management Toolkit for System Integration

Abstract: The purpose of this two phase program is to investigate the feasibility of and to develop a document management system using Natural Language Processing technology that provides an integrated approach to software life cycle management. In particular, a natural language processing system to search and retrieve relevant DOD-STD-2167A text from within the Rome Laboratory Software Life Cycle Support Environment (SLCSE) is being developed. The text retrieval system 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 document management concept provides the means for users to perform a computer search, information retrieval task, or "electronic cut and paste" operations over digitally stored DOD-STD-2167A software documentation at all phases of a program life cycle. This enables the software life cycle manager to quickly locate information on all aspects of a comprehensive software project relevant to a specific task. 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 (e.g. English) languages rather than formal (e.g., Ads) languages. The Phase I program demonstrates the feasibility and utility of natural language text search applied to DOD-STD-2167A documents. The Phase II program will develop a detailed production version of the document management system and integrate it into SLCSE. In addition to its utility in SLCSE, this program has immediate relevance to the Computer Aided Acquisition and Logistics Support (CALS) initiative for accessing and managing electronic documents. This SBIR will result in a commercial product. Significant commercial partners have been identified.

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CARLSBAD, CA 92008  
Phone: (619) 438-1010

Topic#: 91-163 ID# 91PXP-822  
Office: PL1  
Contract #: F29601-93-C-0008  
PI: Michael M. Salour

Title: Microwave/Millimeter-Wave Field Sensor

Abstract: We propose the exploration, development, and characterization of a novel sensor for the measurement of electromagnetic fields at micro- and millimeter-wave frequencies. Based on previous hardware developments and extensive investigations carried out during Phase I, this innovative approach permits the observation of pulsed waveforms as well as the monitoring of continuous wave signals. It is, therefore, ideally suited for the use in electronics vulnerability. Depending on various design parameters, the sensitivity of the proposed sensor is better than 0.1mW/cm<sup>2</sup>, and it can respond to pulsed signals with powers in excess of 1000 W/cm<sup>2</sup>. The sensitivity of the sensor extends to frequencies of 40 GHz. An all fiber-optic monitoring and powering link between the probe and external processing station guarantees complete dielectric isolation. The relatively simple design can be easily contained in a compact volume. In addition to the electronics vulnerability testing, other military applications include the monitoring of the intensities of stray fields near microwave transmitters, the characterization of radar field patterns, and remote sensing. Scientific and medical uses may emerge in applications of electron spin resonance spectroscopy and the chemical processing industry.

TCAM TECHNOLOGY, INC.  
8729 Hilltop  
Mentor, OH 44060  
Phone: (216) 257-4692

Topic#: 91-104 ID# 91WL4013  
Office: WL4  
Contract #: F33615-92-C-3613  
PI: Edward T. Schneider

Title: Thermochemically Activated Motion (TCAM) Valve Actuator

## AIR FORCE SBIR PHASE II AWARDS

**Abstract:** An improved mechanical actuator is proposed utilizing ThermoChemically Activated Motion (TCAM) technology. The TCAM process is a new technology for developing very high power density mechanical actuators which operate with total silence, offer proportional control, simpler control electronics, lower cost, and many other projected benefits. These many attractive features of TCAM devices promise to allow them to replace solenoids, gearmotors, and hydraulic cylinders in valve and other actuator markets. TCAM devices can generate actuation forces exceeding hydraulic actuators without the support hardware of pump, reservoir, valves and lines and can be applied with the convenience of solenoids, requiring only electrical power. This proposal is to apply TCAM devices directly to the operation of the main hydraulic control valve of the F-16 Integrated Servo Actuator (ISA), eliminating primary and secondary backup pilot hydraulic circuits, servovalves, solenoid valves for switching to backup circuits, and simplifying the electronic control circuitry.

TDA RESEARCH  
12345W, 52nd Ave  
Wheat Ridge, CO 80033  
Phone: (303) 422-7953

Topic#: 91-131 ID#: 91WL6-161  
Office: WL6  
Contract #: F33615-92-C-2292  
PI: Michael E. Karpuk

**Title:** A Compact Heat Exchanger Reactor for Endothermic Fuels

**Abstract:** Endothermic-fuel reactors for aircraft must be very compact and light. Previous analyses of endothermic-fuel reactors for aircraft show that a major limitation to the design of these reactors is heat transfer to the catalyst since the thermal conductivity of the catalyst is very low. By attaching the catalyst to the wall or metal structure, a direct and efficient conduction path can be provided to transfer the heat from the tube wall to the catalyst. In the Phase I project, TDA Research, Inc. (TDA) investigated methods for attaching thin layers of catalyst directly to metal surfaces. In Phase II, TDA proposes to scale-up the technology for attaching catalysts to metal structures to sizes that would be useful for both military and commercial users. The work will include coating tubes (much longer than previously coated) with variable geometries and internal fins. Catalyzed inserts will also be investigated. The work will culminate in the construction of an endothermic-fuel reactor which will be tested at Wright-Patterson AFB.

TECHNOLOGY INTEGRATION, INC.  
54 Middlesex Turnpike  
Bedford, MA 01730  
Phone: (617) 275-4545

Topic#: 91-103 ID#: 91WL4-067  
Office: WL4  
Contract #: F33615-92-C-3211  
PI: Dr George P. Succi

**Title:** High-Gain Acoustic Sensor System for Aircraft Noise Signature Detection

**Abstract:** The purpose of this program is to develop a microphone which enhances signal-to-noise ratio. This objective is achieved through directionality and steering of the microphone. The microphone uses a coaxial cable and an interrogating electrical signal. We develop specialized electronics so that the microphone can be steered to a particular direction or tuned to a particular frequency. The innovation is that the steering is all done in hardware. Only one coaxial cable is required and only one analog-to-digital converter is needed, resulting in a simpler, lower-cost system. The microphone resembles a conventional steerable array of discrete microphones. It differs in that all elements are connected to the same coaxial cable, in effect, producing a single, very long microphone.

TOYON RESEARCH CORP.  
75 AERO CAMINO, SUITE A  
GOLETA, CA 93117  
Phone: (805) 968-6787

Topic#: 91-174 ID#: 91BMO-004  
Office: PL6  
Contract #: F04704-92-C-0029  
PI: BERNARD B. GRAGG

**Title:** Effective MaRV Trajectories for Multiple Missions

**Abstract:** In principle, an advanced MaRV can exploit its maneuverability to achieve a number of tactical objectives: enforce a large footprint, evade or avoid area defenses, duel with terminal defenses, home on a target to maximize kill probability, or search out and attack mobile targets. For any particular scenario, however, it is necessary to devise a specific trajectory which, within maneuver constraints and a limited energy budget, best meets mission objectives. With existing methods, designing a MaRV trajectory to maximize effectiveness for any specific mission is a complex and tedious process. Toyon Research Corp. proposes to develop and implement a PC-based interactive simulation which will employ animated graphics to allow a user to rapidly and efficiently synthesize MaRV trajectories to meet specific mission objectives for a variety of possible scenarios. The

AIR FORCE SBIR PHASE II AWARDS

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simulation will evaluate each trajectory quantitatively in the context of the particular mission phase being simulated, enabling overall mission effectiveness to be readily evaluated. In addition, a number of parametric and tradeoff studies will be conducted to evaluate MaRV effectiveness in various roles and missions, for a range of MaRV design parameter variations, and for differing concepts of operation.

ULTRAMET  
12173 Montague Street  
Pacoima, CA 91331  
Phone: (818) 899-0236

Topic#: 90-096 ID#: 39852  
Office: WL4  
Contract #: F33615-92-C-3407  
PI: Andrew J. Sherman

Title: Lightweight Thermal Protection System

Abstract: 20-40% of the overall weight of hypersonic crew escape vehicles is due to the thermal protection system (TPS). Phase I demonstrated that a 60-80% reduction in TPS weight can be achieved by switching from ablative or carbon-carbon system to a foam core composite sandwich panel construction, the result of reduced ablation and improved thermal, structural, and insulative abilities. In this Phase II program, Ultramet proposes to complete the development work begun in Ph I, resulting in a completely designed, verified, and tested foam core composite sandwich panel TBS able to survive single - and multiple - use reentry conditions at a weight of 1-3 lb/ft<sup>2</sup>. Material selection, composite fabrication, and ablative response of carbon-reinforced refractory ceramic materials will be investigated; foam core fabrication and properties determined; sandwich panel fabrication determined; TPS panel attachment and integration defined; ablative, thermal, and structural performance modeled; complete TPS system design made; and subscale elements fabricated and tested to verify design and attachment procedures. This program will resolve the technical issues currently preventing the incorporation of composite sandwich panels in critical applications, allowing a 5-20% reduction in reentry vehicle weight and expanded mission profiles, while improving TPS performance, reliability, maintainability, and life cycle cost.

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PACOIMA, CA 91331  
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Topic#: 91-145 ID#: 91PAH-708  
Office: PL5  
Contract #: F29601-92-C-0119  
PI: ROBERT H. TUFFIAS, PH.D.

Title: Design and Fabrication of Solar-Thermal Propulsion Thruster

Abstract: Current launch vehicles place less than 1% of their ground launch mass into geosynchronous Earth orbit (GEO). This small payload fraction translates to small available on-orbit masses and a high cost per pound of delivered payload. New approaches to propulsion efficiency must be found if substantial gains in payload fraction to high Earth orbit (HEO), and subsequent cost reductions are to be realized. Significant gains in propulsion efficiency in the launch-to-low-Earth-orbit (LEO) phase appear unlikely due to the already optimized state of both solid and liquid propulsion systems. However, very gains in propulsion efficiency in the LEO to HEO phase can have dramatic payoffs compared to those available from small enhancements to the launch vehicle. A recent study revealed that OTVs using solar-thermal propulsion would achieve the greatest payload to GEO of all the propulsion technologies evaluated. Solar powered space propulsion is a concept that utilizes solar heating of a propellant such as hydrogen to impart thrust to a rocket when the hydrogen exits through an appropriately designed nozzle. Although power and thrust levels for chemical combustion systems are much higher, solar powered space propulsion offers a significant reduction in fuel usage and hence either a significant increase in available payload mass or a significant launch cost savings, if the required longer mission time can be tolerated. In Phase I, Ultramet demonstrated the materials and fabrication technology for producing a solar-powered rocket engine by fabricating a subscale absorber/thruster. In the Phase II program, Ultramet proposes to refine and optimize the absorber/thruster design and fabricate a prototype absorber/thruster using this design. The prototype will be delivered to Phillips Laboratory for testing and evaluation.

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Topic#: 91-181 ID#: 91BMO-987  
Office: PL6  
Contract #: F04704-92-C-0031  
PI: ANDREW J. SHERMAN

Title: Thermal Protection System for Maneuvering Reentry Vehicle

Abstract: Thermal protection system (TPS) requirements for high performance maneuvering reentry vehicles are more advanced

## AIR FORCE SBIR PHASE II AWARDS

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than present systems. The high performance maneuvering reentry mission requires multimission capabilities encompassing both the extreme temperature and peak heat fluxes associated with ballistic trajectories and the extended flight times associated with gliding trajectories. This combination of high peak heat loads and extended heat soaks requires new materials and TPS concepts to mitigate both the high temperature and high heat flux exposure. Through measurement of material properties and modeling of thermal and mechanical response, the Phase I program demonstrated the feasibility of using a reticulated ceramic foam core sandwich panel with composite facesheets as the primary thermal protection system for a maneuvering reentry vehicle. In this Phase II program, Ultramet will further develop and optimize this TPS concept through detailed design, modeling, fabrication, demonstration, and optimization, leading to a flight test in the 1996-1998 time frame.

VIASAT, INC.  
6120 PASEO DEL NORTE, SUITE J2  
CARLSBAD, CA 92009  
Phone: (619) 438-8099  
Title: 5 KHz UHF DAMA

Topic#: 91-030 ID#: 91FSD-669  
Office: ES2  
Contract #: F19628-91-C-0151  
PI: Kristi Jaska

Abstract: Program to design, build, test, and demonstrate a 5KHz DAMA Network Controller and a small, lightweight Network Member modem, both in accordance with JTC3A Specification 9129. The proposed work builds on the results of the Phase I program, and also on results of a previous ESD sponsored Phase II SBIR program (VM-100 TDMA/DAMA modem development). In addition, this proposal addresses some research and development that builds upon JTC3A Specification to provide improved network performance and modem capabilities.

ZALLEN INTERNATIONAL ASSOC.  
14216 Turner Court N.E.  
Albuquerque, NM 87123  
Phone: (505) 299-3025  
Title: Halon Replacements

Topic#: 91-072 ID#: 91ASD-571  
Office: XRZ  
Contract #: F33657-92-C-2122  
PI: Dennis M. Zallen

Abstract: This halon replacements study was a Phase I SBIR project for the U.S. Air Force (USAF) to find a halon-type replacement agent for USAF applications. This baseline study investigated the military requirements for an agent being developed for streaming applications in ground firefighting. The selection process began with a very broad range of chemical types. Chemical families and the influence of functional groups, substitution of high and low ODP/GWP drivers, and molecular size and structure were evaluated. Then pragmatic factors were included for chemicals that could be used within the next several years. The results of the logical analysis show that there are only about ten primary chemicals that have all the characteristics for replacing Halon 1301 for USAF applications in the next few years. Tradeoff analyses show that these ten primary chemicals can be ranked for applications with fire suppression system weight and volume being high priority for aircraft applications. In addition to the identification of primary agents, the advantages of mixtures of chemically active agents, of property modifying mixtures, and of azeotropes were presented. An azeotrope of the primary agents was identified as being a capable flooding agent within the next few years.

DARPA SBIR PHASE II AWARDS

ACTIVE TECHNOLOGIES, INC.  
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ALAMOGORDO, NM 88310  
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Topic#: 90-127 ID#: 9020084  
Office: UWO  
Contract #: DAAH0192CR385  
PI: HAROLD SCOTT

Title: Cost Reduction Designs of a Large Range of High Performance PM Alternators And Controls

Abstract: The design software written and the experience gained in building the 200 watt, 4.5 ounce model airplane engine permanent magnet alternator in Phase I and the dual voltage, post Phase I, 7.5 kW alternator will be used as the basis in Phase II to further develop alternators for four different applications, two for sub-scale aircraft and two for commercial bus and truck applications. Four methods of pm alternator voltage regulation will be further developed. Preliminary patent searches indicate three of these methods may be proprietary. Applicable safety regulations, industry standards and field maintenance requirements will be integrated into the alternator and control designs with an emphasis on simultaneously increasing reliability and reducing cost in both material and labor for future production. A limited quantity of pm alternators and controls for each application will be manufactured and field tested under actual use conditions. Data will be gathered on performance, reliability and maintenance required. Anticipated benefits: Miniature PM alternators will be field tested and ready for production for DoD applications and hobbyist use. The 7.5 kq pm dual voltage vehicle engine driven alternator will meet all applicable regulation requirements and be producible in commercial quantities. Applications include ambulances, instrumentation vans and non-CFC hermetically sealed mobile refrigeration and air conditioning. A 10 watt prototype (or as specified) will be built and tested to compare performance with the computer designed model for rpm vs. output, efficiency and weight. Anticipated benefits/potential commercial applications - The lightweight generator will provide on-board electrical power to enable long duration flights of very small aircraft. Uses include surveillance, aerial mapping, expendable flights into hazardous situations and low cost relay platforms. The miniature engine driven generator provides the basis for very small portable generator sets. A quart size gen set would produce 500 watts for emergency lighting or remote car or truck starting in the winter.

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Topic#: 91-161 ID#: 9120686  
Office: ESTO  
Contract #: DAAH0192CR371  
PI: RICHARD KETCHPEL

Title: High Efficiency Color LCD Backlight

Abstract: There is a need for a low cost, high efficiency backlight for color LCD display to replace the existing inefficient 20 watt backlight. In Phase I study, a new high efficiency color backlight system was investigated utilizing ultra-violet excitation of RGB phosphor color stripes behind RGB modulator rows in the LCD which were coupled with concentrating optics. Experimental results showed a factor of 12x increase in efficiency over the present backlight system. Because of this order of magnitude improved efficiency, a portable, light weight color LCD display would become feasible. The Phase I study was concentrated on developing and testing various components required for a power efficient display. Specifically, a high efficiency uv distribution system was designed and tested, and the result showed the efficiency to be 47.5%. The goal of the Phase II is to incorporate the high efficiency features developed in Phase I into an operational color STN-LCD display as a retrofit into the existing functional color portable display. The high contrast backlighted color LCD display will have a total power consumption of less than 2 watts and overall thickness of less than 12mm. Anticipated benefits: the successful development of this high efficiency color backlight will have immediate commercial applications in existing color LCD notebook computers where "windows" software requires full color for efficient use. Similar techniques can be applied to light large area LCD displays for use in HDTV systems. In addition, the system will be useful for color LCD displays for avionic use in which power consumption is a problem.

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Topic#: 91-055 ID#: 9110572  
Office: ASTO  
Contract #: DAAH0192CR410  
PI: M. KHAN

Title: Metalorganic Atomic Layer Epitaxy for YBACuO SIS Detector Fabrication

Abstract: This proposal describes a program aimed at developing superconductor insulator superconductor (SIS) detectors in thin films of YBACuO deposited on SrTiO3 substrates. When operated in the quantum mode, our proposed HTC based SIS detector can potentially have a very high sensitivity for lwir detection. We plan to use a MOVPE based atomic layer epitaxy approach.

## DARPA SBIR PHASE II AWARDS

Our selection of atomic layer move eliminates the abruptness and thickness control problems that plague conventional material deposition techniques. This demonstrated technique (by us and several other research groups) results in atomically controlled interfaces and surfaces. The first years effort of the Phase II program will result in high quality single crystal layers of superconducting YBACuO. Also, we will demonstrate abrupt insulator superconductor interfaces deposited using atomic layer move. We expect to be able to control this to within an atomic scale due to the use of the ale approach. The second years effort of the Phase II program will focus on depositing the entire sis junction and fabricating LWIR sensors. We plan to collaboration with professor Singh of Clemson University on the proposed effort. He will act as a consultant to the program. Dr. Singh's expertise in the area of MOVPE deposition of YBACuO, combined with our resources and experience with atomic layer epitaxy and semiconducting devices gives a high success probability to the proposed effort. Anticipated benefits - Microwave and infrared detectors and receivers are widely used in space applications. For example, the mapping of background radiation is an important application requiring the ultimate in receiver sensitivity. The potential for improved sensitivity to LWIR radiation offered by the high TC SIS detector will yield benefits by making possible reduced observation times and smaller collection optics.

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Topic#: 90-072 ID#: 9020558  
Office: MTO  
Contract #: DAAH0192CR347  
PI: STEVEN GLIDDEN

Title: 1 kW X-pinch Soft X-ray Source for X-ray Lithography

Abstract: We propose a Phase II program to build and test a proof-of-technology x-pinch soft x-ray source system for lithography in the microelectronics manufacturing industry. This program follows up on scientific feasibility demonstration experiments performed at Cornell University and on our Phase I program in which the required high repetition rate (40 pulses per second - pps) pulsed power generator and x-pinch wire loader mechanism were designed. Phase II objectives are to build and test that system, which will be capable of up to 1 kW average power in the 7-10 wavelength band, and to demonstrate that an x-pinch soft x-ray lithography system can have the long component life, system reliability and overall electrical-to-soft-x-ray efficiency (expected to be in the range 1-2%) required of an industrial production line system. The lithography goal for the system is to achieve a complete resist exposure in 1s at a distance of 40 cm with a minimum feature size of 0.20 um. At 80 cm, a minimum feature size of 0.1 um is expected. The final goal of Phase II is to design and estimate the cost of a complete production line prototype system; we presently estimate the cost will be about \$1,000,000 or less, and that it will require less than 1 m2 of floor space in a production facility clean room. Specifically, we will build and test a 500 ka, 100 ns pulser and a wire loading mechanism, both designed to achieve at least 40 pps and separately test the pulser at 3 pps and the wire loader at 40 pps. Tests to the complete x-ray source will be carried out at 3 pps initially, and up to 40 pps if optional tasks are undertaken. System reliability and component lifetime tests will be carried out for 10 6-10 7 pulses. Resist exposure tests will be carried out in collaboration with ihm or other expert scientists on x-ray lithography. Anticipated benefits/potential commercial applications - the low cost of an x-pinch soft x-ray source system will allow small production-run manufacturers to compete effectively with larger companies that may use a synchrotron based soft x-ray system. By using multiple x-pinch based systems, a larger manufacturer may operate with greater flexibility and efficiency than using a synchrotron with fewer than the maximum number of wafer steppers. In addition the x-pinch system may be easily extended to achieve 0.1 um minimum feature size with a larger source-wafer distance.

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Topic#: 90-109 ID#: 9020427  
Office: MTO  
Contract #: DAAH0192CR372  
PI: HEINRICH ARLINGHAUS

Title: Quantitative and Sensitive Profiling of Dopants and Impurities in Compound Semiconductors

Abstract: The continual reduction of lateral dimensions and junction depths in modern electronic devices is now challenging the microanalysis industry's capability to perform accurate spatial measurements. We demonstrated in Phase I that the high efficiency (useful yield) of sputter initiated resonance ionization spectroscopy (SIRIS) results in good sensitivity even with low-energy ion beams (0.5 KeV). This, combined with the ability to integrate data over narrower depth ranges, results in high depth resolution. SIRIS also suffers from fewer matrix effects than SIMS because SIRIS analyzes neutrals instead of ions. Phase II work will take full advantage of Phase I conclusions to improve the speed of analyses and further improve SIRIS performance.

## DARPA SBIR PHASE II AWARDS

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New hardware will be added to improve dynamic range and unconventional rastering techniques will be tested to reduce effects from crater walls. In optional proposed work, techniques requiring two ion guns will be tested to improve surface smoothness and to decrease atomic mixing. We will also explore a tomography technique in which the high depth resolution of SIRIS can be translated to high lateral resolution. The final result will be a microanalysis capability with better lateral resolution, better depth resolution, greater dynamic range, and higher accuracy than what is now available. Anticipated benefits/potential commercial applications - Successful completion of the proposed work will produce a new analytical capability with improved depth resolution, higher accuracy, and better dynamic range than existing technologies. These capabilities are required for process control and simulations of the ever-smaller devices in modern semiconductors, and they will undoubtedly be extremely useful in many aspects of materials science. We plan to commercialize the new technology and offer it to the semiconductor and surface science community in the form of instrument sales and sample analyses.

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Topic#: 90-029 ID#: 9010102  
Office: ASTO  
Contract #: DAAH0192CR342  
PI: S. TRIVEDI

Title: Mercury Zinc Telluride a New Infrared Detector Material: Crystal Growth and Fabrication of Detector

Abstract: Phase I research efforts were aimed at demonstrating the feasibility of producing device grade mercury zinc telluride (MZT) crystals by using travelling heater method (THM). This goal was successfully accomplished. Also under this program, Brimrose built the first commercially available single element MZT PV detector which was also delivered to DARPA. In recent years MZT has attracted attention as a superior alternative detector material to replace conventional detector material mercury cadmium telluride. In view of the increasing importance of MZT, Phase II will be focussed at optimizing them to produce device grade MZT crystals and fabricate infrared detector arrays using them. The approach to produce homogeneous device grade material includes (a) preparation of a homogeneous polycrystalline ingot of MZT and (b) controlling the buoyancy driven convection in the solvent (liquid tellurium) by controlling the amount of the solvent. The photovoltaic detectors will be fabricated using mesa technology. The p-n junction will be formed by indiffusion of mercury. It was recently shown that even though the phase diagram of HgTe-ZnTe suggest that the crystal growth MZT is more difficult than that of MCT; in reality it is not the case. Due to superior structural and chemical properties, MZT crystals of superior compositional homogeneity could be grown. Moreover superior mechanical, temperature and chemical stability will produce MZT devices with better performance, longevity and consistency than mct devices. Anticipated benefits/potential commercial applications: Phase II will result into low cost alternative material to MCT and detectors with superior structural, mechanical and chemical stability. This research program will help to commercialize MZT photovoltaic detectors which are not commercially manufactured at this time in the U.S.A.

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Topic#: 90-072 ID#: 9020054  
Office: MTO  
Contract #: DAAH0192CR195  
PI: HARRY SHIELDS

Title: Excimer Laser-produced Plasma X-Ray Source

Abstract: A Phase II SBIR program is proposed to develop a high-brightness x-ray source for advanced semiconductor fabrication by x-ray lithography. The x-rays are generated in a laser-produced plasma which is created by a high intensity excimer laser. Two key elements in the laser system are an advanced high power excimer laser which embodies technology originally developed for the U.S. Navy submarine laser communications program and a patented pulse compressor developed by Jamar. The Phase I program has successfully carried out several important feasibility demonstrations including: compression of the laser pulse duration from 60 ns to 4 ns and extraction of 1 J pulse energy; focussing of high peak power pulses to a intensity of  $2 \text{ tw cm}^{-2}$  on x-ray target materials (120  $\mu\text{m}$  focal spot diameter); generation of 8-14 x-rays with an efficiency of ~5%. The proposed Phase II program will extend this work to higher target intensity, higher conversion efficiency and higher pulse repetition rate to result in a source brightness of  $\sim 1.5 \text{ W/sterad}$ . Tasks are included to address system engineering for commercialization and interface with a wafer stepper. Anticipated benefits/potential commercial applications - This source will address the requirements of two market segments where x-ray lithography using synchrotron is not cost effective. First, it will provide a low cost, versatile x-ray source for process development and device prototyping. Second, it will be sufficiently powerful for manufacturing of low volume, specialized devices such as military and commercial application specific integrated circuits

DARPA SBIR PHASE II AWARDS

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(ASIC's).

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Topic#: 91-004 ID#: 9110255  
Office: LSO  
Contract #: DAAH0193CR124  
PI: SUMAN GANGULY

Title: Passive Sensing Using Electromagnetic Array

Abstract: During Phase I we have demonstrated the feasibility of using the innovations in electronics, signal processing, artificial intelligence and improved sensors in order to significantly improve the detection range and in locating and identifying several non-cooperative targets. The scheme for the cancellation of environmental noise has been demonstrated and both magnetic detection and passive monitoring of low frequency A.C. emissions have been used. During Phase II we propose to develop these concepts into an advanced prototype system. Various sensor technologies are currently under development and we propose to design the system based on concurrent engineering. We propose to select the appropriate sensor; (both for current and future needs) experimentally evaluate its performance, acquire data for various environmental situations and for targets of military significance, design the software to identify the targets and then integrate the complete system. Finally, we demonstrate the performance of the prototype system in a field-type situation. Anticipated benefits: although the specific targets for which the prototype will be designed will be foot soldiers and military vehicles, the system could be easily modified to cover a wide range of targets and situations. The system can be used with various types of sensors and specific sensors could be used depending on the nature of the target and the overall objective. A large commercial potential exists. Anticipated benefits/potential commercial applications - proposed magnetic array scheme will have several commercial applications that involve earth resource survey, geophysical monitoring, etc. most significant applications through various DoD agencies. The concept could be used for detection, tracking and identification of various objects ranging from mines to missiles.

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Topic#: 90-025 ID#: 9010312  
Office: DSO  
Contract #: DAAH0192CR303  
PI: JOHN MOSES

Title: Supercritical Fluid Processing of Aerogels

Abstract: Aerogels are unusually low density, high surface area solids with a variety of potential military and commercial applications. Produced using various supercritical processing and drying techniques these amorphous solids are being produced and tested by an increasing number of foreign countries for their remarkable thermal, optical, and physical properties. During Phase I, success in developing new laboratory scale products and processes opened up a number of new processing, materials, and application opportunities. For example, lightweight "structural" aerogels were produced with improvements in mechanical properties such as Young's modulus of as much as 2000%. The objective of this Phase II project is to further develop multicomponent aerogel products and processes using supercritical carbon dioxide low temperature drying. The Aerogels produced will be tested for general physical, chemical, and mechanical properties. They will also undergo specific application testing for several defense applications. The process for manufacturing these new aerogels will be scaled up from laboratory testing to full scale prototype process design. Target applications include multimetallic catalysts for the destruction of hazardous materials, light weight materials for various space structure applications, precursors for electric ceramics such as superconductors and semiconductors, thermal and sound insulators, and fire barrier. Anticipated benefits/potential commercial applications - Potential commercial applications for multicomponent aerogels include: manufacture of superconductor precursor, semiconductors, and capacitors; porous materials for storing propellants; noise attenuation; catalysts; and ultrasonic detection equipment. Some benefits of supercritical processing include excellent reproducibility of product, low temperature profile for heat sensitive or reactive substances, high purity, and chemically homogeneous material with uniform physical structure.

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Title: Reactions in Supercritical Fluid Media

Topic#: 90-025 ID#: 9010704  
Office: DSO  
Contract #: DAAH0192CR355  
PI: JOHN MOSES

## DARPA SBIR PHASE II AWARDS

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**Abstract:** Supercritical fluids have been used to extract a wide variety of materials. They have been shown to exhibit unique solvent properties such as large changes in solubility with minor changes in temperature and pressure. This project seeks to exploit the combination of these properties with the addition of low temperature reaction systems to allow extraction and destruction of hazardous materials inside a totally enclosed system under controlled conditions. Anticipated benefits/potential commercial applications - the benefits of this project if successful will be the development of a system capable of cleaning contaminated materials and destroying the contaminants without release or handling of the contaminant. This technology could have potential applications in cleaning materials ranging from machined parts to hazardous waste sites.

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Topic#: 90-097 ID#: 9020340  
Office: SSTO  
Contract #: DAAH0192CR376  
PI: MARC GOODMAN

**Title:** Temporal Reasoning In a Case-Based Reasoning System

**Abstract:** This report presents a new paradigm for integrating temporal and case-based reasoning technologies, called projective reasoning. It uses past experience, in the form of cases, which are decomposed into temporally related subcases, to select appropriate operators which can be applied in a given situation. The situation is then projected into the future, allowing the results to operator application to be evaluated directly. Projected reasoning can be used for planning, scheduling, fault diagnosis and recovery and autonomous process control in a manner akin to heuristic search, but avoids many of the classic pitfalls of the search method. The approach significantly extends the variety of problems which can be addressed with case-based reasoning while retaining CBR's ease of knowledge engineering and incremental learning. A discussion of projective reasoning as well as an example of the paradigm are followed by an examination of temporally-based classification and prediction tasks. Finally, a plan for integrating these approaches into CSI's remind CBR shell is given along with associated costs and manpower requirements. Anticipated benefits/potential commercial applications - CBR technology has a wide range of problem solving applications in such domains as planning, scheduling, fault diagnosis and recovery, and autonomous process control.

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Topic#: 91-021 ID#: 9110742  
Office: ESTO  
Contract #: DAAH0192CR382  
PI: MURAT ERON

**Title:** Process and Physics-based MESFET Models for MESFET, HEMT, and HBT

**Abstract:** Compact software has been successful in meeting the critical commercialization objectives of the Phase I program by making available the new commercial releases of super-compact and microwave harmonica (version 5.0), scheduled for release by August 1992. Both simulators will contain the physics-based linear mesfet model developed under the Phase I of this program. The overall objective of the proposed Phase II program is to build on the technical findings of Phase I while addressing near term commercial objectives in accordance with our proposed Phase II development plan. Within the Phase II program we will provide further upgrades to our linear and non-linear simulators to accommodate the incorporation of fast, first-order, physics-based MESFET, HEMT and HBT models developed during the course of this program. The program is focused on the development of a new generation of advanced circuit interactions are unavoidable and have to be taken into consideration. The CAD enhancements resulting from this effort will be of immediate benefit to not only the MIMIC community but also to the DoD MIC, MMIC suppliers and commercial microwave companies. Anticipated benefits: within the Phase II program we will provide upgrades to our commercially available simulator, microwave harmonica to accommodate the incorporation of fast, first-order, physics-based linear and non-linear advanced MBD MESFET, HEMT, PHEMT and HBT models developed under this program. The resulting cad enhancements from this effort will be of immediate benefit to the mimic Phase II and others. Anticipated benefits/potential commercial applications - The anticipated benefits of this effort are as follows: 1) the integration of physics-based MESFET, HEMT and HBT models into an existing microwave commercial nonlinear simulator, microwave harmonica; 2) analysis of the linkage between process parameters to device characteristics to circuit performance and yield; 3) a detailed "case study" of a production MMIC circuit; 4) establishment of closer ties between commercial simulators and physics-based MESFET/HEMT/HBT modelling efforts. In particular, in Phase II, compact software will seek to integrate efficient numerical 2-D models into our simulators.

## DARPA SBIR PHASE II AWARDS

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Topic#: 90-127 ID#: 9020227  
Office: UWO  
Contract #: DAAH0192CR405  
PI: SIDNEY DAVIS

Title: Generators for Miniature Reciprocating Engines

Abstract: It is proposed herein that the promising results of the Phase I development of a comprehensive theoretical foundation for the optimal design of miniature generators driven by model airplane type reciprocating engines be extended in Phase II to accomplish the design, construction and test of a set of miniature generators covering the range of powers from 10 watts to 1000 watts. The methodology for optimization utilizing computer generated universal design curves is detailed. It is shown that a highly reliable, rugged generator, 0.75" in diameter. Less than 0.6" long and weighing less than 2 ounces can produce a well regulated power output of 10 watts continuously. A novel concept of an electromechanical throttle control of the drive engine to ease requirements on the output electronic regulator is proposed for evaluation in Phase II. Proof-of-performance tests and limited environmental testing of the set of prototype generators are detailed. The transfer of the technology developed here under to a multitude of commercial and industrial applications is addressed. Anticipated benefits/potential commercial applications - Multiple applications for a light weight, rugged and reliable low power dc electromechanical generators.

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Topic#: 91-050 ID#: 9110405  
Office: SSTO  
Contract #: DAAH0193CR079  
PI: HEIDI JACOBUS

Title: Intelligent Next Generation Controller/Sensor Operations Planning Systems

Abstract: The project supported by Defense Advanced Research Projects Agency (DARPA) in the Phase I, has been directed towards implementing a framework for performing model-driven vision-based robot system planning and execution for advanced next generation intelligent machines. The architecture designed and implemented in Phase I prototype defines a set of tools for single and multiple focal plane sensor image processing and understanding which can accept and are driven by active object recognition models. The tool set provides a formalized environment for implementing image algebra-based preprocessor and model-based object recognizer. In Phase II we plan to implement a real time parallel processor-based accelerator. Anticipated benefits: this project provides three important potential Phase III commercialization prospects: (1) hardware and software support for common image understanding environments, (2) a high speed image transfer bus subsystem which will be of strong interest in the workstation and advanced PC markets, and (3) a ruggedized gigaflop class embedded parallel architecture for field-portable signal/image processing applications.

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Topic#: 91-027 ID#: 9110823  
Office: ESTO  
Contract #: DAAH0192CR354  
PI: ROBERT L COTTLE

Title: Integrated Technology Cad: SWR Commercialization and Advancement

Abstract: This proposal emphasizes commercialization and advancement of SWR (semiconductor wafer representation) standards for integration of semiconductor technology cad (TCAD) tools: basic SWR 1.0 system. This will produce an SWR 1.0 server (as defined by the CFI TCAD group) integrated with an object-oriented database and an interactive visualization tool. Functional SWR compliance tests plus client-server performance tests will be made. SWR system tests will demonstrate integration of commercial 2D process and device simulation tools. Option 1: integrated SWR/TCAD/ECAD system. This will integrate the basic SWR 1.0 system into a commercial ECAD (electronic CAD) framework, provide integration with mask layout and circuit parameter extraction, and demonstrate full simulation from mask layout through circuit simulation. An interactive SWR object editor/browser will also be provided. Option 2: 3D SWR system. This will define extensions of SWR to 3D for TDAC tool integration, implement a 3D SWR system including an object-oriented database and 3D visualization, and demonstrate integration of 3D TCAD tools via SWR. Option 3: extended functionality 2D SWR system. This will explore and develop functional extensions of SWR which provide capabilities beyond TCAD tool integration, i.e., which enable more rapid development of more sophisticated 2D TCAD tools. Anticipated benefits/potential commercial applications - The proposed effort will commercialize and advance SWR standards to provide (1) industry standard TCAD tool integration, (2) accelerated transfer of university TCAD tool research to the semiconductor industry and (3) more rapid and advanced TCAD tool development. Option

## DARPA SBIR PHASE II AWARDS

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1 will integrate SWR and TCAD tools with commercial ecad to provide concurrent engineering and accelerated IC technology development. Options 2 & 3 will improve SWR to meet needs of advanced TCAD and IC technology.

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Topic#: 90-050 ID#: 9010218  
Office: LSO  
Contract #: DAAH0192CR235  
PI: CHARLES KALT

Title: Thin Films With Electrically Controllable Reflectivity/Transmissivity to Visual or Infrared.

Abstract: A new kind of electro-optic display operates by electrostatic deflection of extremely thin films of polymer and metal. It provides a new display mechanism which is an order of magnitude less expensive than currently used displays, as well as providing higher contrast, higher speed, wider viewing angle with better colors and color gradations. The device is flat, light weight, has a temperature range considerably better than LCD and has proved excellent on life tests. In addition to having very low energy consumption, it is reflective and therefore operates in bright sunlight or any light level in which the human eye can function. It can also operate in the transmissive mode or a combination of reflective/transmissive. Anticipated benefits/potential commercial applications - If this project succeeds as expected, it will open up millions of dollars worth of new markets in the electronic sign business in the near future and billions of dollars in flat panel TV and computer business in two to five years.

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Topic#: 90-005 ID#: 9010392  
Office: ASTO  
Contract #: DAAH0192CR349  
PI: PETER COLOGER

Title: Evaluation of Thermal Control Concepts for Small Satellites

Abstract: Future small satellites are anticipated to operate at greatly increased power levels requiring advanced thermal technologies to manage their waste heat. Five thermal technologies were investigated during Phase I. Of these five, deployable radiators provide the most effective enhancement of heat rejection capability. However, their application requires flexible and thermally efficient connections between radiator and spacecraft. A flexible heat pipe joint and a miniature capillary pumped loop were investigated during Phase I and will be developed during Phase II. In addition, a parametric analysis of the thermal requirements of generic small satellites will be performed. The results will be used to define the optimum implementation of the new technologies. Anticipated benefits/potential commercial applications - the technologies identified in the proposal have applications in military and nasa missions and commercial communication satellites. Deplorable radiators and the required flexible joints are of interest to SDIO because they can be protected against external threats.

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Topic#: 91-101 ID#: 9120120  
Office: DSO  
Contract #: DAAH0193CR111  
PI: K. ABRAHAM

Title: Novel Solid Electrolytes for Lithium Batteries

Abstract: Studies in Phase I have demonstrated the feasibility of developing new solid polymer electrolytes with conductivities of  $10^{-4}$  to  $10^{-2}$  ohm<sup>-1</sup>. cm<sup>-1</sup> in the milspec temperature range of -40 to 70°C. The proposed Phase II work involves optimization of the composition of the electrolytes identified in phase i, their full characterization, and the fabrication and testing of solid-state rechargeable Li cells utilizing them. Anticipated benefits: New solid electrolytes identified in this research can lead to the development of solid-state li batteries with high-rate discharge capability at ambient temperatures. Commercial applications of such batteries include portable radios, telephones, computers, televisions, camcorders, handheld tools and, ultimately, electric vehicle propulsion.

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Topic#: 90-111 ID#: 9020075  
Office: DSO  
Contract #: DAAH0193CR099  
PI: KURT BAUM

DARPA SBIR PHASE II AWARDS

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Title: Advanced Fouling Control Coatings

Abstract: Barnacle removal on ships entails significant cost to the navy, and current anti-fouling paints is being restricted because of environmental problems. On the Phase I program, hydrophobic elastomers were obtained with T<sub>g</sub> of about -50°C. On the Phase II program the chemical processes will be optimized and related systems will be explored. Testing of fouling-release properties will be carried out. Anticipated benefits: Advanced anti-fouling coatings will result in improved operating efficiency of both naval and commercial shipping. Environmental problems of tin/copper based paints would be avoided.

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Topic#: 90-115 ID#: 9020269  
Office: MTO  
Contract #: DAAH0192CR353  
PI: ROBERT HECHT-NIELSEN

Title: Analog Neural Network Controller Chip

Abstract: In Phase I of this project, HNC, Inc., with assistance from the University of Southern California, developed a preliminary design and supporting simulations for a new neural network controller chip, which uses analog circuitry to implement arithmetic operations and digital circuitry to store and adapt the weights. Using spice simulation data, it was demonstrated that the chip can learn a complex control function using low-precision analog VLSI arithmetic circuits. In Phase II, HNC and USC will carry out the detailed design of the chip, and develop a real-world application demonstration, leading to commercial development of the chip. The proposed multivariate controller chip can support up to 8 sensor inputs and produce as many as 4 control outputs, with configurations for setpoint, supervised, or optimal control. A key innovation of the proposed chip over other analog VLSI designs is the use of HNC's graded learning algorithm, which provides a new, powerful, on-chip methodology for implementing an optimal control law according to an arbitrary, user-specified performance function. Graded learning is also well-suited to analog VLSI because it can adapt to inaccuracies in the arithmetic circuit elements, which provides significant implementation advantages over other neural network learning laws, such as back propagation. Anticipated benefits/potential commercial applications - The proposed Phase II activity will complete the design of a high speed, low-cost, single chip VLSI adaptive neural network controller. The use of graded learning and its encoding into the chip minimizes application analysis and software design costs, without sacrificing hardware production costs or system performance. Therefore, this chip will significantly reduce the cost and difficulty of designing high speed controllers for a variety of military and commercial applications.

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Topic#: 90-127 ID#: 9020201  
Office: UWO  
Contract #: DAAH0192CR402  
PI: MICHAEL AMPELA

Title: A Compact, Lightweight, and Rugged Voltage Multiplied Homopolar Generator

Abstract: As electronics become smaller through miniaturization, the ability to fully utilize the sophistication they are capable of on unmanned autonomous vehicles is becoming more limited by the weight associated with power supplies needed to energize them. In the interest of making use of the high energy density of chemical fuels to replace batteries, Interscience, Inc. proposes to develop the voltage multiplied homopolar generator (VMHPG) as a compact, lightweight, and ruggedized power supply that can be mass produced at low cost. Under the 1990 SBIR Phase I program, Interscience, Inc. built and tested a prototype VMHPG power supply which demonstrated 380 watts of continuous 10v dc power in a cylindrical package 3 inches in diameter and 1 inch long. The weight of the prototype unit was 189 grams which corresponds to a power density of 2 kW/Kg. Based on our predictions for an optimized design, power densities beyond 5 kW/Kg can be achieved in the 1 to 1000 watt output power range. For missions requiring as little as 10 watts of power, the VMHPG offers a wright advantage over batteries after only three minutes of operation. In addition, the basic design of the VMHPG is highly modularized and can be redesigned with little effort to accommodate an extremely broad range of performance specifications. The results of this effort, which have met or exceeded all the Phase I technical objectives, serve as the basis for full implementation of the VMHPG concept under Phase II. Anticipated benefits/potential commercial applications - Development of the voltage multiplied homopolar generator will extend the range of missions carried out by unmanned autonomous vehicles by increasing the level of sophistication provided by electronic systems. In addition, the development of a compact, lightweight, and rugged generator that can be mass produced at low cost is expected to capture a significant portion of the portable generator market including the automotive sector.

DARPA SBIR PHASE II AWARDS

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Topic#: 90-028 ID#: 9010290  
Office: MTO  
Contract #: DAAH0192CR222  
PI: DAVID DOERR

Title: In-Situ Manufacturing Control by Ellipsometry

Abstract: Optical coatings have numerous important military and commercial applications, ranging from antireflecting coatings on photovoltaic infrared sensors to rugate filters, to surface waveguides for optoelectronics. Most of these coatings are applied using evaporation. There is a strong need for improved measurement and control of film physical thickness, packing fraction, and index of refraction, in order to increase accuracy, performance, reproducibility, durability, and long-term stability of these coatings. Reflectance of a HeNe laser beam is presently commonly used, but unfortunately measures only the "optical thickness" (product of index times physical thickness). It is used mainly for thick films, and is not as accurate if very thin films for ultraviolet coatings are being deposited. This proposal is to extend the substantial success of the Phase I work to the specific application of ellipsometry to optical coatings technology. This proposal differs from a parallel Phase II proposal to DARPA utilizing ellipsometry in organometallic CVD of HgCdTe, as discussed in section c. The present proposal addresses the in-situ (real-time) control of thin film deposition processing as applied to optical coatings. A substantial collaborative effort with CVI laser corporation is proposed. Anticipated benefits/potential commercial applications - this technology will permit real-time control of layer thicknesses, film densities, index of refraction, and material composition in multilayer optical coatings for use in military optics. Examples are optical band pass and reject filters, rugate filters, and graded index of refraction waveguide structures.

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Topic#: 90-044 ID#: 9010349  
Office: MTO  
Contract #: DAAH0192CR191  
PI: BLAINE JOHS

Title: Non-Invasive Control of II-VI Semiconductor Growth

Abstract: HgCdTe is important for focal plane array infrared detectors, and as the Gulf War demonstrated, these arrays are enormously important in imaging, and guidance systems. Yet HgCdTe and related compounds are difficult to grow with uniform flatness, high homogeneity, and with precise control of layer thicknesses, surface smoothness, and proper ratios of alloy constituents. Increase of properties perfection will result in increased performance, higher device yields (a severe problem presently), and lower costs. Another II-VI class of semiconductors of military importance is Zn<sub>1-x</sub>Cd<sub>x</sub>Se and Zn<sub>1-x</sub>Cd<sub>x</sub>Te. In Phase I we successfully demonstrated that in-situ spectroscopic ellipsometry can precisely determine layer thickness (monolayer sensitive), surface conditions, alloy ratios, and temperature of II-VI semiconductors grown by metal organic vapor phase epitaxy (MOVPE). Data were taken during growth but analyzed afterwards. In order to control growth data need to be analyzed in "real-time," with feedback to the growth system. "Real-time" ellipsometric analysis was achieved during mbe growth of GaAs under a separate contract with darpa, thus we are confident that it can be achieved in movpe growth, in spite of it being a much more difficult task for movpe. Thus the goals in Phase II are to effect real-time ellipsometric data analysis, and use this in controlling MOVPE growth. In Phase III this capability will be commercialized. Anticipated benefits/potential commercial applications - Spectroscopic ellipsometry will allow non-invasive control of II-VI semiconductor growth resulting in controlled alloy constituent ratios, better surfaces, and precise layer thicknesses. This increased control of crystal and device perfection will result in increased device performance, higher yields, and reduced costs.

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Topic#: 90-032 ID#: 9010617  
Office: DSO  
Contract #: DAAH0192CR329  
PI: BRET HALPERN

Title: Jet Vapor Deposition of Ferroelectric PZT Thin Films for Electronic Memory Applications

Abstract: Non-volatile, radiation-hard, ferroelectric random access memories (FRAMs) offer an attractive alternative to semiconductor DRAMs and SRAMs, for future military and commercial electronic systems. The challenge is to reliably and economically manufacture high quality, sub-micron thin films of ferroelectric compounds such as lead-zirconate-titanate (PZT) which are key component layers in FRAM integrated circuits. Phase I of this program demonstrated convincingly that our innovative Jet Vapor Deposition (JVD) process can solve this manufacturing problem. The patented JVD process uses supersonic

DARPA SBIR PHASE II AWARDS

inert gas jets to codeposit the constituent vapors of multicomponent ferroelectric compounds onto the semiconductor wafer substrate. The ferroelectric films produced during Phase I were of excellent quality, and the "pilot" production rates achieved suggest that the JVD can readily be scaled-up for commercial production. We propose a Phase II program to build on this Phase I success to develop more reliable, scaled-up, high-throughput JVD process equipment suitable for use in commercial semiconductor IC fabrication lines. Anticipated benefits/potential commercial applications - JVD process equipment for ferroelectric thin films will be perfected under this Phase II program and then manufactured for sale to fram IC manufacturers in the Phase III commercialization stage of this program. This will enable the IC manufacturers to reliably and economically produce innovative FRAM devices on a significant commercial scale.

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Topic#: 90-048 ID#: 9010379  
Office: ASTO  
Contract #: DAAH0192CR175  
PI: ROBERT GORDON

Title: Act-Based Sigint Receiver IF Signal Processor

Abstract: Present and future sigint receiving systems must be capable of providing rapidly tunable frequency conversion, switched-bandwidth and/or center frequency predetection IF and/or post detection baseband filtering and transversal equalization, interference excision and programmable time delay in the transmission paths of all signals of interest in order to intercept and characterize signals of unknown parameters in a disadvantaged carrier to noise environment. Noting the ability of Acoustic Charge Transport (ACT) monolithic GaAs-based device to serve as either a tapped variable analog delay line, analog memory, variable bandwidth and/or center frequency BPF or programmable transversal equalizer, a recently completed six month SBIR Phase I study applied the characteristics of present and projected ACT devices to the generation of an advanced sigint receiver design with the above capabilities. Accordingly, using the foregoing design study as a starting point, a 12 month Phase II follow-on program is proposed to develop, implement and thoroughly evaluate, in a suitable end to end sigint test bed, a brassboard feasibility model ACT-based receiver IF processor. The latter will include, as a baseline, a VHF adaptive channelizer/tracking filter, DDS-based dechopping downconverter and rapidly scanned HF IF narrow BPF. Proposed add ons to the above baseline include ACT-based interference excisor and delay-multiply feature detector. Anticipated benefits/potential commercial applications: The advanced ACT-based sigint receiver if processor feasibility model developed during the proposed Phase II brassboard implementation program will form the basis for a Phase III follow-on productization effort culminating in a fully packaged sigint receiver if processor reproduction prototype, ready for retrofit and field testing in a "host" sigint receiving system. Successful demonstration of the latter will lead to the manufacture and deployment of these IF processor products in sigint receiving systems fielded by the U.S. Army, Navy, Air Force and other government agencies.

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Topic#: 91-003 ID#: 9110372  
Office: LSO  
Contract #: DAAH0193CR003  
PI: JOHN MORRISON

Title: Distributed Interactive Simulation Protocol Extensions for Logistics Simulation

Abstract: This project proposes to increase the fidelity of distributed interactive simulations (DIS). The SimNet system (short for simulator networking) is a system of network of combat vehicle simulators designed for combined arms tactical training, and weapon development. Because the primary goal of the system was to combat training, many important mechanisms to enable higher fidelity left out of the network protocol. In Phase I, MAK designed two new generalized protocols, the Newtonian protocol, and Migratory Object protocol to provide many of these capabilities. Phase II will implement these new protocols, and integrate them with the next generation DIS network for a four-pronged approach is outlined. It will add personnel considerations to SimNet combat models and logistics system world. By integrating engineering simulations into DIS, the validity of weapon experiments and combat results will be greatly increased. Research funds will also be conserved by increasing the utility and applicability of engineering simulation developments. Phase II effort is structured as a progressive array of demonstrations which will illustrate the capabilities of the new protocols, and advances in DIS fidelity. These development can be customized and re-prioritized to accommodate any pressing customer needs. Anticipated benefits: The proposed protocols will enable unprecedented integration of high fidelity simulations into DIS. Large scale networked virtual reality systems for education, entertainment, and business can make use of these capabilities.

DARPA SBIR PHASE II AWARDS

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Topic# 91-062 ID# 9110410  
Office: DSO  
Contract #: DAAH0192CR373  
PI: MARIO CAZUCA

Title: Stable Photocrosslinkable Nonlinear Optical Polymer Based Practical Second Harmonic Devices

Abstract: Organic materials with large and stable optical nonlinearities are expected to find applications in a number of photonic technologies such as frequency conversion, optical memory and optical recording media among others. In our Phase I research highly stable polymers with strong nonlinear optical properties were developed. These polymers presented excellent mechanical properties and good transparency in the regions of interest, which made them ideal for the fabrication of waveguiding devices for second harmonic conversion. Cerenkov-type phase-matched second harmonic experiments were performed with planar waveguides made from these polymers. High efficiencies of second harmonic conversion of the order of  $5.6 \times 10^{-3}$  percent per watt were obtained from experiments for the fundamental wavelengths of 830 and 1060 nm. The Phase II effort will concentrate on the fabrication of polymeric channel waveguides made of alternate regions of poled and unpoled polymer. These improvements are expected to increase the efficiency by more than two orders of magnitude, making practical frequency conversion devices a reality. Anticipated benefits: Results of the Phase II research are expected to lead to government and commercial applications of polymeric waveguide devices for frequency doubling in the area of optical recording. Additional applications are expected in the areas of communications, optical signal processing and optical computing, instrumentation, smart weapons and the graphic arts. Anticipated benefits/potential commercial applications - in addition to the fundamental knowledge on nonlinear optical processes in polymers that will be gained through this study, significant practical benefits are expected to follow. Due to the compatibility of the proposed invention with planar semiconductor fabrication, wavelength conversion devices of this type should find wide application in both discrete emitter-frequency doubler systems and integrated optical circuits and subsystems.

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Topic# 91-033 ID# 9110791  
Office: MTO  
Contract #: DAAH0192CR400  
PI: ALEX SHIMKUNAS

Title: Multilayer Membranes for X-Ray Lithography Masks

Abstract: X-ray lithography membranes, consisting of precisely controlled multiple layers of silicon carbide and silicon nitride, will be developed. The benefits of multilayer membranes have been shown in phase I: compared to single-layer silicon carbide, the multilayer membranes showed superior optical transmittance, manufacturing yield, fracture strength, and chemical resistance. An advanced multilayer coating process will be developed in a single-chamber electron cyclotron resonance chemical vapor deposition system. The coating process will feature substrate temperature control and in situ layer thickness monitoring, the essential requirements for the degree of precise control of layer thickness and stress needed for multilayer membranes, in situ monitoring of process-induced defects, cross-sectional coating defect identification, and techniques for defect reduction will be used to increase the membrane yield, strength, and smoothness to levels beyond those achieved in phase I. The focus of Phase II will be to develop low-cost, rugged, transparent, and radiation-hard membranes usable by end users of x-ray lithography systems. Membranes will be designed and fabricated to the specifications of existing commercial x-ray lithography aligned tools and distributed to U.S. x-ray lithography users for tests and evaluations. Accelerated tests of radiation hardness will be made to obtain realistic mask lifetime measurements. Anticipated benefits: advanced and improved x-ray lithography masks. The key benefits for masks are: improved mask alignment, improved patternability, higher yield and lower cost, increased durability, and increased lifetime. Also, improved x-ray windows and filters having greater burst strength.

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Topic# 91-181 ID# 9120095  
Office: ESTO  
Contract #: DAAH0193CR001  
PI: GREGORY DIEHL

Title: Strategic Manufacturing Planning, Strategic Business Planning and Short Term Scheduling of Semiconductor Factories

Abstract: This Phase II proposal responds to the stated goals of DARPA SBIR topic 91-181 by proposing three specific development projects (a) development of a framework and decision support tools for strategic manufacturing design, planning, and operations of semiconductor factories based upon rapid modeling technology (RMT). (b) creation of tools and

## DARPA SBIR PHASE II AWARDS

methodologies for evaluating different business and product introduction strategies based upon (a) and cost analysis principles. These will be used to analyze the early and middle phases of new product manufacturing. (Where the most yield learning is occurring) so as to realize maximal profits (termed rapid yield learning). (C) development of scheduling and learning tools, based on lagrangian realization and perturbation analysis techniques to deal with the complexity of multiple products in semiconductor manufacturing. These techniques have potentially significant advantages over existing heuristic approaches, and exploit some novel on-line sensitivity analysis approaches in order to develop real-time control mechanisms driven by actual real-time factory data. In all cases, our Phase II goal is to develop tools and methodologies that are readily accepted within the industry because of their (a) ease of use, b) business focus (rather than technical focus), c) implementation of standard user interfaces, and d) use of common database interfaces and standards. Anticipated benefits: we anticipate that the successful completion of the proposed Phase II effort will include the development of easy-to-use commercial software tools for rapid modeling, design, and scheduling of semiconductor factories. These tools will lead to a greater focus on analysis of manufacturing and business strategies, consistent improvement, and increased learning from other manufacturing industries. As a byproduct, this project will contribute to solving one of the major problems identified in the 1990 DoD list of critical technologies (#5 simulation and modeling).

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Topic#: 90-080 ID#: 9020562  
Office: CSTO  
Contract #: DAAH0192CR192  
PI: ALLAN GERRISH

Title: All-Optical Gigabit LAN

Abstract: All-optical networks offer the long range solution to the challenge of providing high-speed computational resources and data access for a large number of users. Current barriers to all-optical networks include optical switching (including control), optical buffering and computation, and network protocol compatibility. Optivision has found a solution to some of these significant barriers, which, if proven to be successful in the proposed Phase II prototype development, could result in the early implementation of an optical space division switch that is compatible with current and emerging high-speed network protocols. The specific innovation offered is the use of a polling receiver in conjunction with a matrix vector multiplier optical switch to provide in-band signalling and control of the switch. During the first baseline year, a proof-of-principal prototype in-band controller will be designed for the serial-hippi protocol, fabricated, integrated with an existing crossbar switch and out-of-bank switch controller, and functionally tested using a in-house test bed. During the second year, an enhanced network test bed will be used for a complete closed loop functional demonstration of the in-band optical switch. In addition, the in-band control approach will be extended to multiple switch networks and to multiple protocols using analysis and simulation. Anticipated benefits/potential commercial applications - the prototype in-band controller developed here provides the technology development needed for field placement of an optical switch in high-speed networks. Commercial opportunities include applications requiring large scale simulation, modelling, visualization, systems analysis, and shared databasing, such as aircraft design, weather forecasting and scientific research. Compatibility with existing electronic switches will ensure a commercial market.

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Topic#: 91-068 ID#: 9110467  
Office: DSO  
Contract #: DAAH0193CR005  
PI: THOMES BROTHERTON

Title: Applications of Data Fusion to Signal Processing

Abstract: A problem of interest to the U.S. Navy is the development of signal processing techniques to detect and classify threat sources of short-duration, acoustic transient events in underwater acoustic data. The problem is very difficult because (1) every threat source has many classes of associated acoustic events, and (2) the underwater environment has an even greater number of interference acoustic events, such as those from biologics. Orincon has found, through experiments with actual transient data, that no single signal processing technique can create sufficient features to enable one to distinguish uniquely among the large classes of transients. Rather, several techniques are required to generate metrics from which transients can be classified. The data fusion of these features is difficult because (1) each feature-versus-time plot found from processing real data is usually a complex pattern to the human eye, and (2) the aggregate pattern from all the features is even more complex to perceive. During Phase I, this program demonstrated that improved classification performance was attained by hierarchically fusing three different feature sets. In Phase II, the performance improvements through hierarchical feature fusion will be quantitatively examined and

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a real-time hierarchical feature fusion system will be implemented using new neural network hardware and vlsi technology developed under DARPA sponsorship. Anticipated benefits: neural network data fusion of multiple feature outputs will shorten the cycle time to field an operational transient processing system for navy applications. The multifeature approach will improve system performance and broaden the number of signals that can be classified. There are many other applications that can benefit from this approach, including medical diagnostics, control, seismic monitoring, meteorological forecasting, environmental monitoring, economic forecasting, nondestructive testing, and machine-based fault detection.

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Topic#: 90-026                      ID#: 9010660  
Office: DSO  
Contract #: DAAH0192CR386  
PI: BRIAN HEBLE

Title: Finite Elements Software for Modeling Chemical Vapor Deposition and Plasma Reactors

Abstract: The success of advanced materials manufactured by Plasma Enhanced Chemical Vapor Deposition (PECVD) has led to applications of these materials in a variety of industries. Technical difficulties with quality control, safety, and process efficiency have spawned industrial r&d interest to solve these problems. Models which accurately predict important aspects of PECVD systems would serve as a valuable tool for understanding fundamental phenomena and help address these manufacturing issues. These models would include a description of the flow and energy field, RF fields in the cavity containing a plasma, spatially varying electron energy distribution, and the chemistry within the plasma and on the substrate surface. Existing models have at best predicted two of these phenomena on small-scale R&D systems. Little effort has been directed towards a marketable modeling system which can be applied towards industrial production systems. This Phase II proposal is prepared by Process Analysts, Inc. to define development of a commercial finite-element model, which will simulate the behavior of industrial pecvd systems. This work is based on the successful results from our Phase I research project. The model will solve the equations of the electric field, ion transport, nonionic transport and electron energy equations and could be used as a stand-alone application or in partnership with an existing commercial fluid dynamics package that further solves for fluid flow and heat progress and validate the modeling tool. Additionally, experimental verification studies will be completed on an existing r&d reactor. Anticipated benefits: It is anticipated that the modeling package will become the industry leader in providing state-of-the-art plasma modeling technology to customers in a broad range of industries. Successful completion of the Phase II program, and future enhancements in Phase III will result in a complete and commercially available modeling package capable of simulating and predicting reactor conditions over a broad range of reactor design, flow field and plasma/film chemistry.

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Topic#: 91-057                      ID#: 9110003  
Office: UWO  
Contract #: DAAH0192CR370  
PI: MICHAEL FRISH

Title: Vorticity Optical Probe Development: Particle Manufacturing Technology and Applications

Abstract: Physical Sciences Inc. has developed an optical technique, known as the Vorticity Optical Probe or VOP, for directly measuring vorticity vectors in water flows. The VOP operates by seeding into the flow transparent spherical particles that are tens of microns in diameter with each containing one or more embedded lead carbonate crystals that act as planar reflectors or "mirrors". Recently, a means for manufacturing these problem particles from gels with refractive index and density closely matched to water was invented, for the first time enabling use of the VOP in water flows. A manually-operated benchtop apparatus was assembled in Phase I to produce enough of these gel particles needed to support vorticity measurements in a high-speed water tunnel. To seed other flows of interest to DARPA, and to support anticipated commercial product needs, development of an automated particle production facility is now proposed. The facility will include capabilities for altering particle and reflector sizes as appropriate for specific applications. In addition, a new class of probe particles, made from multi-faceted polyhedrons and suitable for use in vorticity visualization and imaging, and for measurements from long distances between the sampled volume and detection optics, will also be manufactured. The advanced particles will be used to visualize and quantify critical vortical regions around a vehicle being studied in a test facility such as the large cavitation channel. Anticipated benefits: This effort will facilitate application of the VOP to studies of critical flowfields in water tunnels and around test vehicles. Success in Phase II will establish a basis for commercial sales of instruments and probe particles to other fluid mechanics laboratories worldwide. Other potential beneficiaries of this manufacturing technology are Particle Imaging Velocimetry (PIV) and studies of two-phase flows where new classes of refractive index and/or density matched particles may

DARPA SBIR PHASE II AWARDS

enhance existing technology.

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Topic#: 91-096 ID#: 9120833  
Office: DSO  
Contract #: DAAH0193CR116  
PI: GEORGE RHODES

Title: Nondestructive Evaluation of Ceramic Bearings

Abstract: In Phase I, Resonant Ultrasound (RUI) was applied to Si<sub>3</sub>N<sub>4</sub> ceramic bearings to determine their quality. By calculating the spherical mode degenerate resonance of a homogeneous isotropic elastic sphere, we were able to predict all resonant frequencies. A coarse scan does not find all resonances, however subsequent examination of the predicted region yields a 100% correlation with the model. A cerbec laboratory process produced 1/4 inch SiN spheres which are essentially perfect (2 ppm total defects). An operationally superior process labeled NBD-200 produces spheres which contain 100 ppm total defects. These bearings show much higher wear capabilities than the earlier NBD-100 samples. The RUI measurement detects all flaws including asphericity, density variations, cracks and voids. It can be used to find batch to batch variations rapidly. Phase II will develop an automated process by which Si<sub>3</sub>N<sub>4</sub> spheres, of various diameters may be cheaply, rapidly and reliably selected after meeting acceptance criteria. The laboratory process by which Si<sub>3</sub>N<sub>4</sub> spheres may be evaluated will also be developed including the resonance model. Anticipated benefits: This method will provide a cost effective monitoring technique for use in various stages of bearing production. If successful, dimensional tolerances and bulk integrity can be measured inexpensively, thus achieving a high level of reliability for a low cost of inspection.

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Topic#: 90-032 ID#: 9010214  
Office: DSO  
Contract #: DAAH0192CR108  
PI: JOHN COLEMAN

Title: Discrete Ferroelectric Non-Destructive Read Out Memory Device

Abstract: Radiant Technologies has developed and patented a novel non-destructive read out (NDRO) ferroelectric memory suitable for both military and commercial applications. The structure uses thin lead lanthanum zirconate titanate (PLZT) film as the memory medium. The ferroelectric NDRO structure has been successfully fabricated and operated by radiant technologies and is presently in development for prototype devices. The ferroelectric ndro is a radically new device whose long term reliability will depend upon the understanding of its operating physics. The Phase II program will fabricate the ferroelectric ndro device, test its performance, and characterize its underlying physics. Phase II will lay the foundation for the fabrication of an integrated circuit memory IC in Phase III. Anticipated benefits/potential commercial applications: a ferroelectric based NDRO memory should exhibit 1E10 write cycle and unlimited read cycle performance in addition to having significant resistance to radiation effects. The technology can significantly reduce the cost and increase the effectiveness of space based non-volatile memory systems or other systems used in a radiation environment. With a cell size smaller than standard SRAM, a ferroelectric NDRO memory will have the performance and price advantage to penetrate commercial EEPROM and SRAM markets and establish new markets world wide.

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Topic#: 90-109 ID#: 9020351  
Office: MTO  
Contract #: DAAH0192CR358  
PI: THOMAS BUSHMAN

Title: Demonstration of a High Resolution Commercial Instrument for Non-Destructive Testing of GaAs Wafers

Abstract: By completing the Phase I effort, recognition technology inc. had developed a breakthrough non-destructive inspection and analysis methodology and a cost effective tool, which provides the ability to profile GaAs in order to define dopant and impurity levels and determine the existence of spatial defects. Our focus on Phase II objectives are closely integrated to successful Phase I results. The Phase II effort shall attempt to accomplish the technical feasibility which was demonstrated in Phase I. We propose to extend and expand our developmental work to Phase II in which we will build a field-test a functional automated system in real fabrication line environment. The successful completion will not only be a significant innovation in the field of semiconductor material testing, we are confident that this new and purposeful methodology will provide a pathway

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to 100% quality inspection, in higher yields and reduced production costs. The semiconductor industry's adoption of our technology will ultimately help the us maintain its lead in MMIC device manufacturing. An operating plan for Phase III effort with commercial financing is already underway. Anticipated benefits/potential commercial applications - (1) technology transfer to the private sector and other applications; (2) more efficient and effective industrial inspection; (3) improved gaas boule quality; (4) increased fabrication line productivity; (5) higher yields for both wafers and devices.

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Topic#: 91-203 ID#: 9120175  
Office: SSTO  
Contract #: DAAH0193CR006  
PI: SCOTT MYERS

Title: Design of a Robotics Research Vehicle (RRV)

Abstract: There is a growing requirement to remove the soldier from the hazardous battlefield environment and replace him with unmanned ground vehicles. Pure teleoperation requires constant operator attention during "menial tasks" such as driving, which eliminates any of the potential force multiplication available with single operator/multi-vehicle control. Currently DARPA is actively developing the key technologies to provide autonomous navigation functions for unmanned ground vehicles and will demonstrate this technology under a program called "DEMO III". DEMO II will use four Surrogate Semi-autonomous Vehicles (SSV) working autonomously in a cooperative mission. In order to insure the success of DEMO II, each of the universities and key organizations developing pieces of the advanced software and electronic hardware required need a common laboratory testbed to prove out their software algorithms and hardware components before integration onto the fielded SSV systems. These common laboratory testbeds should be easy to work with and modify and be 100% electronically and software compatible with the fielded ssv systems to reduce technology transfer risk to the fielded systems. RST will provide an all-electric, small-scale, low cost Robotics Research Vehicle (RRV) which is highly suited for the laboratory environment and is functionally identical to the SSV. The robotics research vehicle will also be capable of being used for several additional applications such as interior physical security (government and commercial), nuclear waste cleanup, EOD, and as a test-bed for future technology advances by the research community.

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Topic#: 91-088 ID#: 9120906  
Office: NMRO  
Contract #: DAAH0193CR107  
PI: RONALD MCDANIELS

Title: Production of Miniaturized, Ruggedized, Low Cost Seismic Station for Development in Third-World Environments

Abstract: This document presents a proposal for the construction of a rugged, miniaturized, low cost, seismic station for deployment in third world environments. The design is based on the Analog Interface Module (AIM), a 24-bit digitizer that is user programmable, the DSP-EB, a DSP board for high-speed signal processing, the CIM, a general purpose communications processor that provides remote users with open access to the digital data, and AIMOS, an operating system which controls the data flow between these modules and schedules user downloadable processing programs for execution by the DSP. While the design presented here is for an open, GSE station, it is by no means limited to that specification. In fact, the AIM/DSP/CIM/AIMOS environment is an extremely powerful platform for the generation and acquisition of digital data from single stations, arrays, seismic networks and for the implementation of very sophisticated signal processing programs that perform on-site analysis of that data. While we present the construction of a gse open station, what we will develop is not only open, but has the possibility of being "smart," i.e., a smart open station limited only by the users imagination. Anticipated benefits: Third world national seismic data centers, university seismic research, and nuclear testing intelligence.

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Topic#: 91-112 ID#: 9120052  
Office: MTO  
Contract #: DAAH0192CR075  
PI: DANIEL BIRX

Title: Efficient, Reliable ARF Laser Drivers for 193 NM Projection Lithography

Abstract: The objective of this effort is to develop new ARF laser technology for use in 193 nm projection lithographic systems. These lithographic systems will enable cost-effective fabrication of military application specific integrated circuits with feature

## DARPA SBIR PHASE II AWARDS

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sizes at or below 0.25  $\mu\text{m}$ . In the proposed program, new all-solid-state ARF laser driver technology will be developed to replace thyatron-based drivers used in current, commercially available ARF lasers. This new all-solid-state technology will extend driver lifetime by a factor of 20 (to  $6 \times 10^{10}$  shots) and will feature novel circuits which recover energy reflected from the time-varying discharge load. The recovered energy will be stored and then reused on the next discharge pulse. These energy recovery circuits will extend laser discharge electrode life and increase overall laser efficiency. This new driver will also be designed to increase ARF laser repetition rate from 400 pps to 1000 pps, increase laser duty factor and thereby extend the life of the deep-UV laser resonator optics. This all-solid-state ARF laser driver technology is based on SCR-computed, nonlinear magnetic pulse compression coupled with a novel fractional-turn transformer which enables an extremely compact, low cost, modular design. In the Phase I effort, final design specifications for this driver will be established and a detailed engineering design of the driver will be completed. A breadboard version of this modulator, denoted XLD I (excimer laser driver - 1) was fabricated and tested on an arf laser made available. In the Phase II effort, the technology demonstrated by the XLD-I tests at Cymer Corp. will be applied to the development of XLD-II. XLD-II will be a production prototype modulator fully compatible installation in the existing laser enclosure, thereby acting as a direct replacement for the existing thyatron based modulator. The new all-solid-state pulsed power technology to be developed in this effort will extend ARF laser driver lifetime by a factor of 20 over previous thyatron-based designs, extend laser discharge electrode lifetime and optics lifetime and increase laser power and efficiency. Potential commercial applications include use of these drivers in the development of reliable rare gas halide lasers for metal-working (welding, cutting, heat treating), medicine (neurosurgery lithotripsy, angioplasty, corneal sculpting) and deep-UV projection lithography.

STR CORP.  
10700 PARKRIDGE BLVD., SUITE 200  
RESTON, VA 22091  
Phone: (703) 758-1103

Topic#: 91-075 ID#: 9110376  
Office: DSO  
Contract #: DAAH0192CR403  
PI: WILFRED GOODSON

Title: Assessment of Materials, Structures, and Component Development Using a Theater-Level Effectiveness Model

Abstract: Although the use of new technology in weapon systems may result in obvious benefits to that system, it has been difficult, until now, to assess the impact of these changes on theater-level campaign outcomes in an efficient and consistent manner. Our Phase I effort demonstrated our unique capability to quantify the military worth of advanced materials research and development programs. The OME-III methodology was used to estimate the change in theater-level campaign outcomes that would result from incorporating advanced materials into a weapon system. For Phase II, we propose to use the OME-III methodology to develop the Technology Evaluation System for Military Applications (TESMA). TESMA will be a Mackintosh-based tool which will allow an analyst to quickly determine a very good approximation of the impact of changes in material characteristics on overall force outcomes. The outputs of TESMA will be the probability of enemy success and change from the baseline. This tool will provide DARPA with information to assist analysts and program managers in making funding decisions for R&D programs, or choosing between programs. These campaign outcome results will literally be at darpa's fingertips, eliminating the need to wait months for campaign analysis results. Anticipated benefits: This work will provide those responsible for allocating scarce resources to materials research and development projects with a valuable tool to aid in the decision process. It will be possible to estimate the contribution of advanced materials and structures in terms of the impact on theater-level campaign outcomes. This will allow comparisons to be made between various materials and to changes in force structure. It will also help advanced materials developers by identifying those characteristics which have the most impact on theater outcomes.

TRELLIS SOFTWARE & CONTROLS, INC.  
2619 PRODUCT DRIVE, SUITE 106  
ROCHESTER HILLS, MI 48309  
Phone: (313) 853-0700

Topic#: 91-050 ID#: 9110347  
Office: SSTO  
Contract #: DAAH0193CR086  
PI: KENNETH STODDARD

Title: Demonstration of an NGC/SPARC-Based Machine Tool Controller

Abstract: The proposed project consists of the implementation and demonstration of a prototype machine tool controller utilizing a SPARC hardware platform and based on the NGC specification for an open system architecture standard (SOSAS). The demonstrations will show modularity, scalability, performance, and the benefit of open architecture. The use of the SPARC platform leverages off of the high market volumes and rapid increases in performance driven by other markets while providing a controller with greater computational power than existing controllers. The resulting controller will have higher accuracy path

## DARPA SBIR PHASE II AWARDS

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control, better surface finish and faster cycle times. The controller will utilize advanced motion control technology that implements features such as adaptive control and multi-machine coordination. The spox real time operating system for the digital signal processor, which is proposed as an option for the controller, will enhance the probability and scalability of the lowest layers of the proposed system. The demonstration will be implemented on a multi-axis work center or a turning center. Several verbal and written commitments have been received for the demonstration machine tool. The controller can be used in a wide variety of applications including robot control. Anticipated benefits: The computational power of the proposed controller enables trajectory generation at state-of-the-art rates, while retaining an open system architecture on which new sensing and control technology can be quickly and easily integrated. The controller's flexible, expandable, modular, open architecture enable continual module improvements to be developed by small entrepreneurial software companies (a unique U.S. strength.)

DNA SBIR PHASE II AWARDS

ANRO ENGINEERING, INC.

Five Militia Drive  
Lexington, MA 02173  
Phone: (813) 957-3080

Topic#: 90-167

ID#: 92-92-001

Office: DNA

Contract #: DNA001-92-C-0157

PI: Gerald F. Ross, Ph.D.

Title: Next Generation Ultra Wideband (UWB) Intrusion Detection Radar for the Protection of Nuclear Facilities

Abstract: Based on definitive Phase I results, it is proposed to develop a next generation ultra wideband (UWB) extended range intrusion detection radar sensor for the protection of nuclear facilities. The range of the original impulse radar intrusion detection sensor developed for dna in 1988 can be extended from 300 feet to a mile or greater for a walking intruder with a significant reduction in false alarms in mildly cluttered areas by the proposed enhancements. The three key elements of the extended range system are: an electronically scanned array of 10 low-cost synchronized sources of s-band energy at 1 ns duration that increase peak power from 50 watts to 100 kW, a new superhetrodyne tunnel diode receiver with a 8-1/2 dB improvement in sensitivity, and a so-called Leading Edge Filter (LEF) for target discrimination and false alarm reduction. Experimental and theoretical result are presented from Phase I in support of the proposed development. In Phase II it is proposed to develop a breadboard model of the extended range sensor and test it at a local civilian airport; later testing to be done in concert with a Phase II partner at a more appropriate facility.

HY-TECH RESEARCH CORP.

P.O. Box 3422  
Radford, VA 24143  
Phone: (703) 639-4019

Topic#: 88-002

ID#: 91-P2-001

Office: DNA

Contract #: DNA001-92-C-0034

PI: Dr. Edward J. Yadlowsky

Title: Study of ION Mass Effects on Long Conduction Time Plasma Opening Switches using Resonant Diagnostic Techniques

Abstract: With the increasing use of inductive storage technology for pulsed power applications in x-ray simulators and other devices, the need to extend the operating capabilities of plasma erosion opening switches (PEOS) is a vital concern. In addition to higher currents, future PEOS's must be able to conduct for longer periods of time (microseconds) while still opening on tens of nanoseconds time scales in order to make inductive store technology useful for planned simulators such as the decade or century machines. Hy-Tech therefore proposes a study to develop switches based on plasmas with difference z's in order to ascertain their effect upon the conduction and opening phases of the switch operation. In the study, Hy-Tech will bring to bear on the switch plasma, a battery of resonant, laser based diagnostics, such as: 1) laser induced fluorescence to measure local ion densities, plasma temperatures, ion drift velocities and magnetic fields, 2) resonant rayleigh scattering to measure ion velocity profiles and microturbulence levels in the switch plasmas, 3) resonant refractive measurements including holography, interferometry, and schlieren techniques to give spatially resolved density profiles and density gradients. These techniques, which have been developed by Hy-Tech will provide a more complete understanding of the operation of a PEOS in general, and a high z PEOS in particular.

IBIS TECHNOLOGY CORP.

32A Cherry Hill Drive  
Danvers, MA 01923  
Phone: (505) 777-4247

Topic#: 90-003

ID#: 91-P2-015

Office: DNA

Contract #: DNA001-92-C-0017

PI: Dr. Peter M. Sandow

Title: Improved SIMOX by Means of the Application of Gettering Techniques

Abstract: The reduction of heavy metals such as Fe, Cu, Ni and others is critical to the successful utilization of UHSi grade Simox materials. Based on the early results of Phase I that showed a reduction in defect density in the early results of Phase I that shown a reduction in defect density in the silicon layer, it is proposed that additional gettering, methods will be applied during annealing, prior to epitaxial deposition and within device fabrication. The techniques that will be used to characterize the improvements gained will include total reflectance x-ray fluorescence (TXRF) surface photo voltage (SPV) and decorative defect etch techniques for both the silicon and buried oxide layers. In addition, devices will be fabricated on optimized Simox wafers and parametric characterization along with radiation hardness measurements will be performed

KTECH CORP.

901 Pennsylvania, NE  
Albuquerque, NM 87110

Topic#: 90-005

ID#: 91-P2-006

Office: DNA

Contract #: DNA001-92-C-0044

DNA SBIR PHASE II AWARDS

Phone: (505) 268-3379

PI: Mr. Edward S. Gaffney

Title: One Microsecond Rise Time Birefringent Hopkinson Bar for Nuclear Airblast Measurement

Abstract: In Phase I, we demonstrated the feasibility of a fully optical airblast gauge concept for nuclear airblast measurement. Testing with gas gun impact showed a risetime to 570 mpa of 1.5 us. The gauge used a sapphire rod in a hopkinson bar arrangement to store and decode an input pressure pulse as long as 15 us. The bar pressure was read by passing a light beam through the rod and detecting the stress induced change in the birefringence of the sapphire. The light can be brought to and from the gauge with standard optical fibers or by mirrors. The gauge is thus fully optical and inherently noise immune. The objective of Phase II is to develop and test a nuclear-airblast gauge using the optically-read sapphire hopkinson bar as the transducer. The gauge will be capable of measuring peak pressures up to 600 mpa (6kbar) with a rise time of 1 us in a nuclear weapon test environment. The bar will be designed to provide at least 35 us of recording time before reflections return from the end of the bar. The gauge resolution will be approximately 5 mpa (50bar).

MISSION RESEARCH CORP.

1720 Randolph Road, SE  
Albuquerque, NM 87106

Phone: (505) 768-7640

Title: Advanced Memory Tester

Abstract: This program will develop an advanced tester for high performance and developmental memories. Memories will be tested at speeds up to 50 MHz using modern, complex algorithms to insure pattern sensitivities and failures are detected. Known bad bits will be masked off so they do not confuse the analysis. Real time logical-to-physical mapping of test vectors and results will allow fast analysis. Facility timing and control systems will position radiation pulses in exact relation to memory strobe edges. Advanced analysis and plotting programs will make test planning and analysis simple and inexpensive. The low cost and portable size of the units will make them available to a wide range of users.

Topic#: 91-005

ID#: 92-P2-07

Office: DNA

Contract #: DNA001-92-C-0152

PI: Mr. Hans J. Tausch, Jr.

PHYSITRON, INC.

3325 Triana Blvd  
Huntsville, AL 3805

Phone: (205) 534-4844

Title: Soft X-ray Reflectors which are Transparent to Harder UGT X-rays

Abstract: Physicon proposes to build an x-ray optical system which will allow the exposure area on an underground nuclear test (UGT) to be used more efficiently. This system will consist of a large area soft x-ray multilayer reflector deployed in front of a hard x-ray scatterer. Soft x-rays will reflect from the reflector into an experimental area while the harder x-rays pass through the reflector essentially unattenuated. Scatterer experiments do not make use of the soft x-rays so this system will allow them to be used without interfering with the scatterer. This will effectively increase the soft x-ray exposure area of a UGT without increasing the size of the line-of-sight (LOS) pipe. In Phase II, we are proposing to test the hard x-ray transparency of our reflectors, test their survivability on a UGT, and build a large reflector and deploy and test it on a UGT. Although this may sound somewhat ambitious for a Phase II SBIR, it is possible because of the parallels between the proposed program and Physicon's DNA-sponsored x-ray pulse modulation system (XPMS) project. A substantial amount of the proposed UGT experiment development has already been done as part of the XPMS so the cost for this Phase II program can be kept lower than it would be otherwise. At the conclusion of this Phase II project, we will have tested a prototype x-ray optical system on a UGT to prove it will work to enlarge the useable soft x-ray experimental area. We will then be ready to build a system for use by experimenters who need a soft x-ray environment free of hard x-rays and neutrons.

Topic#: 90-011

ID#: 91-P2-09

Office: DNA

Contract #: DNA001-92-C-0053

PI: Mr. David B. O'Hara

SCIENCE AND ENGINEERING ASSOC., INC.

P.O. Box 3722  
Albuquerque, NM 87190

Phone: (505) 884-2300

Title: Multi-Phase Stress Experiment

Abstract: This proposal addresses a key issue for reentry vehicle fratricide -- the dynamics of high-speed ejecta from catering detonations as affected by the soil material model used for code calculations. At the present time, two very different material

Topic#: 91-004

ID#: 91-P2-16

Office: DNA

Contract #: DNA001-92-C-0040

PI: Mr. William R. Seebaugh

## DNA SBIR PHASE II AWARDS

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models, a multi-phase effective stress model and a dilatancy model, give essentially identical results for the maximum ejection velocity for dry porous soils. There is ample experimental evidence of the presence of dilatancy effects; however, there is currently no evidence regarding the occupance of the effects dictated by the multi-phase model. Phase I initiated an experimental program on event distant image to test the assumptions in this model related to compression of pore air. Pre-shot soil samples from the test bed, post-shot samples of natural ejecta fragments, soil samples contained within aluminum cans emplaced in the crater pre-shot and recovered post-shot, and material from the post-shot crater lip were obtained. The Phase II program addresses the analysis of these soil samples, and extended data acquisition and analysis program for the upcoming event Husky Jaguar 1, and the development of ejecta implants for determining surface spall velocities for Husky Jaguar 1 and the associated small half-space experiments.

SCIENCE AND ENGINEERING ASSOC., INC.

P.O. Box 3722

Albuquerque, NM 87190

Phone: (505) 884-2300

Title: Field Demonstration of the Technical and Operational Feasibility of Laser Exchanged Nuclear Security

Abstract: Providing physical security for nuclear weapons is unique and challenging because (1) nuclear security must be as failure-proof as possible, (2) a variety of potential threats are involved, and (3) the impending drawdown of nuclear forces requires new approaches to nuclear security. These challenges can be dealt with, in part, by applying innovative technologies. Phase I of this SBIR demonstrated analytically that low energy lasers can enhance physical security in nuclear scenarios by providing warning, additional intruder delay, and intruder functional and combat impairment. The goal of Phase II is to validate the technical and operational feasibility of low energy laser weapons systems in nuclear security applications through proof-of-concept field demonstrations. To meet this goal, three supporting objectives have been defined: (1) design and build brassboard demonstrators of three laser concepts identified in Phase I, (2) use these devices in field tests to demonstrate that warning, delay and impairment can be provided by current laser technology and (3) conduct additional field tests to determine the bounds of usefulness of laser enhanced nuclear security. A successful Phase II will produce several products including validation of the feasibility of laser enhanced nuclear security, laser concept designs for transition into Phase III operational hardware development, and brassboard demonstrators for tests involving other applications.

Topic#: 91-008

ID#: 92-P2-02

Office: DNA

Contract #: DNA001-92-C-0127

PI: Mr. John D. German

SCIENCE RESEARCH LAB., INC.

15 Ward Street

Somerville, MA 02143

Phone: (617) 547-1122

Title: Multi-Beam Laser Interferometer for Plasma Density Measurements in a Plasma Erosion Opening Switch (PEOS)

Abstract: Science Research Laboratory has designed an ultra-sensitive, high bandwidth, visible light interferometer system for the measurement of plasma and neutral gas density in plasma erosion opening switches (PEOS) during their conducting and opening phases. Such measurements will help clarify the physical processes involved in the PEOS opening phase and enable the performance of the switches to be enhanced. An existing visible interferometer has also been used to measure plasma and neutral gas densities near a standard PEOS flashboard. The proposed system uses a CW krypton ion probe laser at 0.647  $\mu\text{m}$ , a stable mach-zehnder interferometer and a fast fringe shift detection circuit to measure the change in the refractive index of a plasma due to free electrons. A second configuration will use two difference wavelength probe beams, combined onto a single path, which will allow the simultaneous measurement of the neutral gas density as well. A third, single-wavelength, multiple-beam configuration will allow the measurement of plasma densities integrals over two parallel paths. The use of visible wavelengths provides significant advantages over microwaves and CO<sub>2</sub> systems. These include higher spatial resolution, higher measurement bandwidths and the ability to probe very high plasma densities with a dynamic range of our order of magnitude.

Topic#: 90-015

ID#: 91-P2-11

Office: DNA

Contract #: DNA001-92-C-0098

PI: Dr. Stephen F. Fulghum

TETRA CORP.

4905 Hawkins N.E.

Albuquerque, NM 87109

Phone: (505) 345-8623

Title: Plasma Cathode for High Power Photoionized Lasers and Plasma Switches

Topic#: 89-001

ID#: 90-P2-10

Office: DNA

Contract #: DNA001-92-C-0031

PI: Ms. Juan M. Elixondo

## DNA SBIR PHASE II AWARDS

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Abstract: The proposed program is to 1) develop a new innovative approach to vacuum plasma erosion opening switches, 2) to develop electron beam and ion beam sources of high brightness and high repetition rates. A feature of technology is the ability to sustain long pulses (10's usec) and/or operate at high frequencies (10's KHz). The concept is different from a vacuum trigger switch, since by injecting the plasma into the gap, it provides for two functions at the same time; triggering the gap and providing a dense plasma for current conduction. Preliminary testing showed evidence of current densities as high as 600 a/cm<sup>2</sup> in single pulses. The current transport is through the plasma and thus independent of space charge limitations. The plasma is rich in metallic ions from the erosion of the gun wall, providing a defuse discharge that results in long lifetime for the electrodes and the overall system.

UTD, INC.  
8560 Cinderbed Road  
Newington, VA 22122  
Phone: (703) 339-0800

Topic#: 90-012 ID#: 91-P2-017  
Office: DNA  
Contract #: DNA001-92-C-0025  
PI: Dr. Eugene L. Foster

Title: Development of Improved Yield Estimation Technology

Abstract: Phase II is the continuing development and evaluation of a new method for yield estimation for use in direct support of the test directorate of DNA in its expanded role in nuclear test ban treaty monitoring. The method is designed to provide accurate results, independently of existing yield estimation methods. The new method is based upon thermodynamic analysis of the events taking place in the cavity formed immediately following initiation of an underground nuclear explosion. The thermodynamic cavity analysis is combined with a dynamic analysis of the variation of peak shockwave pressure with distance from the working point. The Phase I result indicated that the new method, when applied to a selected group of 7 nts events, was accurate to within plus or minus 10%, and that the method is sensitive enough to provide similar accuracy at low yields. The Phase II effort consists of the following tasks: analysis of temperature distribution and turbulence in the cavity; evaluation of non-rock materials' effects; analysis of geometric spreading and energy dissipation of a ground shockwave; evaluation of methods for free field pressure measurement and interpretation; collection of thermodynamic and physical rock properties, and computer model development and evaluation. After the model is developed and completely evaluated, plans for applying the new method to future tests will be developed.

VIRTUAL IMAGE LABORATORIES, INC.  
4925 Edgewood Road  
College Park, MD 20740  
Phone: (301) 206-3129

Topic#: 91-001 ID#: 91-P2-04  
Office: DNA  
Contract #: DNA001-92-C-0173  
PI: Mr. Ernest T. Wright III

Title: Microcomputer Visulation of Nuclear Cloud Models

Abstract: DNA currently uses several supercomputer dyrocodes to create 3D models of complex nuclear burst environments as they evolve in time. Our successful Phase I effort has demonstrated that microcomputers can help meet the need for a low-cost path to high quality 3D visulatization of the results of these codes. We propose to develop the prototype visualization software written in Phase I into a program to be used by DNA and distributed to the simulation community. We will provide the software support necessary for translating simulation results into a standard format understood by our program, as well as the documentation and any technical and training assistance that might be required. We will also continue our research into advanced microcomputer visulatization techniques that employ animation and full color display hardware to enhance the information content of the images. It will not be our purpose to compete with the powerful visualization facilities available on large systems, but rather to complement those facilities by offering a standard, independent and convenient small system forum for the examination and comparison of 3D results.

SDIO SBIR PHASE II AWARDS

ADVANCED DEVICE TECHNOLOGY, INC.  
3 BUDWAY, #29  
NASHUA, NH 03063  
Phone: (603) 886-4943

Topic#: 91-003 ID#: 91-063  
Office: AFSTC  
Contract #:  
PI: DR. PETER KANNAM

Title: 128X128 Element Monolithic Dual Band HgCdTe Staring Arrays

Abstract: Present technology is incapable of collecting both long waveband and mid-waveband signals in each pixel. Dual band detection is currently achieved by the hybrid assembly of two separate focal plane arrays in a single focal plane imaging system. This requires large power consumption, large size and weight, and high cost. Phase II will develop a single monolithic focal plane array that can operate in either mid-wave or long wavebands in the same pixel. This design has never been attempted. Advanced Device Technology, Inc., will complete the following tasks in Phase II: 1) grow and evaluate single band and dual band material for MOCVD reactor; 2) design and fabricate 128x128 element array mask, multi-lead dewar, and 4x4 dual band array; and 3) connect array with off-focal plane MUX and demonstrate dual band detection.

ADVANCED FUEL RESEARCH, INC.  
P.O. Box 380379  
East Hartford, CT 06138  
Phone: (203) 528-9806

Topic#: 92-003 ID#: 92-118  
Office: SDC  
Contract #: DASG60-92-C-0095  
PI: Peter Solomon

Title: Miniaturized FT-IR Sensor for Infrared Measurements

Abstract: Phase II will develop an advanced dynamically-balanced "isolation interferometer" whose mirror motion is decoupled from external vibrations. Such an interferometer can be employed to make an FT-IR instrument which is immune to vibration and is permanently aligned. Advanced Fuel Research, Inc./On-line Technologies, Inc. will test both the plane mirror and corner cube designs, choose the best one and fabricate and test an FT-IR spectrometer for delivery to the Army. Phase II will result in a break-through improvement in portable, rugged, FT-IR instrumentation with the following performance improvements: factor of 30 in vibration suppression; factor of 10 increase in signal-to-noise ratio; factor of 10 increase in scan speed; and a factor of 3 reduction in size and weight. Applications of a passive IR sensor include: identification of rocket launches from satellites, battlefield chemical detection, toxic chemical monitoring, monitoring of emission from superfund sites and monitoring of smoke stack and auto effluents.

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EAST HARTFORD, CT 06108  
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Topic#: 91-015 ID#: 91-402  
Office: AFOSR  
Contract #:  
PI: DAVID FENNER

Title: Superconducting Flux-coupled Fast Switching Device from YBCo Films

Abstract: Applications in High-Temperature Superconducting materials to digital and switching devices have been limited. Magnetic-field flux-coupled switching devices in HTSC may be less limited due to the intrinsic sensitivity of HTSC to magnetic fields. Advanced Fuel Research, Inc., will develop an HTSC microelectronic switching device based on magnetic flux-coupling effects within a single superconductor layer, and fabricated on silicon wafers. Using silicon will have several advantages, including the potential of hybrid integration with semiconductor devices. In Phase I, all key materials and device concepts were tested and proven. In Phase II, Advanced Fuel Research will produce large-area device arrays with high density, element uniformity, and fabrication yield that is compatible with conventional semiconductor microelectronics.

ADVANCED SCIENTIFIC CONCEPTS, INC.  
2020 ALAMEDA PADRE SERRA, SUITE 123  
SANTA BARBARA, CA 93103  
Phone: (805) 966-3331

Topic#: 91-003 ID#: 91-123  
Office: SDC  
Contract #:  
PI: DR. ROGER STETTNER

Title: A Solid-state Visible and Infrared Multiplier

Abstract: In Phase II, Advanced Scientific Concepts will build and test a infrared detector called the Solid-state Visible and Infrared Multiplier (SVIRM), an advanced multi-layered epitaxial material. It extends the sensitivity and dynamic range of Impurity Band Conduction detectors to the level at which individual photons in the 2 to 24 micrometer range are detectable. Because of its high gain, the SVIRM is an ultimate performance IBC detector. SVIRM dark current is low, its internal noise

## SDIO SBIR PHASE II AWARDS

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is low, the maximum flux it can handle is approximately that of a normal IBC detector, its quantum efficiency is that of a normal IBC detector and it is compatible with easily fabricated and conventional silicon readout technology. Dynamic range of Impurity Band Conduction detectors to the level at which individual photons in the 2 to 24 micrometer range are detectable. Because of its high gain, the SVIRM is an ultimate performance IBC detector.

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

Topic#: 91-014                      ID#: 91-567  
Office: DNA  
Contract #:  
PI: PETER S. KIRLIN

Title: Ferroelectric Material for ULSI Devices

Abstract: BaSrTiO<sub>3</sub> has exceptional electronic properties and pending development, thin films of this material have the potential of providing a significant step function improvement in military systems. For instance, its properties should allow the production of integrating capacitors for cryogenic IR detectors, pyroelectric detector array elements for room temperature infrared sensors, cell capacitors in DRAMs and SRAMs, decoupling capacitors for E-M noise suppression, and filters for microwave communications. Despite the numerous potential applications, a manufacturing process for high quality BaSrTiO<sub>3</sub> films remains to be developed. In Phase I, high insulating, low leakage, polycrystalline films of BaSrTiO<sub>3</sub> were grown at 650 degrees Celsius on silicon substrates using a novel PE-MOCVD process establishing ATM as the leader in MOCVD of ferroelectric materials. ATM will team with TI in Phase II to deposit BaSrTiO<sub>3</sub> with properties suitable for fabrication of pyroelectric detector elements in room temperature infrared imaging array. Enabling etching technology will be demonstrated and Phase II will build a prototype of BaSrTiO<sub>3</sub> pyroelectric detectors.

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

Topic#: 91-014                      ID#: 91-032  
Office: ONR  
Contract #:  
PI: ANDREW FREEDMAN,PHD

Title: Atomic Layer Epitaxy of Diamond Thin Films

Abstract: Aerodyne Research will develop an atomic layer epitaxy scheme for the deposition of diamond thin films based on the use of halogenated reagents. Such a scheme will involve use of self-limiting chemical reactions to provide control of the deposition process on an atomic scale. Aerodyne has investigated the surface chemistry of diamond and graphite substrates with both fluorine and chlorine atoms. Using ultrahigh vacuum surface analysis techniques (x-ray photoelectron spectroscopy and low energy electron diffraction), that fluorine atoms (like hydrogen atoms) will maintain a bulk-like structure on the surface. A fluorinated surface offers the hope of controlling the rate at which reactive sites are formed in a deposition scheme. In Phase II, Aerodyne Research will grow diamond in a self-limiting fashion. Both homo- and hetero-epitaxy will be explored using molecular beam techniques using a controlled sequence of reaction steps. These include: reactive site formation and destruction (capping); carbon deposition using a halogenated precursor radical; and an annealing step. The emphasis of this scheme, in contrast to more typical hydrocarbon-based approaches, is careful control of the number of nucleation sites. Applications include aircraft sensors and control devices, automobile sensors, oil, gas, and geothermal well logging, and space and commercial nuclear power.

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

Topic#: 91-011                      ID#: 91-348  
Office: NSWC  
Contract #:  
PI: DR. M. ASIF KHAN

Title: Vertical Cavity Surface Emitting Laser Modules for Optical

Abstract: APA Optics will develop a matrix addressable surface emitting laser modules to serve as a printhead in high speed laser printing. The same modules also form the basis of other commercial applications such as flat panel displays, spatial light modulators, optical imaging and high power laser arrays. Using our unique Phase I approach, Phase II will focus on fabricating 20x20 matrix addressable SEL arrays. This process allows the 400 laser pixels to be controlled by using only 40 connection lines. It therefore makes the laser module packaging practical and suitable for a commercial device.

SDIO SBIR PHASE II AWARDS

ASTROPOWER, INC.  
30 LOVETT AVENUE  
NEWARK, DE 19711  
Phone: (302) 366-0400

Topic#: 91-005 ID#: 91-218  
Office: SDC  
Contract #:  
PI: JAMES A. RAND

Title: Thin Crystalline Silicon Film Photovoltaic Solar Cells and Arrays

Abstract: AstroPower will demonstrate ultra lightweight, efficient, low cost, flexible solar arrays based on thin films of polycrystalline silicon on dissimilar substrates. A new flexible substrate will be used that has been shown to be compatible with a thin silicon solar cell structure. An AM1.5 conversion efficiency of 10.8% has been measured on the new solar cell structure. This breakthrough will allow flexible arrays to be fabricated that demonstrate the stability and high efficiency of crystalline silicon, while having the radiation tolerance and low cost benefits of thin films. The new solar cells will cost less than one tenth that of conventional silicon solar cells, while being of similar conversion efficiency. The incorporation of light trapping and surface passivation will cause the thin film devices to out perform convention thick devices. The prototype array based on this new technology, is being proposed.

BOULDER NONLINEAR SYSTEMS, INC.  
2000 5TH STREET, UNIT B  
BOULDER, CO 80302  
Phone: (303) 670-6116

Topic#: 91-003 ID#: 91-124  
Office: AFWL  
Contract #:  
PI: GARY D. SHARP, PhD

Title: Agile Laser Beam Steering Device Based on a Ferroelectric Liquid

Abstract: A surface-stabilized smectic A\* liquid crystal beam steering device is proposed in Phase II. The active material produces analog phase modulation (nearly 2 pi) with a micron active layer thickness, and switches at microsecond speed. In order to achieve large steer angles and high diffraction efficiency, high spatial frequency resolution (which is limited by cell thickness) and multiple-level phase control are required. Currently, nematic materials are used for such devices, which exhibit slow response times, and typically require several microns of material thickness. While switching speeds and layer thicknesses of ferroelectric liquid crystals (FLC's) have attracted attention for agile beam steering applications, they have largely been dismissed due to the lack of analog phase. Boulder Nonlinear Systems solves this problem, producing large analog phase control with a thin active layer.

BREWER SCIENCE, INC.  
P.O. Box GG, 2401 High Tech Drive  
Rolla, MO 65401  
Phone: (314) 364-0300

Topic#: 90-014 ID#: 40731  
Office: ARO  
Contract #:  
PI: Mary G. Moss, PhD

Title: Miniature Temperature Sensors

Abstract: Phase I demonstrated the forming of thin-film, NTC temperature sensors from ion-implanted nitrile-containing polymers (I2PS). The sensors are applicable for use individually, or as components of a conformal array. The advantages of the I2PS include: close thermal contact with the substrate; patternable to small or large geometries (10 microns and up) by standard photolithographic methods; high film resistivity (2 megohms/square) reduces power requirements and the effects of lead resistance. Phase II work includes improving stability and control of resistance and R-T characteristics, and constructing three test devices: a miniature sensor used in microelectronics circuits or micromachined devices, an active sensor for protecting IC's from over-heating, and a temperature sensing array for measuring thermal gradients. Phase II performance objectives include controllable resistance-temperature characteristics with a maximum use temperature of 100 degrees Celsius and a stability of 0.05 degrees Celsius/year.

CREARE, INC.  
PO BOX 71  
HANOVER, NH 03755  
Phone: (603) 643-3800

Topic#: 91-007 ID#: 91-317  
Office: AFWL  
Contract #:  
PI: MICHAEL G. IZENSON

Title: Cryogenic Heat Pipe Diode

Abstract: Creare, Inc., has designed a light-weight high performance cryogenic heat pipe diode which yields separation distances of 2m and allows effective noise and vibration isolation of the optics from the cryocooler with optimal positioning of the

## SDIO SBIR PHASE II AWARDS

components. Creare has turned to the poor wicking ability (i.e. low surface tension) of cryogenic liquids to Creare's advantage. Using an evaporator section wick and by drilling 10 micron diameter holes in a metal foil to produce a diode heat pipe design. Creare obviates the need for any traps. Through the use of computer controlled laser drilling, the laser power and pulse duration was empirically determined to yield this phenomenal hole density. A potential spin-off application is a high purity filter; since the foil manufacturing does not require binders or talcs, it is ideal for medical applications where there are stringent purity requirements.

EIC LABORATORIES, INC.  
111 DOWNEY STREET  
NORWOOD, MA 02062  
Phone: (617) 769-9450

Topic#: 91-005 ID#: 91-191  
Office: AFAL  
Contract #:  
PI: K. M. ABRAHAM

Title: Solid State Pulse Power Battery

Abstract: An all solid-state carbon/LiNiO<sub>2</sub> rechargeable battery using polyacrylonitrile-based polymer electrolytes has been developed in Phase I. The battery exhibited excellent rechargeability of a bipolar carbon/LiNiO<sub>2</sub> battery by constructing a two-cell, ~6V, battery. Optimization of the polymer electrolytes to achieve higher conductivities, and of the cathode and anode structures to provide long cycle life and improved pulse discharge characteristics are the objectives of Phase II. Both monopolar and bipolar solid-state C/LiNiO<sub>2</sub> batteries will be fabricated and tested. The latter will include a 10 cell, ~30V, battery with a capacity of about 100 mAh. The fully developed C/LiNiO<sub>2</sub> bipolar batteries are expected to have a specific energy of greater than or equal to 100 Wh/kg and a specific power of greater than or equal to 50 kW/kg. Commercial applications include devices such as nail guns, electric drills, screw drivers, portable computers, videocameras, cellular telephones, engine starters, and electric vehicle propulsion.

EPION CORP.  
4R ALFRED CIRCLE  
BEDFORD, MA 01730  
Phone: (617) 275-3703

Topic#: 91-014 ID#: 91-098  
Office: ONR  
Contract #:  
PI: ALLEN R. KIRKPATRIC

Title: Single Crystal Diamond Thin Films

Abstract: Phase II will establish a technique to grow heteroepitaxial single crystal diamond films upon completion of Phase I large area single crystal films of copper. Phase I identified the problems which must be addressed and techniques which can be utilized to accomplish the single crystal diamond objective. Phase II will establish procedures necessary to support carbon ion-induced heteroepitaxial formation of diamond upon single crystal copper film substrates which can be produced by ion-assisted deposition.

FAIRFAX MATERIALS RESEARCH, INC.  
5613 MARBLE ARCH WAY  
ALEXANDRIA, VA 22310  
Phone: (703) 960-4840

Topic#: 91-013 ID#: 91-321  
Office: NRL  
Contract #:  
PI: DR. N.P. LOUAT

Title: The Mechanical Properties of Metal-void Composites

Abstract: Phase I investigated the fabrication of materials with a high content of microscopic gas-filled voids, while reducing density, increasing strength and toughness and vibrational damping in most metals, ceramics and polymers. These composites can achieve incremental strengths, maintained without degradation to high temperatures and fracture toughness. Acoustic vibrations are strongly attenuated. Phase II will develop reliable methods of producing laboratory-scale specimens of void-metal composites and will categorize their strength, toughness and damping properties. Computer modelling will be used to facilitate the fabrication process and to calculate the loss factor for acoustic and electromagnetic radiation, with an emphasis on space vibrations and on marine and aerospace stealth utility.

FOSTER-MILLER, INC.  
350 Second Avenue  
Waltham, MA 02154

Topic#: 90-011 ID#: 90-339  
Office: NSWC  
Contract #:

SDIO SBIR PHASE II AWARDS

Phone: (617) 890-3200

PI: Lawrence Domash, PhD

Title: Manufacturable, Low Cost Spatial Light Modulator

Abstract: High resolution, high frame rate optically addressed spatial light modulators with gray shading are required for optical computing, optical interconnects and fiber optic network switching applications at infrared wavelengths. Multiple Quantum Well technology has shown promise, but is costly and difficult to manufacture. Phase I research showed the feasibility of an alternative, lower cost, much simpler approach based on electro-refractive (Franz-Keldysh) effects in GaAs or InP:Fe combined with photoconductive heterostructures. Speed and contrast ratio are comparable to or better than those of MQW devices, but in addition the Phase I device demonstrated a controllable optical coupling ratio, a capability not shared by MQW or liquid crystal technologies. Phase II will demonstrate a prototype 20x20 pixel spatial light modulator within four man-years of effort, about 1/10 the complexity of MQW technology.

HMJ CORP.

Topic#: 89-004

ID#: 38398

PO BOX 15128

Office:

CHEVY CHASE, MD 20815

Contract #:

Phone: (202) 686-9141

PI: WILLIAM D JACKSON

Title: Disk Magnetohydrodynamic Conversion Systems for Nerva Reactor

Abstract: HMJ Corp will use the combination of a magnetohydrodynamic generator of the disk type with a NERVA reactor yields an advanced space power system with the capability of producing up to gigawatt pulses and multi-megawatt continuous operating capability. Several features result from the combination of this type of reactor and a disk MHD generator in which hydrogen serves as the plasma working fluid. Cesium seeding is utilized under conditions which enable the generator to operate stably in the non-equilibrium electrical conduction mode. In common with all practical MHD generators, the side output is DC and voltages in the range 20-100kV are attainable. This leads to a simplification of the power conditioning system and a major reduction in specific mass. Taken together with the high performance capabilities of the NERVA reactor, the result is an attractively low overall system specific mass. Further, the use of non-equilibrium ionization enables high system specific enthalpy extractions to be obtained, values in excess of 40% being attainable.

IAP RESEARCH, INC.

Topic#: 91-005

ID#: 91-381

2763 CULVER AVENUE

Office: SDC

DAYTON, OH 45429

Contract #:

Phone: (513) 296-1806

PI: NEAL CLEMENTS

Title: Passive HTSC Fault Current Limiter Circuit Breaker for AC and DC

Abstract: IAP will develop a current limited semiconductor circuit breaker using a metallized high temperature superconductor as the current limiting element. The HTSC current limiter feasibility was proven in Phase I. And in Phase II, a circuit breaker system for a 5kW load will be developed. The circuit breaker has applications in high-reliability, fault-tolerant power system architectures since it will allow faults to occur without inducing total distribution shutdown. Current limiting will also allow solid state breakers to be designed using smaller semiconductor devices with simpler, more reliable, and more noise immune over current detectors. This will lead to more reliable and fault tolerant power distribution systems for aircraft and spacecraft. Smaller and more cost effective solid state circuit breakers can be designed by utilizing this technology.

ILLINOIS SUPERCONDUCTOR CORP.

Topic#: 91-005

ID#: 91-303

1840 OAK AVENUE

Office: ETDL

EVANSTON, IL 60201

Contract #:

Phone: (708) 866-0435

PI: JAMES D. HODGE

Title: Self-restoring Fault Current Limiter Utilizing High Temperature

Abstract: Illinois Superconductor Corp. will develop an ultra-fast fault current limiter (FCL) based on high temperature superconductor materials. During normal operation of the FCL, current flows through the device with no losses. When a fault current exceeds the HTS material's critical current density, the limiter becomes resistive and prevents the current surge from reaching components downstream in the circuit. The current limiting is extremely rapid, estimated to be less than 2 microseconds, from testing during Phase I. Phase I assembled the HTSC materials into a test device which carried 10 amperes in its operating state, while producing 10 ohms of resistance. In Phase II, Illinois Superconductor will produce a prototype FCL

SDIO SBIR PHASE II AWARDS

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which will protect cross-field microwave tubes in ground-based radar systems.

**IMAGING SCIENCE TECHNOLOGIES**

P.O. Box 8175, 1425 Seminole, Ste. 310  
Charlottesville, VA 22906  
Phone: (804) 978-7000

Topic#: 88-003

ID#: 88-502

Office: SDC

Contract #:

PI: Michael D. Lockhart

Title: Infrared Sensor and Imaging System

Abstract: Imaging Science Technologies proposes a uncooled imaging system operating near 10 and 20 microns optical wavelength. This is a low-cost, fast response time technology as it is uncooled and all optical; and is therefore cost-effective for commercial applications. There is a natural polarization sensitivity indigenous to photodichroic imaging films which has neither been optimized nor studied in detail. Infrared polarization signatures are useful in discriminating naturally occurring objects from artificial ones. This technology will be used for identification of materials, deposition onto substrates, and testing & evaluation of devices for their minimum levels of discrimination detectability.

**INDUSTRIAL SENSORS AND ACTUATORS**

400 HESTER STREET  
SAN LEANDRO, CA 94577  
Phone: (415) 568-7720

Topic#: 91-001

ID#: 91-278

Office: SDC

Contract #:

PI: BRUCE W. MAXFIELD

Title: Piezoelectric Actuator Sheet as a Low-Cost Deformable Mirror

Abstract: Phase I developments show great promise to produce deformable mirrors with costs of \$100 per actuator (its now \$3K-5K), including electronics, strokes adequate for any reasonable aperture, and reliabilities suitable for the most demanding space-based applications. In addition, cooling for high-energy laser applications can be readily accomplished. Our approach is to fabricate the mirror as a laminated piezoelectric sheet. On each sheet is printed an electrode pattern, and when properly connected with vertical vias, deformation of the surface is achieved as a function of the applied voltage. Phase I demonstrated basic critical issues of design and fabrication, especially processing problems related to firing the material in large sheets. Phase II will further investigate these issues as well as design optimization (actuator spacing and influence functions). The major objective will be to develop and thoroughly test a 100 actuator, fully-functional, deformable mirror.

**INNOVATIVE DYNAMICS**

CORNELL RESEARCH PARK, 244 LANGMUIR LABS  
ITHACA, NY 14850  
Phone: (607) 257-0534

Topic#: 91-013

ID#: 91-404

Office: AFSTC

Contract #:

PI: GAIL A. HICKMAN

Title: Structural Health Monitor System

Abstract: Innovative Dynamics is currently developing a hybrid sensor system consisting of vibration and capacitance-type sensors which can be bonded to the structure. Vibration signatures detect and assess the overall health of the structure, while capacitance measurements provide the exact location and severity of the impact damage. Phase II will develop a space-durable system for a typical satellite configuration. An evaluation of material-sensor integration will be performed to meet the requirements of the harsh thermal and radiation environment of space. The sensor system will be fabricated and tested on representative satellite panels leading to a space experiment in Phase III. Applications include a broad range of spacecraft structures which will not allow embedding such devices (i.e., metal components or structures that undergo severe composite manufacturing process conditions).

**INTEGRATED APPLIED PHYSICS, INC.**

140 E. SANTA CLARA STREET, #19  
ARCADIA, CA 91006  
Phone: (818) 821-0652

Topic#: 91-005

ID#: 91-231

Office: SDC

Contract #:

PI: DR. MUN S. CHOI

Title: Electron-beam Controlled Semiconductor Switch

Abstract: Phase I demonstrated an opening and closing GaAs electron beam controlled semiconductor switch with MHz repetition rate capabilities. This switch has applications in many pulsed power systems including ballistic missile defense radar systems.

## SDIO SBIR PHASE II AWARDS

RF and induction accelerators and systems that require an opening switch for inductive energy storage or for pulse length modulation. Integrated Applied Physics, Inc., will develop this technology in Phase II to produce a switch with the following specifications: holdoff voltage 10kV, peak current 1kA, control efficiency 90% dissipation loss <2%, pulse length agility <50nsec to >100 microsec, and closing time and opening time 10nsec. Applications include: inductive energy storage systems requiring long conduction and short opening times, space based laser radar and communications, and airborne and ground based radar systems.

JOHN R. BAYLESS COMPANY  
20325 SEABOARD ROAD  
MALIBU, CA 90265  
Phone: (818) 707-1131

Topic#: 91-005 ID#: 91-002  
Office: DNA  
Contract #:  
PI: JOHN R. BAYLESS, PHD

Title: Radiation-Processed High-Energy-Density Capacitor Development

Abstract: The availability of high voltage energy storage capacitors with high energy densities ( $> > 1$  kJ/kg) is critical for many applications. Conventional capacitor designs, as well as those under development elsewhere, use assemblies of conductive foils and solid dielectric films which are impregnated with liquid dielectrics. However, since the dielectric strength of liquids is generally much less than that for solids, the maximum operating electric field is limited by the impregnant. This, in turn, limits the energy density that is attainable. We will develop the RADCAP concept for producing energy storage capacitors which contain only solid dielectric material. The capacitor windings are impregnated with liquid monomers which are then polymerized (solidified) by exposure to electron beam and gamma-ray radiation. Phase II will produce large RADCAP capacitors with energy densities of  $> 10$  kJ/kg and  $> 15$  kJ/mE3 for fast discharge ( $\sim 1$  ms) applications. By performing material and optimization experiments, and by constructing and testing 10 kV, 500J RADCAP capacitors, we can reach that goal. Phase II will culminate in the production, testing and delivery of at least six 10 kV/500 J RADCAP units, and a conceptual design for a full-scale RADCAP production facility.

KTAADN, INC.  
1340 CENTRE STREET, SUITE 202  
Newton, MA 02159  
Phone: (617) 527-0054

Topic#: 91-178 ID#: 91BMO-958  
Office: PL6  
Contract #:  
PI: ILYA SCHILLER

Title: A Cloud Forecaster for RV Launches

Abstract: KTAADN will develop a workstation, called the Cloud-Free Line-of-Sight Optimal Locator for Sensor Aircraft or 'CLOSA,' manages RV launch and trajectory parameters, collection aircraft flight constraints, geographical descriptors and current weather inputs. These variables are manipulated by the flight planner on the CLOSA overlay a chart of the probability of a cloud-free line-of-sight for all geographical locations against flight experiment ground track. Individual cloud forecasts for each allocation are provided by neural network elements selected for contextual matches (geography, season, air mass) and trained on extensive sequences of weather satellite cloud image data from within that context. CLOSA is capable of enhancing the neural network performance by retraining against new image data and validation using contingency table evaluation methods. Benefits include: optical collection against distant targets, and agricultural operations requiring estimates of radiation cooling to make a decision on allocating resources to protecting crops from freezing and excessive drying conditions.

NEOCERA, INC.  
100 JERSEY AVENUE, BUILDING D, BOX D-12  
NEW BRUNSWICK, NJ 08901  
Phone: (609) 734-2629

Topic#: 91-015 ID#: 91-570  
Office: RADC  
Contract #:  
PI: ERWIN BELOHOUBEK

Title: Superconducting Non-reciprocal Devices for Microwave Systems

Abstract: In the general trend towards miniaturization of microwave components and subsystems, high-Tc superconducting (HTS) implementations promise to play an important role. Filter structures, delay lines and high-Q resonators in superconducting form have already been demonstrated at frequencies ranging from L-through K-band at temperatures up to 80K. Real systems advantages will be achieved when many of these superconducting components are integrated into a compact subsystem. Non-reciprocal devices in the form of circulators and isolators play a very important role in most advanced microwave subsystems by reducing deleterious interactions between individual components. After the successful demonstration of the

## SDIO SBIR PHASE II AWARDS

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feasibility of operating an HTS thin film in the presence of a high dc magnetic field and the achievement of non-reciprocal action during Phase I. In Phase II, we will extend the technology to the preparation of high quality thin films on low loss garnet or ferrite substrates which would make possible the direct integration of high performance passive microwave components with non-reciprocal devices, all on the same substrate. The goal is to optimize HTS film deposition to achieve a surface resistance less than 1/10th that of copper at 77K, 2000G and 10GHz and fabricate and test several circulator structures and a circulator-coupled 2-channel multiplexer.

NORTHEAST PHOTOSCIENCES  
18 FLAGG ROAD  
HOLLIS, NH 03049  
Phone: (603) 465-3361

Topic#: 91-005                      ID#: 91-152  
Office: AFWL  
Contract #:  
PI: JACQUES LUDMAN

Title: Photovoltaic Systems Based on Spectrally Selective Concentrators

Abstract: Northeast Photosciences has devised a concept in photovoltaic spectrum splitting based upon a transmission holograph design that yields concentration, high efficiency, and broadband operation in a single element. Since the major losses in solar voltaic conversion are due to mismatches in the solar voltaic bandgap and the incident wavelength, this new holographic concentrator focuses, with very high efficiency, incoming solar energy into a spectrally dispersed line suitable for conversion by a pair or an array of wavelength-optimized photovoltaic cells. Phase II is directed at an improved PV spectrum splitting power source for space application. However, the anticipated efficiency improvements, coupled with the inherent low cost of a single-element holographic system, indicates a major potential commercial application in power generation.

NOVA ELECTRONICS, & SOFTWARE  
1525 THIRD STREET, #A201  
RIVERSIDE, CA 92507  
Phone: (714) 781-7332

Topic#: 91-003                      ID#: 91-390  
Office: SDC  
Contract #:  
PI: DR. TUMAY O. TUMER

Title: Wide Aperture, High Angular and Energy Resolution Imaging Gamma Ray

Abstract: The medium energy gamma ray detector (SACRED) was completed by NOVA Electronic & Software in Phase I. In Phase II, NOVA will develop the detector for high angular resolution of 1 degree and source direction measurement better than (plus or minus) 0.1 degree for data with good statistics. The high angular resolution and wide aperture ( approx = 120 degrees) will enable excellent imaging of point or extended sources in the field-of-view in real time, and an energy resolution of greater than or less than 5% at 1 MeV. The detector will have on-board real time data analysis and imaging hardware and software for instantaneous data analysis. The SACRED detector can be scaled up in size to increase its sensitivity to detect exceptionally weak sources; and a functional smaller proof-of-concept prototype SACRED detector will be built in Phase II.

OPTICAL CONCEPTS RESEARCH  
1240 AVENIDA ACASO  
CAMARILLO, CA 93010  
Phone: (805) 733-4299

Topic#: 91-011                      ID#: 91-539  
Office: ARO  
Contract #:  
PI: M. KEVIN KILCOYNE

Title: Surface Emitting Laser and Asymmetric Fabry-Perot Modulator Arrays

Abstract: In Phase II, Optical Concepts, Inc. will develop vertical surface emitting lasers (VCSELs) for optically interconnected computing systems and new types of optical signal processing systems. These arrays provide reconfigurable, multichannel, high speed/high bandwidth data communication at the chip, board, backplane and system levels. The vertical cavity device has the advantage of all size, simplified processing and fabrication, and very low thresholds and power requirements. The key to low threshold (VCSEL) structures is the high Q cavity formed by the multilayer mirrors, grown integrally around the active MQW structure. The mirrors have reflectivities >99.5% which have resulted in VCSELs with very low thresholds (<1mA). These devices have small single mode vertical cavities, which have made it possible to fabricate multiple lasers on a single chip without cleaving as is required for standard laser diodes. Because of the low threshold and high differential operating efficiency, VCSELs have been operated at room temperature and at temperatures exceeding 100 degrees Celsius, showing excellent environmental and reliability capabilities >99.5% which have resulted in VCSELs with very low thresholds (<1mA). These devices have small single mode vertical cavities, which have made it possible to fabricate multiple lasers on a single chip without cleaving as is required for standard laser diodes.

SDIO SBIR PHASE II AWARDS

PHOTONIC SYSTEMS, INC.  
1900 S HARBOR CITY BLVD  
MELBOURNE, FL 32901  
Phone: (407) 984-8181

Topic#: 89-011 ID#: 38578  
Office:  
Contract #:  
PI: DENNIS R PAPE

Title: Acousto-Optic Laser Radar Imaging

Abstract: Photonic Systems, Inc. has designed and investigated the performance of a compact, low power acousto-optic radar image formation processor. This processor utilizes optical signal processing technology where acousto-optic Bragg cells function as optically trapped delay lines in combination with lenses to perform both wideband signal correlation for range resolution and Fourier transformation for Doppler filtering. The image of the target is formed directly on a two-dimensional photodetector array. This approach extends the range resolution and range window offered by the currently used stretch electronic processor and accommodates various imaging waveforms providing optimum image quality.

PHOTONICS RESEARCH, INC.  
350 INTERLOCKEN PARKWAY, SUITE 245  
BROOMFIELD, CO 80021  
Phone: (303) 465-6493

Topic#: 91-011 ID#: 91-189  
Office: AFRADC  
Contract #:  
PI: DR. G. R. OLBRIGHT

Title: Surface-Emitting Laser Logic for Digital Optical Computing and

Abstract: In Phase I, Photonics Research fabricated CELL device (vertical-cavity surface-emitting laser monolithically integrated to a photoreceiver) using standard GaAs semiconductor processing and boolean logic. In Phase II Photonics Research, Inc. will develop a high-speed digital optical processing system based on a 2D digital logic switching array. This development promises to impact several technologies: optical interconnects, optical communications, optical neural networks, optical memory, night vision, and helmet-mounted/heads-up/direct-view visual displays. During Phase II, Photonics Research will fabricate and test: a second generation high performance CELL; a 2D array of CELLS customized to be integrated into the digital optical processor under development at Rome Photonics Laboratory; and design, fabricate and demonstrate a system test structure consisting of multiplicity of cascaded digital optical switching arrays.

PHYSICAL OPTICS CORP.  
20600 GRAMERCY PLACE, SUITE 103  
TORRANCE, CA 90501  
Phone: (213) 320-3088

Topic#: 91-014 ID#: 91-362  
Office: ARO  
Contract #:  
PI: RAY T. CHEN, PhD

Title: Microprism Array for Large-Scale, Wideband Interconnection of

Abstract: In Phase I, Physical Optics Corporation demonstrated an outstanding interconnection device using microprism arrays in conjunction with GRIN polymer optical buses. The results for both optical bandwidth (> 250 nm) and microwave baseband width (60 GHz) are the highest results thus far reported in the world. The coupling bandwidth is two orders of magnitude higher than holographic optical element. In Phase II the focus will be on providing a microprism based optoelectronic interconnection system for achieving high speed data in high performance computers. The optoelectronic interconnection system will meet the following requirements: provide data links capable of handling the full speed of the most advanced processor (from processor to memory and vice versa); provide compatibility with current electronic card board designs; and provide an IBM486 microprism-based optoelectronic computer system.

PRINCETON X-RAY LASER, INC.  
1-H DEER PARK DRIVE  
MONMOUTH JUNCTION, NJ 08852  
Phone: (908) 329-0505

Topic#: 91-001 ID#: 91-233  
Office: NRL  
Contract #:  
PI: LEONARD POLONSKI, PhD

Title: Portable Soft X-Ray Laser

Abstract: Princeton X-Ray Laser will design a prototype of a compact, affordable laboratory 18.2 nm wavelength soft x-ray laser, with output power of 10-20 microjoules using a 10J, 1.5-3 ns pulse from a pump laser. This source, with its output concentrated in approximately a 10 m radian cone, will be about two orders of magnitude more intense than a laser-produced soft x-ray plasma source powered by the same pump laser. Phase II will continue to achieve high gain in a refraction - or nonuniformity-compensated, twin-target system, and construct a portable x-ray laser engineering prototype. This soft x-ray laser

SDIO SBIR PHASE II AWARDS

is based on a new design that combines the gain obtained, with recombining carbon plasma with a solution to the problem of compensating for refraction effects in such plasmas. Applications include surface preparation, electronic materials, device and circuit processing and diagnostics. Immediate uses are for tests in small scale projection x-ray lithographic experiments, photoresistant evaluation, transmission and reflection soft x-ray microscopy, and plasma diagnostics.

QSOURCE, INC.  
239 BURNHAM STREET  
EAST HARTFORD, CT 06108  
Phone: (203) 291-0120

Topic#: 91-003 ID#: 91-176  
Office: SDC  
Contract #:  
PI: PETER P. CHENAUSKY

Title: Wideband, Tunable Laser Oscillator

Abstract: The response of a sensor's heterodyne detector can be degraded by as much as half at these large offset frequencies, a local oscillator capable of being tuned either up or down 1000 MHz to compensate for this relative motion would be equivalent to doubling the sensor's laser transmitter. Such an improved system performance will be achieved with a negligible change in the system's weight, size or power budget since an local oscillator is already required. Two swept cavity configurations of the Phase I device generated tuning ranges of 1250 and 1950 MHz and over 2 watts of cw power on laser line center was extracted from an 8.6 cm length of sealed-off CO2 medium. Two Phase II lasers with tuning range/power goals of 2000 MHz/>2W and 2500 MHz/>5W are proposed. The Phase I method of inferring the tuning range by sweeping over the cavity FSR will be combined with heterodyning the output of each laser with a reference laser. Benefits include a global wind sensor in a low earth orbit, a commercially available, sealed-off, wideband tunable CO2 local oscillator for use in wideband detector evaluation and high resolution IR spectroscopy and a new means for stabilizing a CO2 laser.

ROCKY RESEARCH  
674 WELLS RD  
BOULDER CITY, NV 89005  
Phone: (702) 293-0851

Topic#: 89-007 ID#: 38650  
Office:  
Contract #:  
PI: UWE ROCKENFELLER

Title: Self-Contained Solid-Vapor Heat Pump Cycles for Central Heat Transfer Bus

Abstract: Rocky Research will construct a 1 to 3 kW complex compound-based heat pump with applications toward a space born thermal management system. The device is based on a heat-driven sorption cycle using ammonia as the refrigerant and metal salts as the sorption media. Complex compounds were chosen as working media because they exhibit available to the process. Power densities in excess of 2 kW/kg have been obtained. For temperature lifts up to 40K, coefficients of performance COPc=1.45 and COPh=2.5 can be reached in a waste heat actuated system with no moving parts and therefore no parasitic power requirements. The hardware will be designed to evaluate both single stage high lift (up to 100K) as well as high efficiency operation.

SCHMIDT INSTRUMENTS, INC.  
2476 BOLSOVER SUITE 234  
HOUSTON, TX 77005  
Phone: (713) 523-7119

Topic#: 91-014 ID#: 91-633  
Office: ONR  
Contract #:  
PI: MARK HAMMOND, PhD

Title: Diamond Atomic Layer Epitaxy

Abstract: In Phase I, Schmidt Instruments successfully demonstrated a new method of rapidly screening candidate atomic layer epitaxy (ALE) processes on single crystal diamond surfaces, and found evidence that a radical addition/ligand desorption cycle could support a viable diamond ALE process. In Phase II, the radical addition/ligand desorption cycle results will be expanded upon to develop a practical ALE process, as well as establish thermal and photochemical avenues to ALE of diamond. From this foundation, Schmidt Instruments will investigate heteroepitaxial ALE growth of diamond on other candidate substrates using the methods established for diamond on diamond ALE. After uniform, single crystal growth of diamond is established with ALE, more conventional growth methods will be used to grow thick diamond heterolayers for future device development. The most economically promising methods will be developed for commercial production of device-quality diamond substrates and diamond electronic devices in a Phase III effort.

SDIO SBIR PHASE II AWARDS

SCIENCE RESEARCH LABORATORY, INC.  
15 WARD STREET  
SOMERVILLE, MA 02143  
Phone: (617) 547-1122

Topic#: 91-001 ID#: 91-030  
Office: ONR  
Contract #:  
PI: DR. JONAH JACOB

Title: Electrodeless Potassium Flashlamps for Pumping Nd:YAG Lasers

Abstract: Phase II will develop advanced flashlamp technology which can be used to: 1) increase the overall efficiency of solid-state lasers by a factor of 5 to 10 over that achievable with conventional xenon flashlamps; 2) extend flashlamp life a hundred-fold, from  $\sim 10E7$  to greater than or equal to  $10E9$  shots; and 3) reduce the cost of efficient solid-state laser pump sources --by a factor of 10,000-- to provide an affordable cost for the overall laser system. Specifically, electrodeless alkali vapor flashlamp technology will be developed for efficiently pumping the Nd:YAG laser for space-based laser radar and communications applications. Long-lived, low, cost, spectrally efficient alkali-vapor flashlamps can also be developed for pumping other solid-state laser materials such as Ti:sapphire and alexandrite. In Phase II, electrodeless, potassium-vapor flashlamps will be tested, overall radiative efficiency into the pump bands of Nd:YAG will be measured, and a Nd:YAG laser pumped by an electrodeless flashlamp will be demonstrated.

SENSOR SYSTEMS GROUP, INC.  
150 BEAR HILL ROAD  
WALTHAM, MA 02154  
Phone: (617) 890-0204

Topic#: 91-003 ID#: 91-591  
Office: SDC  
Contract #:  
PI: MICHAEL I. ANAPOL

Title: Light Weight, SiC Multicolor Telescopes for Interceptors and

Abstract: Sensor Systems Group demonstrated in Phase I ultra-light 3.5 inch diameter solid thin (60:1 aspect ratio) SiC mirror substrates weighing  $\sim 25$  grams which is significantly less than equivalent beryllium mirrors. A mirror has been fabricated to neat net shape using chemical vapor composite process which offers the excellent material properties of SiC/CVD: superior fracture toughness, low density (30-40% dense) for ultra-lightweight; and 5 to 10 times faster fabrication than standard CVD processes or low cost. In Phase II, SSG will develop ULV low cost SiC/Si CVC mirror and CVI structure fabrication processes; demonstrate reproducibility and small scale production capability by fabricating 10's of mirrors and 5's of structures; develop a minimum of 2 flight worthy GBI or BP telescope systems; and perform acceptance level performance and environmental tests. The telescope hardware will be available for space flight and underground nuclear tests.

SIERRA MONOLITHICS, INC.  
103 WEST TORRANCE BOULEVARD, SUITE 102  
REDONDO BEACH, CA 90277  
Phone: (213) 379-2005

Topic#: 91-015 ID#: 91-251  
Office: AFRL  
Contract #:  
PI: DAVE ROWE

Title: Josephson Junction Digital Waveform Generation

Abstract: Stable wide-band signal sources are key components in Strategic Defense Radar and Communication systems. Ultra-wideband direct digital synthesis of complex waveforms using superconducting Josephson junction logic technology is proposed. A ten-fold improvement in bandwidth over the best GaAs based direct digital synthesizers is projected. Profound impact on radars and communication systems can be expected. Phase II will include design, fabrication and testing of a complete superconducting direct digital synthesizer with a 10 GHz clock frequency and 2 GHz instantaneous output bandwidth. This system will satisfy all of the technical requirements of the MILSTAR synthesizer with much lower cost, complexity and size.

SKW CORP.  
1911 NORTH FT. MYER DRIVE, SUITE 800  
ARLINGTON, VA 22209  
Phone: (714) 361-5660

Topic#: 92-003 ID#: 91-498  
Office: SDC  
Contract #:  
PI: SCOTT EVANS

Title: Non-Contact Interconnects for Infrared Focal Plane Arrays

Abstract: SKW Corporation demonstrated in Phase I vacuum microelectronics devices to eliminate the physical contact between the detector and readout substrates in infrared focal plane arrays (IRFPA). Not only does this improve the sensitivity of thermal detectors to levels comparable to cooled detectors (NEDT  $< .01K$ ) but allows the elimination of indium bump bonding benefits IRFPA technology in general. The payoff for improved performance of uncooled IRFPAs is the replacement of cooled systems

## SDIO SBIR PHASE II AWARDS

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of comparable performance because of great savings in cost, weight, complexity, and reliability. Also, eliminating indium bump bonds has benefits: 1) improved performance of cryogenically cooled FPAs by operation of the detector and readout at different temperatures; 2) increased radiation hardness; 3) improved yield and reliability of FPAs by elimination of thermal expansion stress and delamination; 4) a means of non-destructive detector array testing; and 5) low cost, mass producible generic readout.

SPIRE CORP.  
PATRIOTS PARK  
BEDFORD, MA 01730  
Phone: (617) 275-6000

Topic#: 91-014 ID#: 91-103  
Office: ARO  
Contract #:  
PI: FERREYDOON NAMAVAR, ScD

Title: Silicon-Based Light Emitting Diode

Abstract: Spire will demonstrate a silicon-based light-emitting diode which will operate at about 3 volts bias and emit visible light with efficiency comparable to commercial LEDs. As an adjunct to Phase I, we have fabricated the first surface-emitting LED with silicon by depositing a layer of indium tin oxide, a transparent n-type semiconductor, onto the surface of porous silicon samples produced by the anodic etching of crystalline p-type Si wafers. With forward bias applied to these devices, stable red-to-orange light is visible to the naked eye, and the current-voltage characteristics are similar to those of conventional np junction LEDs in other semiconductors. In Spire's devices, the ITO layer not only serves an optoelectronic function, but also provides protection from degradation. Spire's LEDs indicate no degradation in light intensity after many hours of open air operation. Consequently, the overall goal of Phase II is to develop a practical porous silicon technology.

SUPERCONDUCTOR TECHNOLOGIES, INC.  
460 Ward Drive, Suite F  
Santa Barbara, CA 93111  
Phone: (805) 683-7646

Topic#: 91-003 ID#: 91-485  
Office: SDC  
Contract #: DASG60-91-C-0068  
PI: Timothy W. James

Title: Microwave-Based Infrared Detector

Abstract: In Phase II, a high performance superconducting microwave-based IR detectors compatible with advanced IR surveillance systems will be developed and demonstrated. Significant detector advantages include: operation at longer wavelength, all thin film construction, and radiation hardening. The unique and novel architecture enables significant savings in power, weight and size for large sensor systems which look into space backgrounds, i.e., for cold body tracking. An order of magnitude improvement in single detector performance over that achieved in Phase I is projected by using improved HTS thin films, thinner films, optimized device testing and scaled (smaller) detector geometries. Through careful characterization, the program is expected to yield a more thorough understanding of the photodetection mechanism as well as a better correlation of detector parameters with film properties.

TETRA CORP.  
3701 HAWKINS STREET N.E.  
ALBUQUERQUE, NM 87109  
Phone: (505) 345-8623

Topic#: 91-002 ID#: 91-429  
Office: DNA  
Contract #:  
PI: CHRIS YOUNG

Title: High Efficiency Electromagnetic Launcher Technology

Abstract: An innovative electromagnetic launcher called, Optimized Coil Gun (OCG) which overcomes the efficiency and projectile heating problems of conventional coil guns will be developed in Phase II. This is done by mathematically optimizing the magnetic fields for maximum energy efficiency. Tetra Corporation will design and demonstrate a medium scale electromagnetic launcher based upon the optimized coil gun concept in Phase II. The scaling and analysis will be applicable to greater energy systems e.g. 4 kg, 3000 m/s) and a demonstration launcher will accelerate a 10g projectile to 3000 m/s.

TETRA CORP.  
3701 HAWKINS STREET, NE  
ALBUQUERQUE, NM 87109  
Phone: (505) 345-8623

Topic#: 91-005 ID#: 91-344  
Office: AFSTC  
Contract #:  
PI: CHRIS M. YOUNG

Title: Tacitron Switch for Thermionic Reactor Power Conditioning

SDIO SBIR PHASE II AWARDS

Abstract: Tetra will develop a commercially viable cesium tacitron switch based on a new approach to electron emission in tacitrons to meet industry and government needs. The new tacitron has the potential for very low voltage drop (about 1 volt), conduction of large amounts of current, hold-off of reasonable voltages (several hundred volts), efficient switching on and off, fault tolerance, and operation at very high temperatures (1500 degrees Celsius) in a high radiation environment. No other switch technology has the potential of all of these features combined into a single switch. The goal of this program is to eliminate barium from the gas mixture, or at least reduce it to a very small fraction of the mixture. This will enable the new tacitron to be manufactured using conventional packaging techniques currently employed for thermionic converters. Phase III will package and develop manufacturing engineering.

THERMACORE, INC.  
780 Eden Road  
Lancaster, PA 17601  
Phone: (717) 569-6551

Topic#: 91-001 ID#: 91-062  
Office: SDC  
Contract #: DASG60-92-C-0093  
PI: John H. Rosenfeld

Title: Liquid Film Evaporation Cooling of Optics

Abstract: Phase II will demonstrate the technologies required to implement liquid film evaporation cooling of optics. Cooled optics requirements will be defined. Physical process modeling will be performed to identify rate-controlling thermal resistances and establish consistent agreement with fundamental data. Parametric analysis, materials development, and process optimization will be performed to reduce the approach to practice in a cooled optic. Experimental process verification tests will be performed in capillary-pumped and mechanically-pumped LFE cooling tests.

UES, INC.  
4401 DAYTON-XENIA ROAD  
DAYTON, OH 45432  
Phone: (513) 426-6900

Topic#: 91-014 ID#: 91-569  
Office: DNA  
Contract #:  
PI: PETER P. PRONKO

Title: Radiation Response of Epi-Less Bond Etch Silicon-on-Insulator

Abstract: In Phase II, UES will fabricate and test thin, high uniformity, radiation resistant bond-etch SOI made on four inch wafers using a high energy (MeV) boron implanted etch stop. This allows fabricating very high thickness uniformity SOI material and eliminates the need for strain compensated epitaxial layers which tend to be somewhat less uniform. It eliminates unacceptably high residual boron concentrations in the device material when using keV energy range ion implants.

ULTRAMET  
12173 MONTAGUE STREET  
PACOIMA, CA 91331  
Phone: (818) 899-0236

Topic#: 91-002 ID#: 91-483  
Office: SDC  
Contract #:  
PI: ROBERT H. TUFFIAS, PhD

Title: Zero-Erosion Throats for Solid Propellants

Abstract: In Phase I, Ultramet demonstrated the stability of hafnium carbide and tantalum carbide in 6195 degrees Fahrenheit (3425 degrees Celsius) aluminized propellant environments, showing recession rates well below 0.1 mil/sec (2.5 micrometer/sec), compared to 12-20 mil/sec (300/500 micrometer/sec) for state-of-the-art carbon/carbon materials. Motor firing results demonstrated that material stability and thermomechanical response could be used to explain the observed behavior, as opposed to the erosion/ablation mechanisms dominant with other materials, including state-of-the-art materials. These alternate mechanisms are areas where no inherent material limitations exist and significant improvements can be made through material fabrication and design, leading to solid and liquid rocket motor performance levels not achievable with current material systems. In Phase II, Ultramet will investigate fabrication, design, and performance of HfC-, TaC-, and C-based materials and composites, leading to dramatic performance gains in solid and liquid rocket motors.

UNIAX CORP.  
5375 OVERPASS ROAD  
SANTA BARBARA, CA 93111  
Phone: (805) 967-0578

Topic#: 91-014 ID#: 91-101  
Office: AFOSR  
Contract #:  
PI: FLOYD L. KLAVETTER, PhD

## SDIO SBIR PHASE II AWARDS

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Title: Industrial Products Based Upon Processible Conductive Polyaniline

Abstract: UNIAX Corporation has enabled the processing of the stable conducting polymer, polyaniline, in its conducting form, from common organic solvents. This opens an opportunity for the creation of industrial products (conducting coatings, paints, adhesives, epoxies, etc.) based on polyaniline. A great commercial opportunity exists for conducting polyblend materials for electromagnetic interference shielding and for anti-static control by electrostatic dissipation.

XACTON CORP.  
PO BOX 868  
BEDFORD, MA 01730  
Phone: (617) 271-0066

Topic#: 91-003  
Office: AFWL  
Contract #:  
PI: BAL K. JINDAL

ID#: 91-066

Title: Mercury Cadmium Telluride Substrate for Focal Plane Arrays

Abstract: Xacton has grown single crystal wafers with a very high level of crystalline perfection, and very low level of defect density. They are extremely uniform in composition, cutoff wavelength, and other properties. Any non-uniformities observed are well within the margin of error of the measurement techniques. Based on literature data, it appears that the wafers produced by Xacton may be the only wafers that are single crystal at a microscopic level. In Phase II, Xacton will utilize these wafers for the development of high quality detector arrays and extend the process to the growth of even larger diameter wafers, namely 3" diameter. Due to the exceptionally high quality of this material, it is possible to build monolithic arrays, where both the detectors and readout electronics are built in HgCdTe. This eliminates the necessity of bump-bonding the MCT detector array to a silicon multiplexer via in-bumps. This could eliminate problems with precision bump-bonding and performance degradation during heat cycles because of dissimilar thermal properties of the MCT, the Si and the In.

XSIRIUS SUPERCONDUCTIVITY, INC.  
1110 North Glebe Rd., Suite 620  
Arlington, VA 22201  
Phone: (703) 522-8601

Topic#: 92-015  
Office: SDC  
Contract #: DASG60-92-C-0090  
PI: S.C. Han

ID#: 92-109

Title: Scanning Submillimeter Laser Reflectometer for Precision Surface Resistance Measurements

Abstract: Superconductors, materials that carry electrical current without any resistance, can make electronic circuits more efficient and communications between remote locations easier. In the past two years, the materials developments of superconductors have progressed so much that the quality of the materials can no longer be measured even with the most sophisticated techniques. Xsirius Superconductivity, Inc. is developing a new measurement technique using lasers to scan the surface of the superconductors to measure the quality. This new measurement technique improves detection sensitivity by 100 times. This technique will be useful for developing superconducting materials for use in computer chips, communication systems, and particle accelerators.

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