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Department of Defense

DoD DEPARTMENTS/AGENCIES:



Department
of the
Army



Department
of the
Navy



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Defense
Advanced Research
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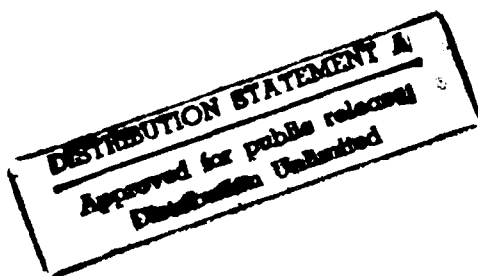


Defense
Nuclear
Agency



Strategic Defense
Initiative
Organization

**DEFENSE SMALL BUSINESS INNOVATION
RESEARCH PROGRAM (SBIR)**



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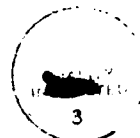


FY 1990 SBIR SOLICITATION
PHASE I AWARD ABSTRACTS
AIR FORCE PROJECTS
VOLUME III

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PREFACE

This report presents the technical abstracts of the Phase I proposals resulting in contract awards in Fiscal Year 1990 that were submitted to the Department of Defense (DoD) Small Business Innovation Research (SBIR) Program. The Army, Navy, Air Force, Defense Advanced Research Projects Agency (DARPA), Defense Nuclear Agency (DNA), and Strategic Defense Initiative Organization (SDIO) are the DoD components of the SBIR Program. Two solicitations inviting small business firms to submit proposals under this program were published in FY90. All six DoD components participated in Program Solicitation 90.1 (Closing Date: 5 January 1990), and Army, Navy, and DARPA participated in Program Solicitation 90.2 (Closing Date: 2 July 1990). The selection of proposals for funding was made from proposals received by the Military Services and Agencies.

FY 1990 SBIR PROGRAM

	<u>Number of Topics</u>		<u>Proposals Received</u>		<u>Phase I Awards</u>	
	<u>90.1</u>	<u>90.2</u>	<u>90.1</u>	<u>90.2</u>	<u>90.1</u>	<u>90.2</u>
Army	206	273	2482	2094	218	272
Navy	310	78	2132	520	334	78
Air Force	199	--	2524	--	233	--
DARPA	61	70	754	563	94	85
DNA	17	--	254	--	16	--
SDIO	15	--	710	--	97	--
Total	808	421	8856	3177	992	435
Grandtotal	1229		12033		1427	

Of the 1427 Phase I awards made in 1990, 180 awards went to minority-owned businesses and 113 awards were to woman-owned businesses. Overall, 11.9% of 1990 SBIR proposals were selected for funding, that is better than a 1 in 9 chance of receiving an award.

In order to make information available on the technical content of the Phase I projects supported by the DoD SBIR Program, four volumes containing the abstracts and contacts for the 1427 awarded projects are published. The small business information with accompanying abstract are arranged in topic number order. When more than one award was made for a given topic, the information is in alphabetical order by firm.

- Volume I contains Army Projects
- Volume II contains Navy Projects
- Volume III contains Air Force Projects
- Volume IV contains DNA, DARPA and SDIO Projects

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

INTRODUCTION

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

Under the SBIR Program, each federal agency with an extramural budget for research or research and development in excess of \$100 million per fiscal year must establish an SBIR Program. The program is funded by setting aside 1.25 percent of the participating agency's extramural R&D contracting dollars. The agency's participating in the Department of Defense SBIR Program are Army, Navy, Air Force, Defense Advanced Research Projects Agency (DARPA), Defense Nuclear Agency (DNA), and Strategic Defense Initiative Organization (SDIO).

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

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

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

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

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

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

SMALL BUSINESS INNOVATION RESEARCH PROGRAM - PHASE I
AIR FORCE Solicitation 90.1

AMERICAN GNC CORP

2701-C SANTIAGO RD

FULLERTON, CA 92635

Program Manager: DR CHING-FANG LIN

Contract #:

Title: HIGH PERFORMANCE ROBUST ADAPTIVE BTT MISSILE AUTOPILOT DESIGN

Topic #: AF90-001

Office: MSD/PMR

ID #: 39674

AN INNOVATIVE APPROACH TO DESIGNING AN ADAPTIVE BBT MISSILE AUTOPILOT USING A TECHNIQUE KNOWN AS GSLQ IS THE BASIS OF THE FOLLOWING PROPOSAL, THE BENEFITS OF WHICH INCLUDE: (1) BEST TRADEOFFS BETWEEN PERFORMANCE AND ROBUSTNESS AMONG DIFFERENT DESIGN METHODOLOGIES; (2) THE ABILITY TO ACHIEVE LOOP TRANSFER FUNCTION RECOVERY (LTR) EXACTLY, AND NOT ASYMPTOTICALLY; (3) ADDITIONAL POLE PLACEMENT CAPABILITY AND REDUCED-ORDER CONTROLLER CAPABILITY; (4) ELIMINATION OF THE HIGH GAINS AND, THEREFORE, HIGH CONTROL ACTIVITY TYPICALLY FOUND IN LQG/LTR; AND (5) THE GAIN MATRIX BECOMES AN EXPLICIT FUNCTION OF SYSTEM PARAMETERS AND CONTROL BANDWIDTH, MAKING IT POSSIBLE TO IMPLEMENT A STRAIGHTFORWARD GAIN SCHEDULE OR AN ADAPTIVE CONTROL SCHEME FOR THE ENTIRE FLIGHT ENVELOPE WITH OPTIMAL PERFORMANCE. PHASE I IS FOCUSED ON: (1) DESIGNING A HIGH PERFORMANCE MIMO ADAPTIVE AUTOPILOT CONTROL LAW FOR A SPECIFIC AIR-TO-AIR MISSILE; AND (2) PERFORMING ANALYSIS AND EVALUATION OF THE RESULTING CLOSED-LOOP CONTROL SYSTEMS OVER THE ENTIRE FLIGHT ENVELOPE, ENSURING HIGH PERFORMANCE AND GOOD ROBUSTNESS. IN THE PHASE II, THE EFFECTIVENESS SHALL BE DEMONSTRATED VIA IMPLEMENTATION OF BOTH SOFTWARE AND HARDWARE IN A REAL-TIME ENVIRONMENT. FURTHERMORE, A USEFUL, UNIFIED PROCEDURE FOR DESIGNING A ROBUST, INTEGRATED CONTROL LAW FOR ADVANCED BBT MISSILE SHALL BE DEVELOPED. THIS INCLUDES: (1) A SIMPLIFIED DIGITAL CONTROLLER DESIGN PROCEDURE; AND (2) A CAPABILITY TO RESOLVE ALL PRACTICAL IMPLEMENTATION ISSUES.

APPLIED RESEARCH ASSOCS INC

4300 SAN MATEO BLVD NE - STE A220

ALBUQUERQUE, NM 87110

Program Manager: WILLIAM L HACKER

Contract #:

Title: DECOUPLED PENETRATION ANALYSIS

Topic #: AF90-001

Office: MSD/PMR

ID #: 39684

THE OBJECTIVE OF THE EFFORT IS TO DEMONSTRATE THAT A DECOUPLED FINITE ELEMENT ANALYSIS OF A PENETRATION EVENT INTO CONCRETE CAN BE USED AS A COST EFFECTIVE EVALUATION TOOL TO ASSIST THE WEAPON DEVELOPER. A PENETRATION CODE SUCH AS SAMPLL OR THE PENCO-3D MODULE OF EVA-3D WILL BE USED TO DETERMINE THE LOADS ON THE PENETRATOR. THE LOADS THEN WILL BE APPLIED TO THE FINITE ELEMENT MESH AND THE RESPONSE OF THE WEAPON CASE, EXPLOSIVE FILL AND FUZE EVALUATION. A TEST CASE WILL BE CHOSEN TO CORRELATE TO TEST DATA.

COLEMAN RESEARCH CORP

5950 LAKEHURST DR

ORLANDO, FL 32819

Program Manager: FRANK J KRENS

Contract #:

Title: APPLICATION OF FLEXIBLE WRAP AROUND AIR VANES TO GUIDED MUNITIONS

Topic #: AF90-001

Office: MSD/PMR

ID #: 39680

SMALL BUSINESS INNOVATION RESEARCH PROGRAM - PHASE I
AIR FORCE Solicitation 90.1

CRC PROPOSES A DESIGN STUDY TO APPLY TWO DEVELOPMENTAL WRAP-AROUND FIN (WAF) TECHNIQUES TO AIR FORCE GUIDED MUNITIONS. THESE FLEXIBLE WAF DESIGNS DIFFER FROM CONVENTIONAL WAF'S IN THAT THEY BECOME STRAIGHT WHEN DEPLOYED. AS A RESULT THEY AVOID THE UNDERSIRABLE (AND DIFFICULT TO PREDICT AND TO MEASURE) AERODYNAMIC PROPERTIES OF CURVED WAF'S. MOST DESIGNERS OF GUIDED MUNITIONS HAVE AVOIDED WAF'S BECAUSE OF THESE PROBLEMS. THE NEW TECHNIQUES PROVIDE THE PACKAGING BENEFITS OF WAF'S WHILE RETAINING THE SIMPLICITY AND PREDICTABILITY OF STRAIGHT FINS. IN THIS STUDY, CRC WILL IDENTIFY PRIMARY AIR FORCE GUIDED MUNITION CANDIDATES FOR APPLICATION OF FLEXIBLE WAF'S INCORPORATE THE WAF INTO THE MUNITION DESIGN, EVALUATE ITS PERFORMANCE AND SUITABILITY, AND IDENTIFY THE RESULTING SPACE AND WEIGHT SAVINGS. PLANS WILL BE MADE FOR VERIFICATION TESTING IN PHASE II.

COLORADO RESEARCH DEVELOPMENT CORP

621 - 17TH ST/STE 1620

DENVER, CO 80293

Program Manager: CHAOQUN LIU

Contract #:

Title: MULTILEVEL ADAPTIVE METHODS FOR THE EAGLE CODE

Topic #: AF90-001

Office: MSD/PMR

ID #: 39679

THE EAGLE GRID GENERATION CODE IS A WIDELY USED SOFTWARE TOOL FOR GENERATING COMPUTATIONALLY UNIFORM GRIDS THAT FIT IRREGULAR PHYSICAL DOMAINS. BASED ON ELLIPTIC GRID GENERATION, IT USES A BLOCK-STRUCTURED APPROACH TO ACCOMMODATE VERY IRREGULAR REGIONS AND POINT DISTRIBUTION FUNCTIONS TO REDUCE FLOW-SOLVER TRUNCATION ERROR. IT ALSO INCORPORATES AS EULER SOLVER FOR INVISCID FLOW CALCULATIONS. WHILE THE EAGLE CODE HAS SUBSTANTIALLY IMPROVED COMPUTATIONAL CAPABILITIES, THERE ARE SEVERAL OF ITS FEATURES THAT COULD BE DRAMATICALLY IMPROVED BY INCORPORATING MULTILEVEL SOLUTION TECHNIQUES. FIRST, MULTIGRID SOLVERS FOR THE CURRENT GLOBAL GRID EQUATIONS WOULD SHARPLY IMPROVE GRID SMOOTHNESS AND GRID/FLOW SOLVER PERFORMANCE. SECOND, MULTILEVEL ADAPTIVE SCHEMES WOULD PROVIDE THE ABILITY TO EFFICIENTLY GENERATE REFINED BUT SMOOTH LOCAL PATCHES FOR INCREASING RESOLUTION AND ACCURACY AT BODY SURFACES, SINGULAR AND STAGNATION POINTS, SHOCKS, AND OTHER PHENOMENA. FINALLY, THE MULTILEVEL ADAPTIVE METHODS WOULD IMPROVE THE FLOW SIMULATION BY ALLOWING BETTER LOCAL FLOW MODELS IN ADDITION TO HIGHER RESOLUTION. IN PARTICULAR, THE FULL NAVIER-STOKES EQUATIONS COULD BE USED TO INCLUDE VISCOUS EFFECTS IN SPECIAL AREAS OF INTEREST (E.G., BOUNDARY LAYERS). SUCH LOCAL MODELS WOULD COME AT LITTLE ADDITIONAL COST YET WOULD PROVIDE INCREASED ACCURACY THROUGHOUT THE DOMAIN. THE PROJECT OBJECTIVES ARE TO IMPLEMENT THESE MULTILEVEL ENHANCEMENTS TO THE EAGLE CODE.

COMPUTER SCIENCE & APPLICATIONS INC

2-H DAVID ST

FORT WALTON BEACH, FL 32548

Program Manager: FREELAND D CRUMLY

Contract #:

Title: AN INNOVATIVE SIMULATED AIRBORNE SYSTEMS VULNERABILITY ASSESSMENT TECHNIQUE

Topic #: AF90-001

Office: MSD/PMR

ID #: 39675

COMPREHENSIVE AIRBORNE TESTING OF TODAY'S COMPLEX WEAPON SYSTEMS HAS AN EXTREMELY HIGH COST TAG WHERE THE FIRING OF A LARGE NUMBER OF MISSILES IS REQUIRED TO ASSESS VULNERABILITY AND EVALUATE EFFECTIVENESS OVER THE ENTIRE OPERATIONAL ENVELOPE AND IN AN ECM ENVIRONMENT. TO MAKE VERY HIGH COST MISSILE COUNT, COMPLEX VECTOR SCORING SYSTEMS ARE REQUIRED WITH KNOWN PERFORMANCE ACCURACIES OVER THEIR ENTIRE SPHERICAL SCORING ENVELOPE. THESE AIRBORNE INSTRUMENTATION SYSTEMS ARE REQUIRED TO DETECT, TRACK, AND MEASURE THE

SMALL BUSINESS INNOVATION RESEARCH PROGRAM - PHASE I
AIR FORCE Solicitation 90.1

CLOSEST APPROACH OF MISSILES FROM ANY DIRECTION THUS REQUIRING A MULTIPLE ANTENNA SYSTEM WITH KNOWN COVERAGE AND PREFERABLY WITHOUT VOIDS. THE FREE-SPACE RADIATION PATTERNS OF ANTENNA ELEMENTS ARE HIGHLY DISTORTED BY REFLECTION AND DIFFRACTION ON COMPLEX AIRBORNE VEHICLES. CUT-AND-DRY ANTENNA ELEMENT DESIGN AND LOCATION ON SUCH STRUCTURES FOLLOWED BY TESTS ARE TIME CONSUMING AND COSTLY. THIS PROPOSED EFFORT WILL DEMONSTRATE THE FEASIBILITY OF ADAPTING STATE-OF-THE-ART ANTENNA RADIATION PATTERN COMPUTER PREDICTION TECHNIQUES FOR COMPLEX STRUCTURES TO THE REQUIREMENTS OF COMPUTER SIMULATION TESTING OF AIRBORNE INSTRUMENTATION SYSTEMS, SUCH AS THE MULTIPLE ANTENNA VECTOR SCORING SYSTEMS. PHASE I WILL DEMONSTRATE FEASIBILITY OF ADAPTING COMPUTER PATTERN PREDICTION TECHNIQUES TO THE MULTIPLE ANTENNA SYSTEM ON TARGET VEHICLES. PHASE II WILL INTEGRATE THE PREDICTION TECHNIQUES WITH A COMPUTER SIMULATION AIRBORNE TEST SYSTEM.

COUSINO METAL PRODUCTS INC

1630 COINING DR
TOLEDO, OH 43612

Program Manager: RICHARD L LANDRUM

Contract #:

Title: COLD-FLOWED WARHEAD LINERS: CONTROLLED MICROSTRUCTURE FOR ENHANCED PERFORMANCE

Topic #: AF90-001

Office: MSD/PMR

ID #: 39673

THE INCONSISTENCY OF MICROSTRUCTURAL AND MECHANICAL PROPERTIES CONTAINED WITHIN THE INPUT MATERIALS USED IN PRESENT MANUFACTURING METHODS MAY BE A SIGNIFICANT FACTOR CONTRIBUTING TO THE ERRATIC PERFORMANCE OF CURRENT SHAPED-CHARGE AND EXPLOSIVELY-FORMED PENETRATOR WARHEADS. CURRENT LOW-DEFORMATION MANUFACTURING PROCESSES, SUCH AS MACHINING OR SHEAR FORMING, THAT ARE USED TO PRODUCE EFP'S DO LITTLE TO CHANGE THE GRAIN STRUCTURE OR MECHANICAL PROPERTIES OF THE INPUT STOCK. SUCCESSFUL COMPLETION OF THIS COUSINO PHASE I STUDY WILL DEMONSTRATE THAT COLD FLOWING HAS THE ABILITY TO PRODUCE ENHANCED AND CONSISTENT METALLURGICAL AND MECHANICAL PROPERTIES IN EFP MATERIALS REGARDLESS OF INPUT SOURCES AND/OR ORIGINAL METALLURGY. THIS PHASE I PROJECT PROPOSES A STUDY COMPARING THE COLD-FLOWED MANUFACTURING PROCESS TO STARTING MATERIAL CONDITIONS OF OTHER MANUFACTURING METHODS. AN ANALYSIS OF GRAIN ORIENTATION, GRAIN SIZE AND MECHANICAL PROPERTIES WILL QUANTIFY ENHANCED MATERIAL BENEFITS OFFERED BY THE COLD-FLOWING PROCESS. IN FACT, IT IS ANTICIPATED THAT THESE SUPERIOR PROPERTIES WILL ENHANCE THE KILL RATIO OF THE EFP AND SHAPED-CHARGE WARHEAD WHICH COUSINO INTENDS TO DEMONSTRATE IN THE FOLLOW-ON PHASE II STUDY.

MALIBU RESEARCH ASSOCS INC

26670 AGOURA RD
CALABASAS, CA 91302

Program Manager: DR DANIEL G GONZALEZ

Contract #:

Title: DEVELOPMENT OF LOW PROFILE MM-WAVE ANTENNA READILY ADAPTABLE TO MULTISPECTRAL SEEKER APPROACHES

Topic #: AF90-001

Office: MSD/PMR

ID #: 39676

THIS ANTENNA CONCEPT IS BASED ON A TECHNOLOGY WHEREBY A CONFORMING SURFACE IS DESIGNED TO REFLECT SELECTED WAVELENGTHS OF ELECTRO- MAGNETIC ENERGY IN A CONTROLLED MANNER. BECAUSE THIS TECHNOLOGY IS INHERENTLY FREQUENCY SELECTIVE, IT IS USEFUL FOR APPLICATION IN MULTISPECTRAL SYSTEMS WHERE TWO WIDELY SEPARATED FREQUENCY BANDS OF INTEREST CAN BE INDEPENDENTLY CONTROLLED IN THE SAME APERTURE SPACE. THIS PROPOSAL DESCRIBES A 95 GHz. ANTENNA THAT COULD BE CO-LOCATED WITH AN I.R. DETECTOR (OR ANOTHER MM-WAVE OR MICROWAVE ANTENNA) IN THE SAME APERTURE SPACE WITH LITTLE OR NO ADVERSE APERTURE BLOCKAGE FOR EITHER BAND OF INTEREST. THE 95 GHz ANTENNA PERFORMANCE WILL BE COMPARABLE TO THAT OF A

SMALL BUSINESS INNOVATION RESEARCH PROGRAM - PHASE I
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METAL PARABOLIC REFLECTOR OF THE SAME APERTURE SIZE. BECAUSE THE SURFACE GEOMETRY OF THE 95 GHz REFLECTOR CAN BE NEARLY ANY SHAPE THE TECHNOLOGY ADDS CONSIDERABLE FREEDOM TO ANTENNA DESIGN IN EXTREMELY TIGHT PACKAGING ENVIRONMENTS SUCH AS MISSILE SEEKERS.

MEGADYNE CORP
8718 ARLINGTON BLVD
FAIRFAX, VA 22031
Program Manager: MARC RODY

Contract #:

Title: INTEGRATED SAFE AND ARM

Topic #: AF90-001

Office: MSD/PMR

ID #: 39677

THIS OBJECTIVE OF THIS PROJECT IS TO DEVELOP AND BUILD A PROTOTYPE OF A DC TO DC VOLTAGE CONVERTER TO BE USED IN ELECTRONIC FOIL INITIATOR APPLICATIONS. THE DC TO DC CONVERTER WILL WORK AT 80% EFFICIENCY USING CURRENT MODE CHARGING. THE WORKING VOLTAGE WILL BE 2.5 KV WITH AN OVERALL POWER DENSITY OF 25 WATTS PER CUBIC INCH. THE DC TO DC REQUIRES AN DYNAMIC ENVIRONMENTAL INPUT FOR CHARGING. THIS UNIT WOULD MEET THE 1316D SAFE REQUIREMENTS. THE KEY TECHNICAL ADVANTAGES OF THE SPECIFIC DESIGN IS THE DC TO DC CONVERTER WILL WITHSTAND HIGH G FORCES, WORK IN MIROGRAVITY, WITHSTAND FULL ENVIRONMENTAL CONDITIONS AND HAVE REDUCE MAGNOSTRICTIVE CHARACTERISTICS. DC TO DC CONVERTER DESIGN WILL BE SUITABLE FOR HIGH VOLUME, LOW COST PRODUCTION. MEGADYNE CORPORATION HAS ALREADY BUILT SEVERAL ADVANCED DC TO DC CONVERTER FOR THE ORDNANCE INDUSTRY. AS A CLASS E SWITCHING SUPPLY WITH DYNAMIC SAFE AND ARM INPUTS, THIS PROJECT PROVIDES A SAFE DC TO DC CONVERTER FOR ORDNANCE APPLICATIONS.

PLAUR CORP
PO BOX 5271
COLUMBIA, SC 29250
Program Manager: ZHONG XU
Contract #:

Title: ADVANCE GUN BARREL TECHNOLOGY THROUGH PLASMA SURFACE ALLOYING

Topic #: AF90-001

Office: MSD/PMR

ID #: 39678

THE HOSTILE ENVIRONMENT EXISTING AT THE BORE SURFACE OF GUN BARRELS USED IN HIGH RATE OF FIRE AIRCRAFT CANNONS PRESENTS A FORMIDABLE DESIGN CHALLENGE TO THE GUN DESIGNER. HEAT, FRICTION, CORROSION AND WEAR AT THE BORE SURFACE ACT IN UNISON TO RAPIDLY DETERIORATE THE BORE. CHROME PLATING IS PRESENTLY THE ONLY COST EFFECTIVE METHOD OF IMPROVING BORE SURFACE LIFE. PLASMA SURFACE ALLOYING IS AN EMERGING NEW TECHNOLOGY WHEREIN IONS OF AN ALLOYING ELEMENT ARE INTRODUCED INTO THE SURFACE OF A METAL THROUGH AN ION BOMBARDMENT TECHNIQUE IN ORDER TO FORM UNIQUE SURFACE ALLOYS. USING A RECENTLY DEVELOPED METHOD OF PLASMA SURFACING ALLOYING, Xu-Tec, REFRACTORY AND CORROSION RESISTANT ELEMENTS WILL BE INTRODUCED INTO THE BORE SURFACE TO IMPROVE BARREL LIFE. Xu-Tec HAS ALREADY FOUND COMMERCIAL APPLICATION IN THE PRODUCTION OF HIGH SPEED SAW BLADES AND HAS PROVEN TO BE A COST EFFECTIVE ALTERNATIVE TO BI-METAL SAW BLADES. IN THE COURSE OF THIS STUDY, VARIOUS SURFACE ALLOYS WILL BE INTRODUCED INTO THE BORE SURFACE AND A SERIES OF TESTS WILL BE PERFORMED TO DETERMINE WHICH ALLOY IS BEST SUITED TO THE GUN BARREL APPLICATION.

SPARTA INC
23041 AVENIDA DE LA CARLOTA - STE 400
LAGUNA HILLS, CA 92653

SMALL BUSINESS INNOVATION RESEARCH PROGRAM - PHASE I
AIR FORCE Solicitation 90.1

Program Manager: DR OWEN C HOFER

Contract #:

Title: LASER NEUTRALIZATION OF MUNITIONS

Topic #: AF90-001

Office: MSD/PMR

ID #: 39683

THE U.S. AIR FORCE HAS A REQUIREMENT TO CLEAR UNEXPLODED ORDNANCES (UXOs) FROM THE AIRBASE RUNWAYS, TAXIWAYS, AND RIVETTE AREAS. THE CURRENT TECHNIQUES FOR CLEARING INVOLVES THE USE OF THE MARV-SMUD, A 50 CALIBER GUN, AND A POWERED BLADE. SPARTA, INC. AND THE U.S. ARMY HAVE INVESTIGATED THE USE OF LASER SYSTEMS TO DETONATE AND NEUTRALIZE ORDNANCE EXPERIMENTALLY AND ANALYTICALLY. THE LASER SYSTEM HAS THE ABILITY TO NEUTRALIZE ORDNANCE WITH LOW ORDER EXPLOSIONS WHICH MINIMIZE THE DAMAGE TO THE RUNWAY, HENCE MINIMIZES THE OVERALL TIME REQUIRED TO RESTORE THE AIRBASE TO OPERATING CONDITION. THIS STUDY WILL COVER THREE AREAS: (1) SPARTA WILL INVESTIGATE THE USE OF INDUSTRIAL LASERS FOR NEUTRALIZING UXOs INSTEAD OF THE MORE EXPENSIVE CUSTOM DESIGNED LASERS, (2) SPARTA WILL INVESTIGATE AREAS OF FIRE CONTROL, AND (3) SPARTA WILL INVESTIGATE LASER DAMAGE FOR LARGE THICK-WALLED MUNITIONS. SPARTA, IN CONJUNCTION WITH U.S. LASER CORP., AND LASERCRAFT WILL PERFORM TESTS TO DETERMINE THE EFFECTS OF PERFORMANCE PARAMETERS SUCH AS LASER ELECTRICAL CONVERSION EFFICIENCY AND BEAM DIVERGENCE WHEN THEY OPERATE AT ELEVATED COOLANT TEMPERATURES.

IAP RESEARCH INC

2763 CULVER AVE

DAYTON, OH 45429

Program Manager: DAVID P BAUER

Contract #:

Title: OVERCOMING THE RAILGUN VELOCITY LIMIT

Topic #: AF90-002

Office: MSD/PMR

ID #: 39660

ELECTROMAGNETIC RAILGUNS HAVE NOT EXCEEDED A VELOCITY LIMIT OF ABOUT 6 km/s. NEITHER, INCREASING RAILGUN CURRENT NOR INCREASING BARREL LENGTH FOR A GIVEN PROJECTILE MASS, RESULTS IN VELOCITIES GREATER THAN 6 km/s. WE PROPOSE TO DETERMINE THE FEASIBILITY OF EXCEEDING 6 km/s WITH A RAILGUN BY MODIFYING THE BARREL AND ARMATURE TO PREVENT PARASITIC SECONDARY CURRENT PATHS. ALL CURRENT WILL BE FORCED THROUGH THE ARMATURE, RESULTING IN HIGH ACCELERATION.

SPARTA INC

23041 AVENIDA DE LA CARLOTA - STE 400

LAGUNA HILLS, CA 92653

Program Manager: GARY D WONACOTT

Contract #:

Title: ULTRALIGHT WEIGHT HYPERVELOCITY PROJECTILE DEMONSTRATION

Topic #: AF90-002

Office: MSD/PMR

ID #: 39685

DEMONSTRATION OF 10 Km/sec LAUNCH VELOCITIES WOULD BE AN IMPORTANT ACHIEVEMENT IN THE CONTINUED DEVELOPMENT OF EM GUNS FOR STRATEGIC APPLICATIONS. NEW EM GUNS, PARTICULARLY THUNDERBOLT, WILL SOON BEGIN EXPERIMENTS TO DETERMINE IF THERE IS A REAL BARRIER AT 6-7 Km/sec WHICH MIGHT BE OVERCOME BY MITIGATING RESTRIKE, BY CONFINING THE PLASMA ARMATURE, OR REDUCING PLASMA FRICTION FORCES ON THE RAIL. BEFORE THESE EXPERIMENTS CAN BE CONDUCTED, A LIGHTWEIGHT PROJECTILE CONCEPT MUST BE DEVELOPED WHICH CAN SURVIVE THE 200-1000 Kgee LAUNCH ACCELERATIONS AND OTHER EQUALLY SEVERE LOADS AND BE SUFFICIENTLY LIGHT TO ACHIEVE 10 Km/sec. THIS PROGRAM WILL EXAMINE ALTERNATIVE PROJECTILE CONCEPTS (E.G., BASE PUSHING OR PULLING, SOLID OR PLASMA ARMATURE, PLASMA BIFURCATION) AND SELECT A BEST APPROACH FOR DETAILED DESIGN, FABRICATION, AND EM GUN TRIALS. THE PHASE I EFFORT WILL DELIVER FOUR RESIN

SMALL BUSINESS INNOVATION RESEARCH PROGRAM - PHASE I
AIR FORCE Solicitation 90.1

MATRIX CONCEPTS OR 2 METAL MATRIX CONCEPTS. A MATCHED METAL NET MOLDING FABRICATION APPROACH WILL BE USED FOR RMC FABRICATION, THUS ENSURING HIGH QUALITY IN THE PROJECTILE FROM PART TO PART. SPARTA ALSO HAS EXTENSIVE EXPERIENCE IN HOT ISOSTATIC PRESSING BORON ALUMINUM IF METAL MATRIX IS THE SELECTED MATERIAL. THE PROJECTILE DESIGN WILL BE SUPPORTED BY A FULL COMPLEMENT OF ANALYSES AND A COMMITMENT AT SPARTA TO EM GUN TECHNOLOGY.

SURFACE OPTICS CORP

PO BOX 261602

SAN DIEGO, CA 92126

Program Manager: MARTIN BRESSLER

Contract #:

Title: RESEARCH INSTRUMENTATION - A MBR (MONOSTATIC BIDIRECTIONAL LASER REFLECTOMETER)

Topic #: AF90-003

Office: MSD/PMR

ID #: 39681

THE DESIGN OF LASER RADARS AND TRACKING SYSTEMS REQUIRES A LARGE BASE OF ACCURATE DATA ON THE MONOSTATIC REFLECTIVITY OF A WIDE RANGE OF TARGET MATERIALS TO FAR-FIELD LASER ILLUMINATION OF MANY DIFFERENT WAVELENGTHS. FAR-FIELD MEASUREMENTS IMPLY LARGE MEASUREMENT DISTANCES AND USUALLY REQUIRE FIELD EXPERIMENTS, BUT A LABORATORY MEASUREMENT SYSTEM, RECENTLY DESIGNED AND BUILT AT SURFACE OPTICS CORPORATION, HAS BEEN SUCCESSFULLY USED TO DEMONSTRATE THE FEASIBILITY OF OBTAINING ACCURATE, FAR-FIELD MEASUREMENTS WITHIN A SMALL LABORATORY WORKING AREA. INFORMATION OBTAINED WITH THIS INSTRUMENT IS BEING USED IN MILITARY SYSTEM STUDIES, AND HAS STIMULATED RENEWED INTEREST IN REFLECTIVITY PHENOMENA (SUCH AS THE OPPOSITION EFFECT) AT RESEARCH CENTERS AROUND THE COUNTRY AND ABROAD. DEFICIENCIES IN THIS FIRST PROTOTYPE DESIGN, HOWEVER, HAVE RESULTED IN LONG HOURS OF ADJUSTMENT AND READJUSTMENT AND DATA ACQUISITION FAR LESS EFFICIENT THAN WHAT SHOULD BE ACHIEVABLE WITH THIS TYPE OF INSTRUMENT. A PHASE I PROGRAM IS PROPOSED FOR THE DESIGN OF AN IMPROVED AND MORE EFFICIENT (I.E. AUTOMATED) MEASUREMENT SYSTEM TO BE BUILT AND DEMONSTRATED IN A PHASE II PROGRAM. THE CURRENT PROTOTYPE WILL BE USED DURING THE PHASE I EFFORT AS A TEST BED FOR IMPROVED DESIGN FEATURES, CONFIGURATIONS, AND COMPONENTS.

UBC INC

8405-A BENJAMIN RD

TAMPA, FL 33634

Program Manager: W C GRABLE

Contract #:

Title: INERTIAL GUIDANCE TECHNOLOGY DEMONSTRATION (IGTD) SEEKER DEVELOPMENT

Topic #: AF90-004

Office: MSD/PMR

ID #: 39661

UBC, INCORPORATED, AN ENGINEERING FIRM PERFORMING RESEARCH, DEVELOPMENT, AND CONSULTING TECHNOLOGY OVER THE ENTIRE ELECTRO- MAGNETIC SPECTRUM, SPECIALIZING IN INFRARED AND MILLIMETER WAVE SENSORS, PROPOSES AN SBIR PROGRAM TO PROVIDE THE DESIGN AND SUPPORTING ANALYSIS LEADING TO A LESS THAN \$5K UNIT PRODUCTION COST 2-COLOR VISIBLE/NIR SEEKER (FOR THE NEAR TERM) AND 2-COLOR THERMAL IR (3-5u/8-12u) SEEKER (FOR FUTURE TECHNOLOGY INSERTION) IN SUPPORT OF THE U.S. AIR FORCE INERTIAL GUIDANCE TECHNOLOGY DEMONSTRATION (IGTD). INCLUDED IN THE SEEKER DESIGN ARE IMAGE PROCESSING/TARGET TRACKING ALGORITHM APPROACHES PREDICATED ON A TARGET/SCREEN TEMPLATE MATCHING TECHNIQUE WHICH TAKES ADVANTAGE OF A PRIORI DATA. THESE ARE THE KNOWN ACCURATE INERTIAL GUIDANCE OF THE IGTD TO THE ENDGAME, KNOWN TARGET HEADING, AIRFRAME DIVE ANGLE TO THE TARGET, TARGET TYPE AND SHAPE, AND RANGE TO GO AT LAUNCH. TO KEEP COSTS LOW, THE SENSOR TECHNOLOGIES PREFERRED WILL BE MATURE MONOLITHIC, UNCOOLED SILICON MICROBOLOMETER (THERMAL IR). SIGNAL AND IMAGE PROCESSING APPROACHES WILL BE BASED ON SILICON ANALOG AND DIGITAL SIGNAL PROCESSORS SUCH AS THE TMS3020XX SERIES.

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FOSTER-MILLER INC

350 SECOND AVE

WALTHAM, MA 02254

Program Manager: KHUSHROO CAPTAIN

Contract #:

Title: CRITICAL HUMIDITY INDICATOR

Topic #: AF90-005

Office: MSD/PMR

ID #: 39682

IT IS ESTABLISHED MILITARY PROCEDURE TO STORE A VARIETY OF ITEMS FOR EXTENDED PERIODS IN SEALED, DESSICATED CONTAINERS. TO ENSURE PROPER PRESERVATION, IT IS ESSENTIAL THAT THE RELATIVE HUMIDITY IN THE CONTAINER REMAIN BELOW A CERTAIN CRITICAL VALUE. CONTAINER HUMIDITY STATUS IS MONITORED BY AN INDICATOR THAT ACTUATES AND REMAINS ACTUATED IF THE CRITICAL HUMIDITY IS EVER EXCEEDED. CURRENT CHEMICAL (COLOR-CHANGE) INDICATORS HAVE BEEN FOUND UNRELIABLE; THUS, AN IMPROVED INDICATOR IS NEEDED. IN PHASE I A NUMBER OF NEW CONCEPTS FOR A CRITICAL HUMIDITY INDICATOR WILL BE GENERATED. A VARIETY OF TECHNOLOGIES WILL BE INVESTIGATED AND DESIGN APPROACHES WILL BE DEVELOPED FOR ALL INDICATOR COMPONENTS, INCLUDING THE SENSING ELEMENT, AND READOUT. THE CONCEPTS WILL BE ANALYZED IN DETAIL TO ESTABLISH THEIR ADVANTAGES AND DISADVANTAGES, AND FROM THIS, TO EVALUATE THEIR POTENTIAL FOR AIR FORCE USE. THE LEADING CONCEPT(S) WILL BE RECOMMENDED FOR FURTHER DEVELOPMENT. IN PHASE II, PROTOTYPES OF THE LEADING CONCEPT(S) WILL BE DESIGNED, FABRICATED AND TESTED IN THE LABORATORY TO CONFIRM PERFORMANCE. DESIGN REFINEMENTS WILL BE INCORPORATED AS APPROPRIATED. FINALLY, TESTED PROTOTYPE INDICATORS WILL BE DELIVERED TO THE AIR FORCE FOR FURTHER EVALUATION.

LANDEC LABS INC

3603 HAVEN AVE

MENLO PARK, CA 94025

Program Manager: DR STEVEN P BITLER

Contract #:

Title: THERMOPLASTIC BINDERS FOR EXPLOSIVE APPLICATIONS

Topic #: AF90-006

Office: MSD/PMR

ID #: 39662

THERMOPLASTIC BINDERS OFFER PROCESS ADVANTAGES OVER CONVENTIONAL THERMOSET ENERGETIC MATERIAL BINDERS BY ALLOWING FORMULATION AT LOWER TEMPERATURES AND UNRESTRICTED POT LIFE. THERMOPLASTICS ALLOW GREATER FLEXIBILITY IN PROCESS CONTROL AND PRODUCT REPROCESSING THROUGH A SIGNIFICANTLY LOWER MELT VISCOSITY IN THE FLUID PHASE THAN THE SOLID PHASE. LANDEC LABS HAS IDENTIFIED A CLASS OF THERMOPLASTIC POLYMERS WITH UNIQUE RHEOLOGICAL AND PHYSICAL PROPERTIES. THE MELTING RANGE OF THESE POLYMERS CAN BE TAILORED TO BE WELL BELOW THE AUTODECOMPOSITION TEMPERATURE OF A PARTICULAR ENERGETIC MATERIALS. WE PROPOSE TO DEVELOP COPOLYMERS WITH A NARROW MELTING RANGE BELOW 80 DEG C HAVING UNUSUALLY LOW VISCOSITY JUST ABOVE THE MELT. THE COMBINATION OF LOW MELT TEMPERATURE, LOW MELT VISCOSITY AND HIGH FILLER ACCEPTANCE MAKE THESE MATERIALS ATTRACTIVE AS BINDERS FOR ENERGETIC MATERIALS. LANDEC HAS SELECTED A COLLABORATOR WHO WILL EVALUATE THE SUITABILITY OF THESE BINDERS WITH ENERGETIC PARTICLES UNDER USE CONDITIONS.

WOOLLAM J A CO

315 S 9TH ST - STE 22

LINCOLN, NE 68508

Program Manager: DR JOHN A WOOLLAM

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Contract #:

Title: DIAMONDLIKE CARBON HERMETIC ENCAPSULANTS

Topic #: AF90-009

Office: MSD/PMR

ID #: 39663

DIAMONDLIKE CARBON (DLC) CAN BE DEPOSITED ON ROOM TEMPERATURE SUBSTRATES. FURTHERMORE, EXPERIMENTS ON SILICON SUBSTRATES HAVE SHOWN THAT MOISTURE DOES NOT PENETRATE DLC FILMS AS THIN AS 150 ANGSTROMS. THE PURPOSE OF THE PROPOSED WORK IS TO DETERMINE IF THIN FILMS OF DLC CAN PROTECT COMPLETE ELECTRONIC DEVICES AND INTEGRATED CIRCUITS FROM MOISTURE, AS WELL AS FROM CHEMICALS CONTAINED IN COMMON EPOXIES USED FOR POTTING. THESE DEVICES CONTAIN POLY-SILICON, SILICIDES, METALS, AND DIELECTRIC FILMS WHICH ALL HAVE DIFFERENT THERMAL EXPANSION COEFFICIENTS AND STICKING COEFFICIENTS FROM DLC ADHESION. THUS (a) MOISTURE AND CHEMICAL PROTECTION, (b) BONDING UNDER CONDITIONS OF THERMAL CYCLING, AND (c) STEP COVERAGE WILL BE PRIMARILY ADDRESSED IN PHASE I.

OPTICS 1 INC

3625 THOUSAND OAKS BLVD - STE L
WESTLAKE VILLAGE, CA 91362

Program Manager: ROBERT E FISCHER

Contract #:

Title: CORRECTED OPTICAL WINDOW FOR MISSILES

Topic #: AF90-011

Office: MSD/PMR

ID #: 39664

THERE HAS BEEN FOR MANY YEARS A DEMONSTRATED NEED FOR AERODYNAMICALLY IMPROVED MISSILE DOME SHAPES OVER THE CONVENTIONAL HEMISPHERICAL SHAPE WHICH RESULTS IN BOTH HEATING AND DRAG. IN ORDER TO VIRTUALLY ELIMINATE ALL OPTICAL IMAGE ABERRATIONS FROM THE DOME, HEMISPHERICAL SHAPED DOMES CONSISTING OF TWO SURFACE WHICH ARE SPHERICAL AND CONCENTRIC TO ONE ANOTHER HAVE BEEN USED ALMOST EXCLUSIVELY. TANGENT OGIVES OR SIMILAR DOME SHAPES MAKE THE OPTICAL ABERRATIONS DIFFICULT TO CONTROL OVER ANY FIELD OF VIEW AND/OR FIELD OF REGARD. THIS SBIR PROGRAM WILL GENERATE OPTICAL MEANS FOR CORRECTING THE OPTICAL ABERRATIONS OF AN OGIVE OR SIMILAR AERODYNAMICALLY IMPROVED DOME. WE WILL WORK WITH BOTH THE RECOMMENDED APPROACH OF UTILIZING SANDWICHED MATERIALS OF DIFFERING REFRACTIVE INDEX, AS WELL AS OTHER OPTICAL CORRECTION METHODOLOGIES. THESE OTHER APPROACHES INCLUDE SEPARATE OPTICAL CORRECTORS INTERIOR TO THE DOME (POSSIBLY INTEGRATED WITH THE MISSILE SEEKER OPTICS), THE USE OF BINARY OPTICS TO CORRECT THE OPTICAL ABERRATIONS, GRADIENT INDEX DOME MATERIALS, AND OTHERS. THE DESIGNS WILL BE FOR THE 3-5 μm AND THE 8-12 μm SPECTRAL REGIONS. WHILE THIS IS PRIMARILY AN OPTICAL DESIGN EFFORT, CLOSE COMMUNICATION WITH MATERIAL PRODUCERS WILL BE MAINTAINED.

SUNOL SCIENCES CORP

6400 VILLAGE PKWY

DUBLIN, CA 94568

Program Manager: PETER C STUDDT

Contract #:

Title: FIBER OPTIC MEASUREMENT OF SHOCK FRONT VELOCITY

Topic #: AF90-013

Office: MSD/PMR

ID #: 39665

A DESIGN FOR A HIGHLY ACCURATE, SMALL, MODULAR, RUGGEDIZED FIBER OPTIC LASER SYSTEM TO CONTINUOUSLY MEASURE DETONATION SHOCK FRONT VELOCITY IN EXPLOSIVES IS DESCRIBED. A UNIQUE APPROACH BASED ON A VISAR VELOCITY INTERFEROMETER IS PROPOSED. IN THIS APPROACH, THE SENSOR FIBER MAY BE EMBEDDED IN THE EXPLOSIVE OR ATTACHED EXTERNALLY WITH A SUITABLE ADHESIVE AND TAMPER MATERIAL. A UNIQUE FEATURE OF THE DESIGN MAKES IT RELATIVELY IMMUNE TO THE EFFECTS OF SHOCK INDUCES SELF LUMINOSITY WITHIN THE SENSOR FIBER OR INTENSE LIGHT SOURCES ANYWHERE IN THE OPTIC TRAIN. A PURELY OPTICAL APPROACH TO THE SENSOR HEAD AND DATA

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TRANSMISSION CABLE DESIGNS MAKES THEM IMMUNE TO THE EFFECTS OF ELECTROMAGNETIC NOISE. FURTHERMORE, THE MODULAR NATURE OF THE DESIGN AND ARBITRARY OPTICAL DATA TRANSMISSION CABLE LENGTH ALLOWS THE OPTICAL SIGNAL PROCESSOR AND SUPPORTING ELECTRONICS MODULE TO BE PLACED IN A LOCATION SAFE FROM THE TEST ENVIRONMENT.

REKENTHALER TECHNOLOGY ASSOCS CORP
3400 JENNINGS CHAPEL RD
WOODBINE, MD 21797

Program Manager: JEFFREY S BRUSH

Contract #:

Title: INFRARED IMAGE RESOLUTION (IRIR)

Topic #: AF90-014

Office: MSD/PMR

ID #: 39666

THIS PHASE I SBIR PROGRAM RESULTS IN DETERMINATION OF THE INFRARED SENSOR RESOLUTIONS REQUIRED FOR TARGET DISCRIMINATION (DEFINED HERE AS DETECTION, CLASSIFICATION AND IDENTIFICATION). AN IMAGE PROCESSING PIPELINE IS USED WITH REAL WORLD IR IMAGERY, CONVOLVED AT DIFFERENT RESOLUTIONS, TO ARRIVE AT AN EMPIRICAL DETERMINATION OF THE OPTIMAL PIXEL RESOLUTION(S) REQUIRED TO PERFORM EACH OF THESE THREE FUNCTIONS, USING MID-IR AND BOTH FIXED AND MOVING TARGET SETS.

METRO-LASER
18006 SKYPARK CIR - #108
IRVINE, CA 92714

Program Manager: JAMES D TROLINGER

Contract #:

Title: AN AIRBORNE FLOW VISUALIZATION SYSTEM

Topic #: AF90-015

Office: MSD/PMR

ID #: 39667

THIS IS A PROPOSAL TO DEVELOP AN AIRBORNE FLOW VISUALIZATION SYSTEM WHICH CAN BE INTEGRATED WITH EXISTING AIRCRAFT PODS AND RECORD FLOW FIELD DATA WHICH LOCATE, VISUALIZE, AND CHARACTERIZE LOCAL FLOW PHENOMENA SUCH AS VORTICES, SHOCK WAVES, AND LAMINAR TO TURBULENT FLOW TRANSITION. THE AERODYNAMIC INTERACTION BETWEEN AIRCRAFT STORES AND THE AIRCRAFT ITSELF CONSTITUTES AN EXTREMELY COMPLEX AND ESSENTIALLY UNPREDICTABLE PROBLEM. INSTRUMENTING AN AIRCRAFT TO PROVIDE EXPERIMENTAL DATA ON AIRCRAFT/STORE INTERACTION WILL AUGMENT THE SOLUTION OF THIS PROBLEM. THE PROPOSED DESIGN INCORPORATES A RAPIDLY SCANNED LASER BEAM WHICH IS PROJECTED FROM THE POD AND WHICH ILLUMINATES THE FLOW REGION AROUND AN ADJACENT STORE. DATA CAN BE EXTRACTED FROM EITHER THE LIGHT SCATTERED BY AEROSOLS IN THE FLOW OR LIGHT SCATTERED FROM THE STORE OR AIRCRAFT SURFACE. THE FORMER METHOD IS CALLED LASER SHEET FLOW VISUALIZATION. THE LATTER, DEPENDING UPON THE PROCESSING METHOD CHOSEN CAN BE CATEGORIZED AS EITHER, INDIRECT SHADOWGRAPH, MOIRE DEFLECTOMETRY, SHEAROGRAPHY, OR SPECKLE INTERFEROMETRY.

SAFETY CONSULTING ENGINEERS INC
5420 PEARL ST
ROSEMONT, IL 60018

Program Manager: C JAMES DAHN

Contract #:

Title: BINARY EXPLOSIVE STUDY

Topic #: AF90-016

Office: MSD/PMR

ID #: 39668

STUDIES WILL BE CONDUCTED TO SELECT NON-EXPLOSIVE COMPONENTS WHICH WHEN MIXED WILL BECOME EXPLOSIVE TO BE USED IN AN AIR FORCE MUNITION APPLICATION. THE EXPLOSIVE OUTPUT

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ENERGY WILL BE GREATER THAN OR EQUAL TO TRITONAL. PHYSICAL, CHEMICAL AND NON-EXPLOSIVE PROPERTIES OF THE COMPONENTS WILL BE IDENTIFIED. ALSO THE EXPLOSIVE OUTPUT OF THE BINARY MIXES WILL BE CALCULATED AND/OR TESTED. MIXING TESTS WILL BE CONDUCTED AND DETERMINE EASE AND COMPLETENESS OF MIXING. TRADE-OFF STUDY WILL BE CONDUCTED TO SELECT VIABLE CANDIDATE SYSTEMS FOR THE MUNITION APPLICATION.

CRYSTALLUME
125 CONSTITUTION DR
MENLO PARK, CA 94025
Program Manager: WILSON SMART
Contract #:
Title: DIAMOND WAVEGUIDES FOR THE LONG WAVELENGTH INFRARED
Topic #: AF90-017 Office: MSD/PMR ID #: 39669

IT WOULD BE DESIRABLE TO FABRICATE LONG WAVELENGTH INFRARED (LWIR) OPTICAL WAVEGUIDES AS CRITICAL COMPONENTS TO AIR-TO-AIR MISSILE TARGET DETECTION SYSTEMS. NO MATERIAL IS CURRENTLY AVAILABLE WHICH HAS THE COMBINATION OF STRENGTH, STABILITY, AND LWIR TRANSMISSION CHARACTERISTICS REQUIRED BY THE APPLICATION. DIAMOND FILMS, DEPOSITED BY RECENTLY DEVELOPED PLASMA-ENHANCED CHEMICAL VAPOR DEPOSITION (CVD) TECHNOLOGY, OFFER A NEW MATERIAL WITH PROPERTIES GREATLY SUPERIOR TO THOSE OF OTHER LWIR MATERIALS. WE WILL FABRICATE DIAMOND WAVEGUIDES AND PERFORM TRANSMISSION MEASUREMENTS AT 10.6um TO ASSESS FEASIBILITY OF USING DIAMOND LWIR WAVEGUIDES IN ADVANCED AIR-TO-AIR MISSILES AND OTHER INTERCEPTOR TECHNOLOGIES WITH MORE SEVERE ACCELERATION REQUIREMENTS.

GALAXY MICROSYSTEMS INC
10711 BURNET RD - STE 325
AUSTIN, TX 78758
Program Manager: ROBERT E FOSDICK
Contract #:
Title: FAULT TOLERANT CPU CIRCUIT
Topic #: AF90-018 Office: MSD/PMR ID #: 39670

FAST AND EFFICIENT ERROR DETECTION IS THE CORNERSTONE IN DEVELOPING A FAULT TOLERANT SYSTEM. UNDER CURRENT PROGRAM, GALAXY HAS DEVELOPED AN ERROR TOLERANT CPU ARCHITECTURE THAT WILL REAL TIME DETECT AND CORRECT SOFT ERRORS IN THE REGISTERS. EXPANSION OF THIS WORK WILL LEAD TO INTEGRITY CHECKING OF THE REMAINING PROCESSOR FUNCTIONS I.E. ALU, I/O, CONTROL, ETC. NECESSARY FOR ONBOARD MESSAGE PROCESSING. THIS PROGRAM WILL DEFINE THE TECHNIQUES TO IMPLEMENT A REAL TIME FAULT DETECTION/CORRECTION SINGLE CHIP PROCESSOR/CONTROLLER WITH ONLINE HIGH FAULT COVERAGE. THE OVERHEADS ASSOCIATED WITH THE TECHNIQUES ARE MINIMAL. THE CPU IMPLEMENTATION IS COMPATIBLE FOR GALLIUM ARSENIDE TECHNOLOGY PROVIDING HIGH PERFORMANCE, RADIATION HARDNESS, LOW POWER, AND SMALL DIE SIZE.

CRYSTALLUME
125 CONSTITUTION DR
MENLO PARK, CA 94025
Program Manager: WILSON SMART
Contract #:
Title: DIAMOND COATINGS FOR INFRARED MATERIAL
Topic #: AF90-019 Office: MSD/PMR ID #: 39671

MATERIALS WHICH ARE TRANSPARENT IN THE INFRARED AT 8-12um AND CURRENTLY USED FOR HIGH

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VELOCITY MISSILE RADOMES ARE SUBJECTED TO ABRASION AND EROSION IN FLIGHT BECAUSE OF ATMOSPHERIC PARTICLES AND WATER DROPLETS. IN CONTRAST, DIAMOND FILM DEPOSITED BY PLASMA ENHANCED CHEMICAL VAPOR DEPOSITION (PECVD) HAS BOTH EXCELLENT INFRARED AND MECHANICAL PROPERTIES. RECENT DEVELOPMENTS IN PECVD DIAMOND TECHNOLOGY SHOW PROMISE OF DRAMATICALLY EXTENDING IT TO APPLICATIONS INVOLVING DIFFICULT SUBSTRATES AND LARGER DEPOSITION AREAS. PHASE I OF THE PROPOSED PROGRAM CONSISTS OF A STUDY OF ALTERNATE METHODS OF COATING CURRENTLY USED INFRARED DOME MATERIALS WITH PECVD DIAMOND, METHODS OF PRODUCING FREE STANDING DIAMOND DOMES, AND METHODS OF FABRICATING DIAMOND DOMES THAT ARE PARTIALLY MECHANICALLY SUPPORTED. DURING PHASE I, A DEVELOPMENT PATH FOR DIAMOND RADOMES WILL BE RECOMMENDED, AND A PHASE II PROPOSAL WILL BE SUBMITTED WHICH TAKES THE RECOMMENDED EXPERIMENTAL COURSE.

GENERAL SCIENCES INC

205 SCHOOLHOUSE RD

SOUDERTON, PA 18964

Program Manager: MICHAEL A RILEY

Contract #:

Title: TARGET NEUTRALIZATION MECHANISMS

Topic #: AF90-020

Office: MSD/PMR

ID #: 39672

GENERAL SCIENCES, INCORPORATED PROPOSES THE USE OF HIGHLY ENERGETIC PARTICLE FORMATION TECHNIQUES FOR THE PRODUCTION OF HIGH INTENSITY CLOUDS FOR COMBINED IR OPTICS INCAPACITATION AND ENGINE PARTICLE INGESTION. UTILIZING THE SGI PROPRIETARY HI-THERM SYNTHESIS TECHNOLOGY, THIS APPROACH WILL PRODUCE VERY-FINE REFRACTORY CERAMIC PARTICLES THROUGH A RAPID, HIGH TEMPERATURE REACTION. CALCULATIONS WILL BE MADE TO DETERMINE THE THERMAL FLUX REQUIREMENTS FOR NONLINEAR FUNCTIONING OF IR DETECTORS AND TASKS WILL BE PERFORMED ON ENGINE MATERIALS PERFORMANCE IN A HIGH TEMPERATURE HIGH VELOCITY PARTICLE IMPACT ENVIRONMENT.

AERO-PLASMA TECHNOLOGIES

2421 GLYNDON AVE

VENICE, CA 90291

Program Manager: DR JACOB L SPERLING

Contract #:

Title: TECHNICAL EVALUATION OF X-RAY SIMULATION PLASMA OPENING SWITCH AND OTHER KEY COMPONENT PERFORMANCE AND SYSTEM INTEGRATIONS

Topic #: AF90-021

Office: AEDC/PKP

ID #: 41263

THE PROPOSED EFFORT IS INTENDED TO PROVIDE IN DEPTH TECHNOLOGICAL SUPPORT TO THE ARNOLD ENGINEERING DEVELOPMENT CENTER (AEDC) FOR THE INTERPRETATION AND EVALUATION OF THE RELATION BETWEEN THE MAJOR PULSE FORMING DEVICES IN THE ADVANCED PULSE- POWER SYSTEMS USED IN CONJUNCTION WITH INDUCTIVE ENERGY-STORAGE TECHNOLOGY. PARTICULAR EMPHASIS IN PHASE I WILL BE ON THE CONTROLLED ELECTROMAGNETIC IRRADIATION OF THE PLASMAS WITHIN THE PLASMA EROSION OPENING SWITCHES (PEOS) WHICH ARE KEY COMPONENTS OF THE ADVANCED PULSE-POWER SYSTEMS AND DESCRIBING THE INFLUENCE OF PEOS PERFORMANCE CAPABILITIES ON X-RAY SIMULATOR PERFORMANCE. TO SUPPORT THIS EFFORT, WE WILL, IN PHASE I, DEMONSTRATE THE FEASIBILITY OF USING THE IRRADIATION APPROACH TO SUBSTANTIALLY ENHANCE THE PARAMETRIC OPERATIONAL RANGE AND CONTROLLABILITY OF THE PEOS THROUGH THE PURPOSEFUL MODIFICATION OF PLASMA VELOCITY AND TEMPERATURE PROFILES. PHASE II WILL INCLUDE EXPERIMENTAL ELECTROMAGNETIC-IRRADIATION DEMONSTRATION TESTS IN AN ACTUAL PEOS DEVICE. THE SUCCESS OF THE PROPOSED RESEARCH WOULD HAVE SUBSTANTIAL APPLICATIONS TO ALL PRESENT PULSE-POWER FACILITIES AND POTENTIAL FUTURE FACILITIES SUCH AS THE (DECADE/RETF) X-RAY SIMULATOR.

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ENGINEERING RESEARCH & CONSULTING INC

PO BOX 417

TULLAHOMA, TN 37388

Program Manager: DR Y C L SUSAN WU

Contract #:

Title: NEURAL NETWORK BASED EXPERT SYSTEM FOR ASTF FAULT DIAGNOSIS

Topic #: AF90-021

Office: AEDC/PKP

ID #: 39686

ENGINEERING RESEARCH AND CONSULTING, INC. (ERCI) PROPOSES TO DEVELOP A PROTOTYPE NEURAL NETWORK BASED EXPERT SYSTEM (CONNECTIONIST EXPERT SYSTEM) FOR ASTF FAULT DIAGNOSIS. NEURAL NETWORKS ARE EXCELLENT FOR PARAMETER ESTIMATION AND RECOGNIZING PATTERNS IN SIGNAL DATA. THE OBJECTIVE OF THIS RESEARCH IS TO DESIGN A NEURAL NETWORK ARCHITECTURE TO DETECT FAULT THUS SIGNIFYING AND RESPONDING TO AN ABNORMAL EVENT. ONCE A SUCCESSFUL ARCHITECTURE IS DESIGNED, AN EXPERT SYSTEM WILL BE BUILT USING THE RESULTING NEURAL NETWORK OUTPUT CURVE AS A PREMISE TO A RULE. THE NEURAL NETWORK BASED EXPERT SYSTEM CAN ADVISE THE ENGINEER AND/OR BE INTEGRATED TO THE EMERGENCY DETECTION AND RESPONSE (EDAR) FUNCTION WHICH IS A PART OF THE ASTF FAULT-TOLERANT CONTROL SYSTEM. PHASE I OF THIS PROJECT WILL IMPLEMENT A PROTOTYPE NEURAL ARCHITECTURE USING FAULT DATA GENERATED BY A SIMULATOR. THE RESULTANT NETWORK OUTPUT CURVES WILL BE USED AS RULE PREMISE FOR AN EXPERT SYSTEM, WHERE RULE CLAUSES WILL BE RECOMMENDATIONS TO ENGINEERS AND/OR THE EDAR FOR CONTROL OF ASTF. PHASE II OF THE PROJECT WILL EXTEND THE SYSTEM FROM PHASE I TO BUILD A CONNECTIONIST EXPERT SYSTEM FOR ATSF FAULT DIAGNOSIS.

METRO-LASER

18006 SKYPARK CIR - #108

IRVINE, CA 92714

Program Manager: DR JAMES D TROLINGER

Contract #:

Title: BALLISTIC RANGE INSTRUMENTATION EMPLOYING HOLOGRAPHIC SENSORS

Topic #: AF90-021

Office: AEDC/PKP

ID #: 39689

THIS IS A PROPOSAL TO DEVELOP A NEW CLASS OF SENSORS FOR BALLISTIC RANGES AND WIND TUNNELS CALLED "HOLOGRAPHIC SENSORS". THE RESEARCH WILL FIND WAYS TO MAKE HOLOGRAPHIC SENSORS FOR A VARIETY OF AERODYNAMIC PROPERTIES INCLUDING BOUNDARY LAYER TRANSITION, VELOCITY IN THE BOUNDARY LAYER, TEMPERATURE OF THE MODEL SURFACE, SKIN FRICTION, PRESSURE AT THE MODEL, MODEL DEFLECTION AND STRAIN, AND OTHER RELATED PARAMETERS. THE PROPOSED WORK WILL SHOW HOW THE DIFFRACTION PROPERTIES OF THE ELEMENTS CAN BE MADE SENSITIVE TO EACH OF THESE PROPERTIES. A HOLOGRAPHIC SENSOR IS A THIN PATCH OF MATERIAL THAT IS COATED OR ETCHED ONTO AN AERODYNAMIC SURFACE IN SUCH A MANNER THAT WHEN ADDRESSED BY AN IMPINGING LASER BEAM, THE DIFFRACTED LIGHT IS CODED WITH INFORMATION OF INTEREST. THAT IS, THE SENSOR IS STORED IN A HOLOGRAM OR HOLOGRAPHIC OPTICAL ELEMENT. IF SUCCESSFUL, THIS RESEARCH COULD CREATE AN ENTIRE NEW FIELD OF INSTRUMENTATION THAT COULD SOMETIMES OUTPERFORM OTHER SENSORS SUCH AS HOTWIRE, AND FILMS, PITOT PROBES, THERMOCOUPLES, AND VELOCIMETERS. A PRODUCT IS ANTICIPATED THAT COULD HAVE EXTREMELY WIDE COMMERCIAL APPLICATION.

MICRO CRAFT INC

PO BOX 370

TULLAHOMA, TN 37388

Program Manager: DAVE SHUSHEREBA

Contract #:

Title: NONCONVENTIONAL PRECISION TRAVERSE SYSTEM

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Topic #: AF90-022

Office: AEDC/PKP

ID #: 39690

WITH THE TREND OF DATA ACQUISITION TECHNIQUES CHANGING TO LASER VELOCIMETER SYSTEMS, THE NEED TO ACCURATELY POSITION THE LASER BEAM INSIDE THE TEST SECTION IS OF CRITICAL IMPORTANCE. A SYSTEM WHICH ALLOWS THE BEAM TO BE POSITIONED IN THE THREE TRANSLATIONAL DEGREES OF FREEDOM WILL PERMIT DATA TO BE RECORDED AT ANY POINT INSIDE THE TEST SECTION. THE PROPOSED SYSTEM WILL ACCOMPLISH THE NECESSARY MOVEMENTS UTILIZING SERVO DRIVE MOTORS, PRECISION GROUND BALL SCREWS AND WILL HAVE THE ABILITY TO BE CONTROLLED EITHER MANUALLY OR BY A COMPUTER WITH A PREPROGRAMMED SEQUENCE OF MOTIONS. THE POSITION OF THE OPTICS TABLE WILL BE MONITORED USING LINEAR ENCODERS WITH ADJUSTMENTS IN THE SYSTEM POSITIONS BEING MADE BY A SERVO CONTROL LOOP. THE OBJECTIVES OF THIS EFFORT ARE TO: PERFORM A DESIGN AND ANALYSIS OF A 3-AXIS TRAVERSE SYSTEM AND TO ADDRESS THE ADAPTABILITY OF THE SYSTEM FOR USE IN SEVERAL WIND TUNNELS. THESE OBJECTIVES WILL BE ACCOMPLISHED BY: PERFORMING THE NECESSARY STRUCTURAL ANALYSIS TO ASSURE SUFFICIENT RIGIDITY IN THE PROPOSED SYSTEM AND DESIGNING THE SYSTEM USING COMPONENTS THAT MEET OR EXCEED THE REQUIRED ACCURACY.

SYSTEM SPECIALISTS INC

3125 E 47TH ST

TUCSON, AZ 85713

Program Manager: DR WADE M POTEET

Contract #:

Title: HIGH-ACCURACY CRYOGENIC LINEAR ACTUATOR

Topic #: AF90-023

Office: AEDC/PKP

ID #: 39691

THIS INVESTIGATION WILL BE DIRECTED TOWARDS THE DEVELOPMENT OF A HIGH-ACCURACY CRYOGENIC LINEAR ACTUATOR. ONE OF THE MOST STRAIGHTFORWARD APPROACHES TO THE PROBLEM OF LINEAR MOTION AT CRYOGENIC TEMPERATURES USES A ROTATING STEPPER MOTOR AND LEADSCREW ARRANGEMENT TO ACHIEVE THE DESIRED RESOLUTION AND ACCURACY. TO DATE, THESE EFFORTS HAVE BEEN UNABLE TO PRODUCE HIGH-ACCURACY OVER A REASONABLE LIFETIME, PRIMARILY DUE TO THE BEARING DESIGNS. TO MEET THE REQUIREMENTS OF THIS SOLICITATION TOPIC, THESE BEARINGS MUST BE UNLUBRICATED, LOW WEAR, AND PRODUCE VERY FEW PARTICLES SO THAT A HIGH-VACUUM IS MAINTAINED. A BEARING DESIGN HAS ALREADY BEEN DEVELOPED AND TESTED WHICH SHOWS MUCH PROMISE FOR THE PRESENT APPLICATION. FURTHERMORE, CRYOGENIC STEPPER MOTORS WITH BOTH NORMAL AND SUPERCONDUCTING WINDINGS HAVE BEEN TESTED IN OUR LABORATORY TO TEMPERATURES OF 2.0K WITH SUCCESS. WE PROPOSE AN EFFORT TO DESIGN, FABRICATE A MODEL, AND TEST A CRYOGENIC STEPPER MOTOR/LEADSCREW ASSEMBLY WHICH MEETS OR EXCEEDS THE REQUIREMENTS FOR SPEED, ACCURACY, REPEATABILITY, AND RESOLUTION. ADDITIONALLY, LOW-POWER DESIGNS WILL BE INVESTIGATED TO CONSERVE CRYOGENS IN APPLICATIONS WHERE COOLING IS LIMITED. POSITION AND SPEED READOUTS WILL BE ADDRESSED, AS WELL AS THE VOLUME CONSTRAINTS (<200mm CUBE).

ATSS INC

PO BOX 5487

SAN BERNARDINO, CA 92412

Program Manager: HENRY L MOODY

Contract #:

Title: HIGH TEMPERATURE RAKE PROBE FOR ARC-JET TESTS

Topic #: AF90-024

Office: AEDC/PKP

ID #: 39692

THE OBJECTIVE OF THE PROGRAM IS TO DESIGN RAKE PROBES THAT CAN ACCURATELY MEASURE AND MAP ARC-JET EXIST PLANE FLOW QUANTITIES. THREE RAKE PROBES SHALL BE DESIGNED THAT CAN MAP OUT THE AERODYNAMIC PROPERTIES OF THE TEST SECTION IN HIGH-ENTHALPY/HIGH-PRESSURE ARC-JETS. THE

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FIRST PROBE SHALL BE A CYLINDRICAL PRESSURE/CALORIMETER RAKE THAT CAN BE SWEEPED ACROSS THE TEST SECTION TO MEASURE PRESSURE, CONVECTIVE HEATING AND INFER ENTHALPY. THIS PROBE SHALL BE FABRICATED IN PHASE I. THE SECOND PROBE IS A RAKE WITH AXI-SYMMETRIC PROBES TO CHARACTERIZE THE THREE-DIMENSIONAL FLOW BEHAVIOR OF THE TEST SECTION. THE THIRD PROBE SHALL BE USED TO INFER ENTHALPY.

REMTECH INC
3304 WESTMILL DR
HUNTSVILLE, AL 35805

Program Manager: C IRVIN STUCKEY

Contract #:

Title: HIGH TEMPERATURE RAKE PROBE FOR ARC JET TESTS

Topic #: AF90-024

Office: AEDC/PKP

ID #: 39693

THE LACK OF THE CAPABILITY TO ACCURATELY MEASURE FLOW CONDITIONS IN THE ARC JET FACILITIES MAKES THE DATA GATHERED IN THESE FACILITIES QUESTIONABLE. PRESENTLY, ARC JET FLOW CONDITIONS ARE DERIVED. A DISCREPANCY OF 20 TO 50 PERCENT EXISTS BETWEEN THEORETICAL DERIVATIONS OF FREE-STREAM ENTHALPY AND ARC CHAMBER HEAT BALANCE ENTHALPY. THIS MUCH VARIATION INDICATES THAT THERE IS SIGNIFICANT NEED TO BE ABLE TO MEASURE THE FLOW CONDITIONS ACCURATELY SINCE THEORETICAL CALCULATIONS VARY GREATLY. THE DESIGN OF THE RAKE PROBE AND ELEMENTS REQUIRES THAT THEY BE ABLE TO SURVIVE THE SEVERE ENVIRONMENT PRESENT IN AN ARC JET FACILITY. THIS IMPLIES THAT THE ELEMENTS MUST HAVE A VERY RAPID RESPONSE AND THE DATA COLLECTION RATE MUST BE HIGH SO THE TIME THE PROBE IS IN THE FLOW IS MINIMIZED. THE SIZE OF THE FLOW STREAM AND THE NEED TO MINIMIZE THE PROBE COOLING REQUIREMENTS IMPLY THAT THE SIZE OF THE ELEMENTS MUST BE MINIMAL. PHASE I WILL COVER THE BASIC DESIGN OF THE RAKE PROBE AND ITS ELEMENTS AND DEFINE THE MEASUREMENT TECHNIQUES REQUIRED TO MEASURE THE GAS TOTAL ENTHALPY, POST-SHOCK PITOT PRESSURE, FREE-STREAM STATIC PRESSURE, AND FLOW ANGULARITY.

PHASEX CORP
360 MERRIMACK ST
LAWRENCE, MA 01843

Program Manager: VAL KRUKONIS

Contract #:

Title: DEVELOPMENT OF A SUBMICRON MONODISPersed AEROSOL GENERATOR FOR LASER DOPPLER VELOCIMETRY

Topic #: AF90-025

Office: AEDC/PKP

ID #: 39694

SUPERCRITICAL FLUID NUCLEATION, THE PRINCIPLE EXPLOITED FOR THE DEVELOPMENT PROPOSED, HAS BEEN DEMONSTRATED FOR ITS ABILITY TO PRODUCE MONODISPersed SUBMICRON PARTICLES OF VARIOUS ORGANIC AND INORGANIC COMPOUNDS. THE CONCEPT IS BASED UPON SOLUBILITY PHENOMENA IN SUPERCRITICAL FLUIDS, VIZ., THAT AT HIGH PRESSURE CERTAIN GASES CAN DISSOLVE ORGANIC COMPOUNDS AND THAT PARTICLES NUCLEATE WHEN THE PRESSURE ON THE GASEOUS SOLUTION IS LOWERED. BECAUSE THE RATE OF PRESSURE DECREASE CAN BE VARIED, PARTICLE SIZE CAN BE VARIED. IN SPECIFIC INSTANCES THE PRESSURE DECREASE CAN BE MADE TO OCCUR AT MILLIONS OF ATMOSPHERES PER SECOND, AND THUS, PARTICLE CAN BE FORMED IN THE 0.1 MICRON OR LESS SIZE RANGE. FURTHERMORE, BECAUSE OF THE RAPID CHANGE IN PRESSURE THAT CAN BE ACHIEVED, DISTRIBUTION IN PARTICLE SIZE IS ABSENT. COMPOUNDS FOR CONSIDERATION FOR THE STUDY HAVE MELTING POINTS BETWEEN 350 DEG TO 5500 DEG F AND THUS SATISFY THE REQUIREMENTS SOUGHT. AS A MEANS OF ASSESSING THE POTENTIAL FOR SUCCESSFUL COMPLETION OF A PHASE II EFFORT, THE PHASE I WORK INCLUDES A TASK DIRECTED TO THE DESIGN AND COST ESTIMATE OF A SMALL, SELF-CONTAINED AEROSOL GENERATOR.

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BRICK D B & CO INC
39 SOLOMON PIERCE RD
LEXINGTON, MA 02173
Program Manager: DONALD B BRICK

Contract #:

Title: WIDEBAND REACTIVELY LOADED DIPOLE ANTENNA

Topic #: AF90-026

Office: RADC/XTP

ID #: 39719

A PROPRIETARY TECHNIQUE FOR DRAMATICALLY INCREASING THE BANDWIDTHS OF DIPOLE ANTENNAS WILL BE INVESTIGATED. IT INVOLVES ACTIVE IMPEDANCE LOADING ON THE DIPOLE ELEMENTS OR ARMS THEMSELVES. (PREVIOUS TECHNIQUES UTILIZED EITHER PASSIVE LOADS ALONG THE DIPOLE'S ARMS OR ACTIVE LOADS AT ITS TERMINALS.) IT CAN ALSO BE USED TO MINIMIZE OR MAXIMIZE THE SCATTERING CROSS SECTION OF THE ANTENNA OR ITS GAIN. THE LOADS THAT MAXIMIZE BANDWIDTH, GAIN AND SCATTERING CROSS SECTION ARE ALMOST IDENTICAL. THUS ALL THREE CAN BE 'OPTIMIZED' SIMULTANEOUSLY. PHASE I WILL BE DEVOTED TO VERIFYING THE APPROACH FOR A SPECIFIC OFF-THE-SHELF ANTENNA, ANALYTICALLY AND EXPERIMENTALLY. A DISCRETE COMPONENT VERSION OF THE REACTANCE THAT MAXIMIZES THE BANDWIDTH WILL BE SYNTHESIZED BASED ON MEASUREMENTS OF THE ANTENNA CHARACTERISTICS AND THEN USED TO VERIFY WIDEBAND PERFORMANCE. PRACTICAL CIRCUIT SOLUTIONS FOR VARIOUS APPLICATIONS WILL BE INVESTIGATED (FORM, FIT AND ELECTRICAL DESIGN, APPROACH AND COST). EXTENSION OF THE THEORY TO OTHER ANTENNAS WILL BE INVESTIGATED, INCLUDING DIPOLE-DERIVED ANTENNAS, E.G. FOLDED OR SLEEVE DIPOLES, DIPOLE ARRAYS, ETC. POTENTIAL APPLICATIONS WILL ALSO BE EXAMINED. FINALLY, SINCE ACTIVE IMPEDANCES WILL HAVE RESISTIVE COMPONENTS, THE EFFECT ON ANTENNA GAIN (VERSUS DIRECTIVITY) OF THE RESULTING LOSSY PATCHES ALONG THE DIPOLE WILL HAVE TO BE DETERMINED.

FIELD M D CO
270 ALBANY ST
CAMBRIDGE, MA 02139
Program Manager: DR MELVIN D FIELD

Contract #:

Title: REQUIREMENTS ENGINEERING TECHNOLOGY

Topic #: AF90-026

Office: ESD/XTP

ID #: 45712

REQUIREMENTS ENGINEERING IS A SYSTEMATIC APPROACH TO THE DEVELOPMENT, ALLOCATION, TRANSITION, EVOLUTION AND MANAGEMENT OF REQUIREMENTS FOR A SYSTEM OVER THE LIFE-CYCLE. THE SYSTEM REQUIREMENTS PROCESS AND CAE TOOLS ARE AN ARCHITECTURAL PRODUCT WITH AN ASSOCIATED LIFE CYCLE. STRUCTURED FUNCTIONAL FLOW BLOCK DIAGRAMMING IS THE BASE FOR THIS TECHNOLOGY. PERFORMANCE AND FUNCTIONAL REQUIREMENTS OF A SYSTEM ARE ADDRESSED FOR HARDWARE, SOFTWARE, FACILITIES, PERSONNEL AND PROCEDURAL DATA; AND FOR ALL PHASES INCLUDING ACQUISITION, T&E, DEPLOYMENT, O&M AND LOGISTICS. EMPHASIS IS ON COMMAND AND CONTROL AND TACTICAL SYSTEMS. THE METHODOLOGY TO DRAW THE BLOCK DIAGRAMS WILL BE DEVELOPED. THERE IS ALSO A SYSTEM ENGINEERING DATA BASE THAT HAS RECORDS KEYED TO THE DIAGRAM BLOCKS CONTAINING DESCRIPTIONS, REQUIREMENTS AND OTHER ENGINEERING DATA. IT WILL BE ABLE TO STORE, CORRELATE AND RETRIEVE DATA BY USING THE FACILITIES OF A SOPHISTICATED RELATIONAL DATA BASE MANAGEMENT SYSTEM (ORACLE). EXPERT SYSTEM TECHNIQUES WILL ENABLE USER TO EFFECTIVELY ENTER AND RETRIEVE REQUIREMENTS DATA. THIS REQUIREMENTS CAE TOOL WILL BE USER FRIENDLY AND WILL PROVIDE COST-EFFECTIVE MEANS TO DEVELOP AND MANAGE SYSTEM REQUIREMENT.

FRONTIER TECHNOLOGY INC
530 E MONTECITO ST - STE 105
SANTA BARBARA, CA 93103
Program Manager: JOSEPH S HASHEM

SMALL BUSINESS INNOVATION RESEARCH PROGRAM - PHASE I
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Contract #:

Title: COMMAND CONTROL AND COMMUNICATIONS SYSTEMS/SUBSYSTEM-INNOVATIVE C3 CONCEPTS FOR SRT ATTACK

Topic #: AF90-026

Office: ESD/XTP

ID #: 39703

THE ULTIMATE OBJECTIVE OF THIS RESEARCH ACTIVITY IS TO DEVELOP A C3 MASTER PLAN TO SUPPORT THE SRT ATTACK MISSION. THIS PLAN WILL BE DEVELOPED IN THE CONTEXT OF A MID/FAR TERM SRT ATTACK ARCHITECTURE CURRENTLY BEING DEVELOPED BY FRONTIER FOR THE AERONAUTICAL SYSTEMS DIVISION/DEPUTY FOR DEVELOPMENT PLANNING (ASD/XR). THIS ON-GOING ACTIVITY WILL EXPAND AND EVOLVE THE CURRENT/NEAR SAC PLANS INTO AN INTEGRATED SRT FAR-TERM ARCHITECTURE. OUR PROPOSED PHASE I OBJECTIVES ARE TO (1) IDENTIFY C3 CONCEPTS AND C3 SYSTEM CONSTRUCTS (2) DEFINE MAJOR ELEMENTS, CONNECTING INTERFACES AND FUNCTIONAL REQUIREMENTS AND (3) DEVELOP A METHODOLOGY FOR EVALUATING C3 CONCEPTS. IN PHASE II WE WILL DEVELOP AND DEMONSTRATE THE METHODOLOGY (PC BASED COMPUTER PROGRAM) AND USE IT TO DERIVE C3 SYSTEM REQUIREMENTS, EVALUATE ALTERNATIVES, IDENTIFY TECHNOLOGY DRIVERS AND GENERATE C3 DEVELOPMENT ROADMAPS.

HUMAN FACTORS SOLUTIONS

4617 GEMSTONE TER

ROCKVILLE, MD 20852

Program Manager: COLLEEN CROWDER

Contract #:

Title: COMMAND CONTROL AND COMMUNICATIONS SYSTEMS/SUBSYSTEMS: ATALARS HUMAN FACTORS

Topic #: AF90-026

Office: ESD/XTP

ID #: 39695

THE U.S. AIR FORCE AND OTHER DEFENSE ELEMENTS HAVE RECOGNIZED THE NEED TO SOLVE THE PROBLEM OF LACK OF SURVIVABILITY OF CURRENT AIR TRAFFIC MANAGEMENT CAPABILITIES IN A TACTICAL ENVIRONMENT. AS PART OF THE TRANS-CENTURY SOLUTION TO THIS PROBLEM, THE DEVELOPMENT OF THE AUTOMATED TACTICAL LAUNCH AND RECOVERY SYSTEM (ATALARS) MUST INTEGRATE EMERGING AUTOMATION CAPABILITIES AND DISPLAY TECHNOLOGIES IN A SYSTEM DESIGN THAT INCREASES THE JOINT EFFICIENCY OF BOTH MEN AND MACHINES. THE REQUIREMENTS OF THIS FUTURE SYSTEM WILL FOCUS ON THE NEED FOR INTEROPERABILITY OF THE INTERSERVICE AND INTERNATIONAL COMMAND AND CONTROL SYSTEM. THESE REQUIREMENTS IMPLY AN INCREASE IN THE NUMBER OF AUTOMATED FUNCTIONS, AND THAT MORE COMPUTER ASSISTANCE WILL BE SUPPLIED TO BOTH THE CONTROLLER AND THE PILOT. A PRIMARY GOAL OF THE SYSTEM DESIGN WILL BE THE OPTIMAL ALLOCATION OF FUNCTIONS TO THE SYSTEM, THE CONTROLLER, AND THE PILOT. THE ROLES OF EACH OF THESE CRITICAL SYSTEM ELEMENTS MUST EVOLVE IN WAYS THAT EMPHASIZE THEIR STRENGTHS, AND MINIMIZE THEIR WEAKNESSES. THE PRESENT WORK WILL DEFINE THE HUMAN FACTORS ISSUES THAT ARE OF CRITICAL IMPACT TO THE SUCCESSFUL DEPLOYMENT OF ATALARS. THE WORK WILL ALSO IDENTIFY HUMAN FACTORS RESEARCH FOR WHICH FURTHER DEVELOPMENT WOULD BE OF SIGNIFICANT BENEFIT IN THE DESIGN OF A FUTURE AIR TRAFFIC CONTROL SYSTEM THAT EXPLOITS THE BEST CAPABILITIES OF HUMANS AND MACHINES FOR OPTIMAL EFFICIENCY AND SAFETY.

L&S CONSULTANTS

401 HOWARD ST

SYRACUSE, NY 13202

Program Manager: ROBERT LUCENTE

Contract #:

Title: COMMUNICATION ISSUES IN DISTRIBUTED TARGET DETECTION

Topic #: AF90-026

Office: ESD/XTP

ID #: 39721

TARGET DETECTION SYSTEMS USING MULTIPLE SENSORS ARE TYPICALLY REQUIRED TO PROCESS LARGE AMOUNTS OF DATA. HOWEVER, SIGNIFICANT DATA COMPRESSION IS POSSIBLE IF THE RELATIVELY NEW

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TECHNIQUE OF DECENTRALIZED DETECTION IS USED. IN THIS TECHNIQUE, DECISIONS MADE AT THE SENSORS LEVEL ARE TRANSMITTED TO A CENTRAL PROCESSOR VIA COMMUNICATION LINKS FOR DECISION FUSION. SYSTEM PERFORMANCE THEN BECOMES STRONGLY DEPENDENT ON RELIABLE TRANSMISSION THROUGH THE DECISION CHANNELS. IN THIS PROPOSAL, THEREFORE, WE ADDRESS THE OPTIMAL DESIGN OF COMMUNICATION LINKS AND THE DEVELOPMENT AND ANALYSIS OF COMMUNICATION PROTOCOLS WITH FEEDBACK THAT PERMIT REDUCTIONS IN AVERAGE DATA RATES ON THE DECISION LINKS. THIS WILL RESULT IN OPTIMIZED SYSTEM PERFORMANCES, SMALLER AVERAGE TRANSMITTED POWER REQUIREMENTS FOR THE SENSORS, AND A MEASURE OF IMMUNITY TO EAVESDROP AND INTELLIGENT JAMMING. FOR EACH OF THE ABOVE TWO PROBLEMS, WE INTEND TO PERFORM RELEVANT THEORETICAL RESEARCH FOLLOWED BY DEVELOPMENT AND EXECUTION OF COMPUTER PROGRAMS THAT CALCULATE OVERALL SYSTEM DESIGNS AND ASSOCIATED PERFORMANCES. WE SHALL PRESENT AMPLE NUMERICAL RESULTS IN SUPPORT OF THEORETICAL PREDICTIONS.

PHYSICAL OPTICS CORP
2545 W 237TH ST - STE B
TORRANCE, CA 90505

Program Manager: DR THOMASZ JANNSON

Contract #:

Title: PARALLEL PROCESSING BASED ON WAVELENGTH/ANGULARLY MULTIPLEXED HOLOGRAPHY

Topic #: AF90-026

Office: ESD/XTP

ID #: 39720

TO REALIZE THE FULL POTENTIAL OF PARALLEL PROCESSING FOR MILITARY INFORMATION PROCESSING APPLICATIONS, IT IS NECESSARY TO INTERCONNECT A GREAT NUMBER OF PROCESSORS TOGETHER IN A VERY DENSE MANNER. UNFORTUNATELY, ELECTRONICS SUFFER FROM CAPACITIVE AND RADIATIVE FAN-OUT LIMITATIONS THAT GREATLY CONSTRAIN THE NUMBER OF INTERCONNECTIONS/PROCESSORS. OPTICAL INTERCONNECTIONS, ON THE OTHER HAND, ARE LESS CONSTRAINED AND DO NOT REQUIRE A MATERIAL PATH BETWEEN INPUT AND OUTPUT PORTS. IN ADDITION, THE FLEXIBILITY OF HOLOGRAPHY TO ENABLE HIGH FAN-OUT INTERCONNECTIONS WITH LOW LOSS AND CROSSTALK ALLOWS MORE ADVANCED COMPUTER ARCHITECTURES TO BE CREATED. FURTHER, BY DEVELOPING MULTIPLEXED GRATINGS THAT ARE ANGULAR AND WAVELENGTH MULTIPLEXED, IT IS POSSIBLE TO CREATE MORE POWERFUL AND FLEXIBLE INTERCONNECTION NETWORKS THAN TYPICAL FAN-OUT HOLOGRAPHIC NETWORKS CAN ACHIEVE. THIS ALLOWS BOTH MULTIPLE INTERCONNECTION PATTERNS OR ADDRESSABLE INTERCONNECTIONS TO BE CREATED THAT GIVE REAL-TIME RECONFIGURATION CAPABILITIES WITH STATIC HOLOGRAMS BY CHANGING EITHER THE INCIDENT ANGLE OR WAVELENGTH. THUS, PHYSICAL OPTICS CORPORATION (POC) PROPOSES TO FABRICATE A PROTOTYPE OPTICAL INTERCONNECTION NETWORK BASED ON ANGULAR AND WAVELENGTH MULTIPLEXED GRATINGS FOR ADVANCED PARALLEL PROCESSING INTERCONNECTION APPLICATIONS.

SPACE RESEARCH TECHNOLOGY INC
2323 S VOSS RD - STE 123
HOUSTON, TX 77057

Program Manager: LAWRENCE J RENNIE

Contract #:

Title: VLSI IMPLEMENTATION OF TONE ENCODING AND DECODING FUNCTION SPECIFIED IN THE NEW ALE PROTOCOL TO ENHANCE MF AND HF RADIO INTEROPERABILITY

Topic #: AF90-026

Office: ESD/XTP

ID #: 39696

THE OBJECTIVE OF THE PHASE I WORK PRESENTED IN THIS PROPOSAL IS TO GENERATE A PERFORMANCE AND FUNCTIONAL SPECIFICATION AND BLOCK DIAGRAM DESIGN OF A SINGLE VLSI CHIP IMPLEMENTING THE AUDIO TONE ENCODER AND DECODER FUNCTIONS OF A DIGITAL MODEM. THE TONE ENCODER/DECODER CHIP, WHEN COMBINED WITH AN OFF-THE-SHELF AD/CONVERTER, WILL PROVIDE A COMPLETE TWO-CHIP IMPLEMENTATION OF THE DIGITAL MODEM REQUIRED BY THE NEW GOVERNMENT MANDATED AUTOMATIC LINK ESTABLISHMENT ("ALE") PROTOCOL. THE PROTOCOL IS SPECIFIED IN BOTH

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MIL-STD-188-141A AND FED-STD-1045. THE ALE PROTOCOL IS REQUIRED IN ALL GOVERNMENT (MILITARY AND GOVERNMENT AGENCY) MF AND HF RADIOS INCORPORATING AN ALE CAPABILITY TO IMPROVE RADIO INTEROPERABILITY.

FALCON COMMUNICATIONS CORP
1005 ELKTON DR
COLORADO SPRINGS, CO 80907
Program Manager: PAUL COOK

Contract #:

Title: WORKSTATION/PC TRI-TAC INTERFACE - (WS/PC TTI)

Topic #: AF90-027

Office: ESD/XTP

ID #: 39697

AS THE GOVERNMENT TRANSITIONS TO THE USE OF GOSIP AND OTHER INDUSTRY INTERFACE STANDARDS, PROVISION MUST BE MADE FOR COST EFFECTIVE INTEROPERABILITY WITH EXISTING DOD SYSTEMS. THE TRI-TAC SYSTEM DEVELOPED IN THE 1970'S IS NOW BEING FIELDDED. AT THE SAME TIME THERE IS INCREASING EMPHASIS WITHIN THE AIR FORCE ON THE UTILIZATION OF COTS EQUIPMENT, AND PROLIFERATION OF COTS BASED WORKSTATION/PC EQUIPMENT. THE TRI-TAC STANDARD DIGITAL INTERFACE IS BASED ON A CONDITIONED DIPHASE TRI-TAC STANDARD WHICH IS INCOMPATIBLE WITH STANDARD COMMERCIAL DIGITAL INTERFACES. THE INTERFACE OPTIONS FOR COTS WORKSTATION/PCs, TERMINALS AND ADP EQUIPMENT HAS BEEN LIMITED TO THE USE OF VOICE TERMINAL DATA PORTS OR LIMITED DIGITAL MULTIPLEX PORTS, WITH LIMITED FLEXIBILITY AND COST IMPACTS. THE PROPOSED RESEARCH PROGRAM WILL DEVELOP AN EMBEDDED TRI-TAC CDI INTERFACE FOR AIR FORCE STANDARD WORKSTATIONS/PCs WHICH WILL ALLOW DIRECT CONNECTION THROUGH THE TRI-TAC COMMUNICATIONS RESOURCES. THE PHASE I EFFORT WILL DEVELOP BASELINE PROTOTYPE DESIGN AND INVESTIGATE REQUIREMENTS FOR FUTURE EVOLUTIONARY ENHANCEMENTS TO THE BASELINE DEVICE IN THE AREAS OF SIGNALLING, CCEP ENCRYPTION, AND ISDN. THE WS/PC TTI SOLVES AN IMMEDIATE PROBLEM FOR APPLICATION OF THIS CLASS OF EQUIPMENT, AND PROVIDES THE BASIS FOR APPLICATION TO OTHER UNIQUE INTERFACES AS WELL AS EVOLUTION TO SUPPORT FUTURE GOVERNMENT/ COMMERCIAL REQUIREMENTS.

KTAADN INC
1340 CENTRE ST - STE 202
NEWTON, MA 02159
Program Manager: ILYA SCHILLER

Contract #:

Title: FIELD TRAINABLE MISSION ADAPTABLE UNMANNED AIR VEHICLES

Topic #: AF90-027

Office: ESD/XTP

ID #: 45662

THE VALUE OF UNMANNED AIR VEHICLES (UAVs) AS AN ELEMENT IN THE AIR FORCE INVENTORY WILL IMPROVE AS THEY HANDLE A LARGER VARIETY OF MISSIONS. AUTONOMOUS MISSION CAPABILITIES ARE CURRENTLY LIMITED AND PROGRAMMING THE UAV FOR SPECIALIZED MISSIONS REQUIRES HIGHLY TRAINED PERSONNEL. THE PROPOSED WORK ADDRESSES BOTH OF THESE ISSUES. THE RESULT WILL BE UAV MISSION SUPPORT SYSTEM WHICH IS MORE CAPABLE AND WHICH CAN BE USED BY NON-COMPUTER EXPERTS. NEURAL NETWORKS (NNs) OFFER MANY ADVANTAGES WHICH ARE DIRECTLY RELATED TO THE GOALS STATED ABOVE. FIRST, THEY ALLOW NON-EXPERTS TO CREATE MISSION SUPPORT BECAUSE THEY DO NOT REQUIRE PROCEDURAL PROGRAMMING LANGUAGE EXPERTISE. INSTEAD, NEURAL NETWORKS ARE "TRAINED" BY EXPOSURE TO EXPERIENCE. SECOND, NNs ARE WELL SUITED TO AUTONOMOUS VEHICLE OPERATIONS, SINCE THEY CAN ADAPT WHILE IN OPERATION TO AN UNPREDICTABLE ENVIRONMENT. KTAADN, INC. (KI) WILL APPLY ITS EXPERTISE IN NN TECHNOLOGY TO PERFORM AN AUTOMATED MONTE CARLO STUDY TO DEMONSTRATE QUANTATIVE BENEFITS OF NN FOR UAV MISSION PLANNING AND EXECUTION. KI WILL SHOW THAT PERSONNEL UNSKILLED IN COMPUTER AND NEURAL NETWORK TECHNOLOGY ARE CAPABLE OF TRAINING UAV PROCESSORS.

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PRB ASSOCS INC
47 AIRPORT VIEW DR
HOLLYWOOD, MD 20636

Program Manager: ALEX KERSIS

Contract #:

Title: ATPC/SOC DECISION SYSTEM (ASDS)

Topic #: AF90-027

Office: ESD/XTP

ID #: 39698

CURRENT OFFENSIVE AND DEFENSIVE AIR PLANNING WITH 4TH ATAF (EUROPE) SUFFERS FROM A LACK OF A CENTRALIZED AND COORDINATED AUTOMATED DECISION SUPPORT SYSTEM. A CAPABILITY IS NEEDED FOR INTEGRATING ALL AVAILABLE AND PERTINENT TACTICAL AND STRATEGIC INFORMATION INTO A COHERENT VISUAL PICTURE, SO DECISION-MAKERS CAN EFFECTIVELY MANAGE THE BATTLE. THIS PICTURE SHOULD DISPLAY ALL AVAILABLE INFORMATION NECESSARY FOR THE PLANNING AND OPERATIONS STAFF TO GRAPHICALLY SEE THEIR OWN VULNERABILITIES, AND THOSE OF THEIR ENEMIES. THE DECISION-MAKER SHOULD HAVE THE OPTION OF CHOOSING AMONG VARIOUS INTELLIGENCE DATA SOURCES, WITH THE CAPABILITY TO COLLECTIVELY COMBINE DATA. ALL OF THE INFORMATION WITHIN THIS DATA BASE SHOULD BE GRAPHICALLY DISPLAYABLE OVER TERRAIN, E.G., THE LATEST POSITION OF A MOBILE WEAPONS SITE. LASTLY, THIS SUPPORT SYSTEM SHOULD SUPPORT THE DECISION MAKERS' DESIRES TO "WHAT-IF" THE TACTICAL SITUATION. THE RAPIDLY CHANGING GEOPOLITICAL SITUATION IN EUROPE PLACES ADDED IMPORTANCE ON EFFECTIVE DEFENSIVE PLANNING AS WELL AS THE NEED FOR INTEGRATED, RESPONSIVE SYSTEM SUPPORT. HOWEVER, THE DECLINING BUDGET AND THE SINGULAR NATURE OF THE ATOC/SOC IN SEMBACH MINIMIZES THE FUNDING LEVEL AND PRIORITIES FOR A MAJOR SYSTEM DEVELOPMENT EFFORT. THIS SBIR PROPOSAL PRESENTS A COST EFFECTIVE, EVOLUTIONARY APPROACH FOR THE IMPLEMENTATION OF AN ATOC/SOC DECISION SYSTEM (ASDS) USING THE AN/TSQ-142, MISSION SUPPORT SYSTEM, AS A BASELINE.

HORIZONS TECHNOLOGY INC
3990 RUFFIN RD

SAN DIEGO, CA 92123

Program Manager: MICHAEL A STABLER

Contract #:

Title: MILITARY AIRLIFT COMMAND AIRCRAFT MISSION PLANNING WORKSTATION

Topic #: AF90-028

Office: ESD/XTP

ID #: 39699

A NEED EXISTS FOR AN OFF-THE-SHELF WORKSTATION TO PERFORM MISSION SUPPORT FUNCTIONS FOR MAC AIRCREWS. THE SYSTEM MUST BE CAPABLE OF AIRBORNE OPERATION, AUTOMATED ROUTE SELECTION, INTELLIGENCE HANDLING, MAP AND THREAT DISPLAY, RADAR TERRAIN MASKING, FLIGHT PATH, COMPUTATIONS, IMAGERY, AUTOMATED UPLOAD AND DOWNLOAD, AND WORLD-WIDE COMMUNICATION ACCESS. IN MANY ASPECT, SUCH A SYSTEM ALREADY EXISTS AND IS USED BY AV-8B MISSION PLANNERS. THIS SYSTEM NEEDS MODIFICATION FOR THE MAC MISSION, BUT THE MAJOR COMPONENTS ALREADY EXIST AND FUNCTION IN THE FIELD. THIS TRANSPORTABLE SYSTEM USES 80386 TECHNOLOGY TO RAPIDLY DISPLAY AND PRINT COLOR MAPS OVERLAID WITH ROUTE PLANNING, INTELLIGENCE AND THREAT DATA. THE SYSTEM DISPLAYS AND PRINTS 256 COLORS IN A HIGH RESOLUTION 1280x1024 FORMAT. THE AV-8B SYSTEM ALSO PRODUCES DIGITIZED MAPS FROM PAPER MAPS, OPTICAL DISKS FOR USE IN THE COCKPIT MOVING MAP DISPLAY, AND PROVIDES MAINTENANCE FUNCTIONS. PHASE I WILL RESULT IN SYSTEM SPECIFICATIONS AND DESIGN AND DEMONSTRATIONS OF MAC AIRCRAFT MISSION PLANNING USING A SUBSET OF SOFTWARE REQUIREMENTS IMPLEMENTED ON A MODIFIED AV-8B SYSTEM AND ON A PROTOTYPE MAC SYSTEM. PHASE II WILL PRODUCE THE MISSION PLANNING SYSTEM FOR MAC AND DELIVER HARDWARE FOR TWO INITIAL UNITS. PHASE III WILL PROVIDE PRODUCTION UNITS, TRAINING, MAINTENANCE AND SUPPORT.

MIMD SYSTEMS INC
1301 SHOREWAY RD - STE 430

SMALL BUSINESS INNOVATION RESEARCH PROGRAM - PHASE I
AIR FORCE Solicitation 90.1

BELMONT, CA 94002

Program Manager: DR ROBERT E LARSON

Contract #:

Title: A HIGH PERFORMANCE LAPTOP OPTIMAL PLANNING WORKSTATION

Topic #: AF90-028

Office: ESD/XTP

ID #: 39700

THIS PROPOSAL ADDRESSES THE DEVELOPMENT OF A PORTABLE OPTIMAL PLANNING WORKSTATION FOR USE IN ROUTE AND CAPACITY PLANNING FOR AIRCRAFT AND OTHER VEHICLES. THE PROPOSED SOLUTION COMBINES A POWERFUL PARALLEL PROCESSING LAPTOP COMPUTER WITH A SPECIALIZED PARALLEL OPTIMIZATION SOFTWARE LIBRARY TO PROVIDE A SYSTEM CAPABLE OF SOLVING COMPLEX PLANNING PROBLEMS IN REAL-TIME.

MASSACHUSETTS TECHNOLOGY LAB INC

312 AUSTIN ST

WEST NEWTON, MA 02165

Program Manager: TA-MING FANG

Contract #:

Title: INVESTIGATION OF HYPERDISTRIBUTIONS FOR SIGNAL COMPRESSION

Topic #: AF90-029

Office: ESD/XTP

ID #: 39701

WE DEVELOP HERE A TECHNIQUE FOR SIGNAL COMPRESSION/DECOMPRESSION BASED ON NEW ADVANCES IN THE THEORY OF GENERALIZED FUNCTIONS. WE TERM THESE NEW MATHEMATICAL OBJECTS "GENERALIZED DISTRIBUTIONS" OR "HYPERDISTRIBUTION"/ WE PROPOSE TO DETERMINE THE COMPRESSION RATIOS WHICH MAY BE OBTAINED BY REPRESENTING IMAGE DATA IN TERMS OF A TRUNCATED HYPERDISTRIBUTION SERIES, RATHER THAN THE ORIGINAL COLLECTION OF PIXEL INTENSITIES. HYPERDISTRIBUTIONS EXHIBIT INTERESTING MATHEMATICAL PROPERTIES UNDER CONVOLUTION OPERATIONS, AND SO THE POSSIBILITY EXISTS THAT IMAGE PROCESSING OPERATIONS CAN BE COMBINED WITH SIGNAL COMPRESSION/DECOMPRESSION, AND IN PARTICULARLY THAT PARTICULAR CLASSES OF IMAGE PROCESSING OPERATIONS MAY BE CARRIED OUT ON COMPRESSED DATA SETS, WITH CORRESPONDING GAINS IN PROCESSING TIME.

RGB ASSOCS

PO BOX 8

WAYLAND, MA 01778

Program Manager: RICHARD BARAKAT

Contract #:

Title: HIGH RATE IMAGE AND VIDEO DATA COMPRESSION

Topic #: AF90-029

Office: ESD/XTP

ID #: 39702

WE PROPOSE TO DESIGN AND SIMULATE A MASSIVELY PARALLEL DATA COMPRESSION SYSTEM FOR DIGITIZED IMAGE AND VIDEO DATA THAT IS CAPABLE OF PROCESSING DATA STREAMS OF 1 BILLION BITS PER SECOND IN REAL TIME. COMPLETION OF THE WORK OUTLINED IN THIS SBIR PHASE I PROPOSAL WILL PROVIDE THE BASIS FOR A SUBSEQUENT SBIR PHASE II PROPOSAL TO BUILD REAL-TIME COMPRESSION AND DECOMPRESSION HARDWARE. THIS HARDWARE WILL FIT ON A SINGLE CIRCUIT BOARD AND BE PRACTICAL FOR USE IN BOTH GOVERNMENT AND COMMERCIAL APPLICATIONS.

LANGUAGE SYSTEMS INC

6269 VAREL AVE - STE 200

WOODLAND HILLS, CA 91367

Program Manager: CA MONTGOMERY/JL GAUDIOT

Contract #:

Title: HIGHLY PROGRAMMABLE ARCHITECTURES

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Topic #: AF90-030

Office: RADC/XPX

ID #: 39704

WE WILL ASSESS VARIOUS APPROACHES TO DATA-FLOW MODELING, PROGRAMMABILITY, RELIABILITY, COMMUNICATION AND PERFORMANCE BY SURVEYING EXISTING DATA-FLOW WORK. WE WILL EXPERIMENTALLY TEST THE FEASIBILITY OF DATA-FLOW ARCHITECTURE FOR A NUMERIC AND NON-NUMERIC APPLICATION. THE PROBLEM OF SYNTACTIC PARSING IN NATURAL LANGUAGE IS THE SELECTED NON-NUMERIC APPLICATION. WE WILL DEFINE A RESEARCH STRATEGY AND EXPERIMENTS FOR A LARGER MULTIPROCESSOR SYSTEM FOR PHASE II OF THIS PROJECT.

TECHNICAL IMAGING SERVICES INC
PO BOX 1237 - 380 FARMINGDALE RD
JACKSON, NJ 08527

Program Manager: MILES MURDOCCA

Contract #:

Title: OPTICAL ARCHITECTURES FOR REPRESENTATION AND MANIPULATION OF 3D DATA OBJECTS

Topic #: AF90-031

Office: RADC/XPX

ID #: 39705

OPTICAL ARCHITECTURES ARE NEEDED FOR REPRESENTING AND MANIPULATING THREE-DIMENSIONAL DATA OBJECTS IN A DATABASE ENVIRONMENT. A CLASS OF ARCHITECTURES BASED ON ARRAYS OF OPTICAL LOGIC DEVICES INTERCONNECTED IN FREE SPACE WILL BE STUDIED WITH THE EXPECTATION THAT THESE SYSTEMS WILL BE COMMERCIALY VIABLE IN THE NEXT FEW YEARS. FOR THIS CLASS OF ARCHITECTURES, SIGNAL SKEWS DO NOT ACCUMULATE FOR MORE THAN ONE LEVEL OF LOGIC SO THAT FREE-SPACE DELAY PROVIDES A STORAGE MEDIUM. THE USE OF FREE-SPACE STORAGE REDUCES OPTICAL POWER REQUIREMENTS WHILE INTRODUCING ONLY A SMALL DELAY IN STORAGE AND RETRIEVAL OF DATA OBJECTS. MANIPULATION OF 3-D OBJECTS SUCH AS TRANSLATION AND ROTATION IS SIMPLIFIED WITH THIS CLASS OF ARCHITECTURES BECAUSE OPTICAL SIGNALS TRAVEL ORTHOGONAL TO THE DEVICE SUBSTRATES, WHICH RELIEVES PINOUT CONSTRAINTS IMPOSED BY ALTERNATIVE APPROACHES. PRACTICAL CONSIDERATIONS OF THE OPTICAL SYSTEMS LIMIT STORAGE DENSITY, SPEED, SPACE-BANDWIDTH PRODUCT, AND OTHER CHARACTERISTICS, WHICH WILL BE STUDIED IN PHASE I. MANIPULATION OF SPATIAL OPTICAL OBJECTS ADDRESSED IN PHASE I INCLUDES VISUALIZATION, CREATION, PROJECTION, JOINING AND OTHER COMMON DATABASE OPERATIONS.

CREARE INC
PO BOX 71
HANOVER, NH 03755

Program Manager: DR JAMES J BARRY

Contract #:

Title: PC-BASED EXPERT SYSTEM FOR THERMAL ANALYSIS OF ELECTRONIC EQUIPMENT

Topic #: AF90-032

Office: RADC/XPX

ID #: 39706

THERMAL EVALUATION OF ELECTRONIC MODULES AND SYSTEMS FOR RELIABILITY IN THE EARLY STAGES OF DESIGN WOULD PROVIDE COST AND TIME SAVINGS BY AVOIDING REDESIGN OR MODIFICATION OF COMPLETED DESIGNS. SYSTEM AND RELIABILITY ENGINEERS NEED A THERMAL ANALYSIS TOOL THAT DOES NOT REQUIRE HEAT TRANSFER EXPERTISE OR DETAILED INPUT DATA SO THAT EVALUATION CAN TAKE PLACE EARLY IN THE DESIGN PROCESS. THIS PROJECT PROPOSES TO DEMONSTRATE THE FEASIBILITY OF A PC-BASED THERMAL ANALYZER BASED ON AN EXPERT SYSTEM. THE SOFTWARE WILL ESTIMATE COMPONENT TEMPERATURES AND PROVIDE WARNINGS WHEN TEMPERATURES EXCEED SPECIFIED LIMITS USING A SIMPLE INPUT DESCRIPTION OF THE DESIGN AND ASSUMING NO HEAT TRANSFER EXPERTISE ON THE PART OF THE USER. UNSPECIFIED INPUTS WILL BE ESTIMATED WITHIN CONSTRAINTS. THE OBJECTIVE OF THE PHASE I PROJECT IS TO SHOW THAT SUCH A PROGRAM IS ACHIEVABLE AND WILL MEET THE NEEDS OF SYSTEM AND RELIABILITY ENGINEERS. DETAILED SOFTWARE SPECIFICATIONS WILL BE DEVELOPED.

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NKF ENGINEERING INC
4200 WILSON BLVD - STE 1000
ARLINGTON, VA 22203

Program Manager: JEFFREY M KOMROWER

Contract #:

Title: INTEGRATION OF SIMULATED AND MEASURED VIBRATION RESPONSE OF MICROELECTRONICS

Topic #: AF90-033

Office: RADC/XPX

ID #: 39707

METHODS OF INTEGRATING ANALYTICAL AND EXPERIMENTAL TECHNIQUES TO PREDICT ELECTRONIC DEVICE RESPONSE TO VIBRATION AND SHOCK LOADINGS ARE PROPOSED. UNIQUE NONINTRUSIVE EXPERIMENTAL TECHNIQUES, COUPLED WITH ADVANCED DIGITAL SIGNAL PROCESSING ALGORITHMS, WILL BE USED TO VERIFY FINITE ELEMENT MODEL INPUT DATA, MODELING ASSUMPTIONS, BOUNDARY CONDITIONS, AND TO DETERMINE MATERIAL PROPERTIES SUCH AS DAMPING VALUES. METHODS OF COMBINING EXPERIMENTAL AND ANALYTICAL DATA BASES TO DEVELOP VERIFIED TEST/ANALYSIS HYBRID MODELS WILL ALSO BE DEFINED. PHASE I WILL DETERMINE THE FEASIBILITY OF COMBINING TEST DATA WITH ANALYTICAL SIMULATIONS FOR RESPONSE PREDICTIONS OF ELECTRONIC DEVICES AND WILL EXPERIMENTALLY DEMONSTRATE THE FEASIBILITY OF USING NONINTRUSIVE TESTING TECHNIQUES TO DETERMINE STRUCTURAL PARAMETERS. AN OUTLINE FOR A POTENTIAL PHASE II EFFORT THAT WILL BUILD UPON THE PHASE I RESULTS WILL ALSO BE GENERATED.

SEMTAS CORP
7217 MASONVILLE DR
ANNANDALE, VA 22003

Program Manager: DR WILLIAM G DUFF

Contract #:

Title: DETECTING DEGRADED OR SOON-TO-FAIL CABLES AND CONNECTORS

Topic #: AF90-034

Office: RADC/XPX

ID #: 39708

SEMTAS PROPOSES TO INVESTIGATE THE USE OF VARIOUS EMI TYPE MEASURES AS A MEANS OF DETECTING CABLES AND CONNECTORS THAT ARE BECOMING DEGRADED OR HAVE FAILED. EMPHASIS WILL BE PLACED ON DEVELOPING PRACTICAL TECHNIQUES FOR EXCITING CABLES WITH RF SIGNALS AND MEASURING VARIOUS RF PROPERTIES (BOTH RADIATED AND CONDUCTED) TO EVALUATE THE OVERALL STATUS/CONDITION OF THE CABLES AND CONNECTORS. THE SPECIFIC CABLE AND CONNECTOR RF CHARACTERISTICS THAT WILL BE INVESTIGATED TO IDENTIFY POTENTIAL OPERATIONAL PROBLEMS ARE HARMONIC GENERATION OR MODULATION RESULTING FROM NONLINEARITIES IN CORRODED CONNECTORS OR LOOSE CONNECTORS, CROSSTALK IN CABLES AND CONNECTORS, VSWR RESULTING FROM MISMATCHED CHARACTERISTIC IMPEDANCES, INCREASED CONTACT IMPEDANCE, INSERTION LOSS, TRANSFER IMPEDANCE VARIATIONS AND DECREASED SHIELDING EFFECTIVENESS. IF THE RESEARCH SHOWS THAT THE TECHNIQUES ARE PROMISING, BASELINE DATA ON CABLES AND CONNECTORS IN THEIR OPERATIONAL CONFIGURATION CAN BE ESTABLISHED SO THAT MEASUREMENTS AT A LATER TIME MAY REVEAL CHANGES IN BASELINE DATA INDICATING DEGRADED PERFORMANCE OR FAILURE.

QUANTEX CORP
2 RESEARCH CT
ROCKVILLE, MD 20850

Program Manager: SUGANDA JUTAMULIA

Contract #:

Title: NEW ARCHITECTURES FOR OPTICAL MEMORIES AS APPLIED TO HIGH SPEED ELECTRONIC COMPUTERS

Topic #: AF90-036

Office: RADC/XPX

ID #: 39709

WE WILL REVIEW AND EVALUATE EXISTING ARCHITECTURES FOR OPTICAL MEMORIES. THE LIMITING FACTORS WILL BE IDENTIFIED. WE WILL FURTHER PROPOSE AND THEORETICALLY EVALUATE NEW POTENTIAL ARCHITECTURES FOR OPTICAL MEMORIES. NEW ARCHITECTURES ARE ANTICIPATED TO

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DEMONSTRATE THE FOLLOWING FEATURES: 10(15) BITS STORAGE CAPABILITY AND 24x10(12) BITS/SEC THROUGHPUT TO MEET THE COMPUTATIONAL PERFORMANCE AS HIGH AS 10(12) FLOPS.

SOFTWARE PRODUCTIVITY SOLUTIONS INC

122 N 4TH AVE

INDIALANTIC, FL 32903

Program Manager: DR J KAYE GRAU

Contract #:

Title: DATABASE ADMINISTRATION ASSISTANT

Topic #: AF90-037

Office: RADC/XPX

ID #: 39710

THE OBJECTIVE OF THIS SBIR IS TO APPLY EXPERT SYSTEM AND ADVANCED DATA DICTIONARY TECHNOLOGY TO THE PROBLEM OF DATABASE ADMINISTRATION. PHASE I WILL RESULT IN THE DEFINITION AND SPECIFICATION OF A DATABASE ADMINISTRATION ASSISTANT (DBAA). A PROTOTYPE IMPLEMENTATION SHALL BE DEMONSTRATED AT THE END OF PHASE II. THE FOLLOWING TASKS WILL BE PERFORMED DURING PHASE I OF THIS SBIR: IDENTIFY TYPICAL DBA TASKS, EVALUATE TASK AUTOMATABILITY, DEVELOP THE OPERATIONAL CONCEPT AND THE SPECIFICATION FOR THE DBA ASSISTANT, AND DETERMINE THE FEASIBILITY OF DEVELOPING A SUCCESSFUL PRODUCT DURING PHASE II. THE RESULTING SPECIFICATION WILL BE THE BASIS FOR THE DEVELOPMENT OF THE PHASE II PROTOTYPE. AN INTELLIGENT DBAA WHICH INTERFACES TO A DATA DICTIONARY SYSTEM WILL REDUCE LABOR INTENSIVE ACTIVITIES IN LOGICAL DATABASE DESIGN, PHYSICAL DATABASE DESIGN, ENTITY NAME ANALYSIS/RECONCILIATION, PERFORMANCE TUNING, CAPACITY PLANNING, AND INTEGRITY CONTROL. THIS CAPABILITY WILL ALSO BE AN INVALUABLE TOOL FOR THE FAMILIARIZATION AND SUPPORT OF LESS EXPERIENCED DATABASE ADMINISTRATORS.

K C RESEARCH CORP

11231 MAIN RANGE TRAIL

LITTLETON, CO 80127

Program Manager: DR TODD A CERNI

Contract #:

Title: ADVANCED TECHNIQUES IN RADIATION THERMOMETRY FOR SEMICONDUCTOR PROCESSING

Topic #: AF90-038

Office:

ID #: 45621

FEASIBILITY STUDY AND DEVELOPMENT OF ADVANCED TECHNIQUES IN RADIATION THERMOMETRY FOR SEMICONDUCTOR PROCESSING.

SPIRE CORP

PATRIOTS PK

BEDFORD, MA 01730

Program Manager: STANLEY M VERNON

Contract #:

Title: DEVELOPMENT OF A PLANETARY-MOTION MOCVD REACTOR

Topic #: AF90-039

Office: RADC/XPX

ID #: 39711

WE PROPOSE HERE THE DEVELOPMENT OF A METALORGANIC CHEMICAL VAPOR DEPOSITION (MOCVD) SYSTEM HAVING IMPROVED SAFETY ASPECTS AND SOURCE-UTILIZATION EFFICIENCY. OUR NOVEL DESIGN EMPLOYS A PLANETARY-MOTION SUSCEPTOR WHICH IS ROTATED AND LEVITATED SOLELY BY GAS FLOW STREAMS. THIS LARGE-CAPACITY PRODUCTION REACTOR HOLDS UP TO SIX 4-INCH DIAMETER WAFERS PER BATCH, HAS A STAINLESS STEEL ENVELOPE FOR SAFETY, AND UTILIZES A WAFER-TRANSFER LOAD-LOCK MECHANISM FOR INCREASED SAFETY, THROUGHPUT, AND YIELD. THE USE OF A PLANETARY-MOTION SUSCEPTOR WITH A RADIALLY OUTWARD GAS-FLOW PATTERN ENABLES THE ACHIEVEMENT OF BOTH EXCELLENT GROWTH UNIFORMITY AND HIGH SOURCE-UTILIZATION EFFICIENCY OVER A LARGE DEPOSITION

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AREA. THE PHASE I EFFORT WILL CONSIST OF DESIGNING THE DETAILS OF THIS SYSTEM AND CONSTRUCTING A SIMPLIFIED WORKING MODEL; COMPLETE SYSTEM FABRICATION, INSTALLATION AND OPERATION WILL OCCUR IN PHASE II. THE ESTABLISHMENT OF SUCH AN ADVANCED TECHNOLOGY WILL HELP INSURE THAT THE GOVERNMENT HAS A U.S.-BASED COMMERCIAL SUPPLY OF BOTH MOCVD SYSTEMS AND EPITAXIAL WAFERS.

ENERGY SCIENCE LABS INC
10955 JOHN J HOPKINS DR
SAN DIEGO, CA 92121
Program Manager: GEORGE W WEBB

Contract #:

Title: MICROWAVE CHARACTERIZATION OF SUPERCONDUCTORS

Topic #: AF90-040

Office: RADC/XPX

ID #: 39712

MANY GROUPS WORLD-WIDE ARE STRIVING TO PRODUCE BETTER HIGH TRANSITION TEMPERATURE (HT[e]) SUPERCONDUCTING MATERIALS SUITABLE FOR A LARGE VARIETY OF TECHNOLOGICAL APPLICATIONS. ONE OF THE FIRST APPLICATIONS WILL BE THE UTILIZATION OF JOSEPHSON JUNCTION AND RELATED DEVICES, MADE ON WAFERS, AND INTEGRATED WITH ADDITIONAL CIRCUITRY. REGARDLESS WHICH OF THE MANY THIN FILM PREPARATION PROCEDURES CURRENTLY UNDER DEVELOPMENT EMERGES AS MOST PRACTICAL, THERE WILL BE A CONTINUING NEED FOR A SENSITIVE, RAPID, AND ECONOMICAL TESTING PROCEDURE CAPABLE OF DETECTING DEFECTS AND PROVIDING FEEDBACK FOR QUALITY CONTROL, JUST AS IN THE SEMICONDUCTOR INDUSTRY. IN ADDITION, THE INEVITABLE DEMAND FOR IMPLEMENTATION OF VLSI OF COMPLEX CIRCUITRY WILL REQUIRE INSTRUMENTATION CAPABLE OF HIGH TEMPERATURE SUPERCONDUCTING WAFER EVALUATION AND INSPECTION WITH HIGH SPATIAL RESOLUTION. WE PROPOSE THE DEVELOPMENT OF HIGH TRANSITION TEMPERATURE SUPERCONDUCTING WAFER SCANNER (HT[e]-SWS). BY THE COMBINATION OF FIELD-MODULATED MICROWAVE SURFACE IMPEDANCE SPECTROSCOPY AND INNOVATIVE SCANNING METHODOLOGY, WE WILL DEMONSTRATE THE SYSTEM PERFORMANCE AND FEASIBILITY OF OUR APPROACH IN PHASE I. IN PHASE II WE WILL PRODUCE A PROTOTYPE INSTRUMENT SUITABLE FOR MANUFACTURE AND SALE.

GRAHAM RESEARCH
4278 MECHANISVILLE RD
BENSALEM, PA 19020
Program Manager: DR WILLIAM J GRAHAM

Contract #:

Title: ADAPTIVE ARRAY NEAR FIELD MEASUREMENTS USING THE FRESNEL TRANSFORM APPROXIMATION

Topic #: AF90-043

Office: RADC/XPX

ID #: 39713

THIS PROPOSAL IS ADDRESSED TO THE TECHNICAL PROBLEM OF DETERMINING THE FAR-FIELD PERFORMANCE OF ADAPTIVE ARRAY ANTENNAS USING NEAR-FIELD MEASUREMENTS. THE INNOVATIVE CONCEPT PROPOSED IS TO FOCUS THE ARRAY IN THE NEAR FIELD BY THE FRESNEL TRANSFORM APPROXIMATION TO, IN EFFECT, MAKE PLANAR THE SPHERICAL WAVEFRONTS FROM NEAR-FIELD JAMMERS, SO THAT THEY APPEAR TO BE LOCATED IN THE FAR-FIELD WHEN THE ARRAY IS FOCUSED AT THE NEAR-FIELD RANGE OF THE JAMMERS. THE CONCEPT HAS THE POTENTIAL OF PROVIDING A HIGHLY ACCURATE AND EFFICIENT NEAR-FIELD MEASUREMENT TECHNIQUE FOR ADAPTIVE ARRAYS AT VERY LOW COST. IN ADDITION, THE CONCEPT ELIMINATES THE TRANSFORMATIONS GENERALLY NECESSARY TO OBTAIN THE FAR-FIELD PATTERN FROM NEAR-FIELD MEASUREMENTS. THE REQUIREMENTS FOR PROBE PATTERN COMPENSATION AND HIGH PROBE POSITION ACCURACY ARE OBIATED SINCE THE FAR-FIELD PATTERN IS MEASURED DIRECTLY IN THE NEAR FIELD.

DATA RAY
12 TIMBERLINE DR

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BRIDGEWATER, NJ 08807

Program Manager: JACK L JEWELL

Contract #:

Title: MICROLASER OPTICAL LOGIC GATES

Topic #: AF90-045

Office: RADC/XPX

ID #: 39714

OPTICAL LOGIC DEVICES ARE SOUGHT BY MANY INSTITUTIONS TO BE USED IN DIGITAL OPTICAL SIGNAL PROCESSING SYSTEMS. THE DEVICES PROPOSED HERE ARE PARTLY A CONTINUATION IN THE EVOLUTION OF GaAs-BASED GATES, BUT THEIR INCORPORATION OF LASING CHARACTERISTICS PRODUCES REVOLUTIONARY ADVANTAGES IN SYSTEM RELIABILITY AND SIMPLICITY. THEY ARE BASED ON THE VERTICAL CAVITY SURFACE-EMITTING MICROLASERS WHICH THE PRINCIPAL INVESTIGATOR HAS RECENTLY DEMONSTRATED. THESE MICRO-LASERS ALREADY HAVE ACTIVATION ENERGY COMPARABLE TO THAT OF THE LOWEST ENERGY OPTICAL GATES SO FAR, AND CAN BE SCALED DOWN TO THE MUCH LOWER ENERGIES NECESSARY FOR A PRACTICAL DIGITAL OPTICAL SYSTEM. SPEEDS, CURRENTLY UP TO ABOUT 8 GHz, CAN ALSO BE SUBSTANTIALLY IMPROVED. THE PHASE I PROJECT SHALL INTEGRATE A DETECTOR AND CONTROLLING DEVICE WITH THE MICROLASER FOR A SIMPLE TEST. THE RESULTS OF THIS TEST WILL SET THE STAGE FOR MORE AMBITIOUS DEVICES WHICH SHOULD SUPPLY THE RESEARCH INSTITUTIONS IN THE UNITED STATES WITH ARRAYS OF DIGITAL OPTICAL DEVICES WHICH ARE RELIABLE AND EASY TO IMPLEMENT WITH A MINIMUM OF OPTICAL HARDWARE.

ROCHESTER PHOTONICS CORP

67 NETTLECREEK RD

FAIRPORT, NY 14450

Program Manager: DEAN FAKLIS

Contract #:

Title: CHARACTERIZATION OF THE PHOTONIC COMPONENTS OF A MULTI-CHANNEL OPTICAL CORRELATOR BASED ON BINARY OPTICS

Topic #: AF90-046

Office: RADC/XPX

ID #: 39715

BINARY OPTICS PROVIDES THE KEY TECHNOLOGY FOR THE DEVELOPMENT OF STATE-OF-THE-ART MULTI-CHANNEL OPTICAL CORRELATORS. THE KEY COMPONENTS FOR THE CORRELATOR ARE: A LARGE APERTURE, WIDE-FIELD DIFFRACTIVE FOURIER TRANSFORM LENS; A BINARY PHASE GRATING THAT DIFFRACTS LIGHT INTO EQUAL INTENSITY ORDERS; AND A TWO-DIMENSIONAL ARRAY OF DIFFRACTIVE MICROLENSSES. IN THIS EFFORT, THE EMPHASIS IS PLACED ON THE CHARACTERIZATION OF THE PHOTONIC COMPONENTS FOR AN ALL-DIFFRACTIVE, COMPACT, MASSIVELY PARALLEL, OPTICAL CORRELATOR THAT CONSISTS OF HUNDREDS OF INDEPENDENT CORRELATION CHANNELS. OUR INTENT IS TO IDENTIFY INNOVATIVE METHODS OF TESTING THE DIFFRACTIVE COMPONENTS AND TO ADVANCE THE STATE-OF-THE-ART IN CHARACTERIZING THE NECESSARY SPATIAL LIGHT MODULATORS AND DETECTORS. NOVEL TECHNIQUES INCLUDING HARDWARE TO CHARACTERIZE THE DIFFRACTION EFFICIENCY AND IMAGING PROPERTIES OF THE DIFFRACTIVE ELEMENTS WILL BE DEVELOPED FOR IMPLEMENTATION DURING PHASE II. TO TEST THE FEASIBILITY OF OUR APPROACH FOR A SPECIFIC APPLICATION, WE PROPOSE TO ADDRESS THE SYSTEM REQUIREMENTS FOR A MULTI-CHANNEL OPTICAL CORRELATOR SYSTEM FOR IMAGE IDENTIFICATION. PARTICULAR ATTENTION WILL BE GIVEN TO THE ANALYSIS OF THE OUTPUT CORRELATION IMAGE, POSSIBLY USING NEURAL NETWORKS, TO PROVIDE CONTROL FUNCTIONS FOR TARGET IDENTIFICATION AND TRACKING APPLICATIONS. IT IS ANTICIPATED THAT A PORTION OF THE RESEARCH WILL BE PERFORMED BY ROCHESTER PHOTONIC'S PERSONNEL AT THE RADC PHOTONICS LABORATORY.

ATHENS GROUP INC

3424 NW 31ST ST

GAINESVILLE, FL 32605

Program Manager: GIN-KOU MA

Contract #:

SMALL BUSINESS INNOVATION RESEARCH PROGRAM - PHASE I
AIR FORCE Solicitation 90.1

Title: VERY HIGH SPEED SIGNAL PROCESSOR (VHSSP)
Topic #: AF90-047

Office: RADC/XPX

ID #: 39716

WE WILL PROVIDE EXPERT RESEARCH IN THE PROBLEM OF DEFINING THE VERY HIGH-SPEED SIGNAL PROCESSOR (VHSSP) OPPORTUNITIES INTO THE YEAR 2000 AND BEYOND. THE STUDY WILL INTEGRATE THE EXPERTISE OF NATIONAL SIGNAL PROCESSING LEADERS AND RADC PERSONNEL TO DEFINE POTENTIAL STRENGTHS AND WEAKNESSES IN THE PREDICTED VHSSP TECHNOLOGY BASE. BESIDES STUDYING THE VHSSP FROM A BANDWIDTH STANDPOINT, THE STUDY WILL FOCUS ON THOSE PARAMETERS WHICH WILL BE REQUIRED IN FRONT-END C3 AND DATA/SENSOR FUSION APPLICATIONS. THESE INCLUDE SIZE, POWER, I/O PARAMETERS, AS WELL AS FAULT-TOLERANCE AND TESTABILITY. TWO POWERFUL INNOVATIVE TECHNOLOGIES WILL ALSO BE INCLUDED IN THE STUDY, BOTH OF WHICH ARE SHOWN TO BE OPTIMAL IN TERMS OF ACHIEVING MAXIMAL BANDWIDTH IN A MINIMAL VOLUME. ONE TECHNOLOGY IS BASED ON THE RESIDUE NUMBER SYSTEM (RNS) AND IS FIXED-POINT IN NATURE, THE OTHER IS A FLOATING-POINT DISTRIBUTED ARITHMETIC PROCESSOR. BOTH ARE POTENTIALLY IDEAL FOR DATA/SENSOR FUSION AND FRONT-END C3 APPLICATIONS. IN ADDITION TO HARDWARE ISSUES, THE STUDY WILL ALSO ADDRESS THE QUESTION OF ELECTRONIC DESIGN AUTOMATION (EDA). FINALLY, THROUGH RESEARCH AND CONSULTATION WITH THE SPONSOR, A PROTOTYPE VHSSP SYSTEM WILL BE PROPOSED FOR DEVELOPMENT OF A CUSTOM VLSI DEMONSTRATION SYSTEM IN PHASE II.

ELECTRONIC DECISIONS INC
1776 E WASHINGTON ST
URBANA, IL 61801
Program Manager: DR DANIEL A FLEISCH
Contract #:

Title: ACT CO-SITE INTERFERENCE FILTERS

Topic #: AF90-048

Office: RADC/XPX

ID #: 39717

TWO OR MORE FREQUENCY HOP RADIOS OPERATING IN A COMMON SITE CREATE A SUBSTANTIAL INTERFERENCE PROBLEM BECAUSE CONVENTIONAL FIXED FILTERING TECHNIQUES WITHOUT FREQUENCY AGILITY CANNOT BE USED TO SUPPRESS IT. A NEW ENABLING TECHNOLOGY CALLED ACOUSTIC CHARGE TRANSPORT (ACT) HAS GIVEN RISE TO A FAMILY OF PROGRAMMABLE FILTERS THAT HOLD PROMISE FOR REDUCING THIS INTERFERENCE PROBLEM. THE PROGRAMMING TIME FOR THESE MINIATURE FILTERS IS LESS THAN 100 USECS, THE TECHNOLOGY EXISTS TO PROGRAM THE CENTER FREQUENCY ACROSS THE 225 TO 400 MHz BAND AND THE BANDWIDTH IS PROGRAMMABLE TO VALUES LESS THAN 25 KHz. THE STANDOFF DYNAMIC RANGE OF ACT PROGRAMMABLE FILTERS IS IN THE 85 TO 95 dB RANGE FOR THE 25 KHz CHANNELS. THIS DYNAMIC RANGE IS INADEQUATE FOR THE VERY DEMANDING CO-SITE REQUIREMENTS. THIS PROGRAM WILL UPGRADE THE PRESENT FILTERS WITH A PROGRAMMABLE MATCHING NETWORK AT THE INPUT IN ORDER TO INCREASE THE STANDOFF DYNAMIC RANGE AND SIGNIFICANTLY DECREASE THE NOISE FIGURE. THE OBJECTIVE OF THIS PROGRAM IS TO PRODUCE A PROGRAMMABLE FILTER IN A SMALL MODULE THAT CAN BE ADDED TO PRESENT FH RADIOS TO ALLOW THEM TO MEET THE CO-SITE REQUIREMENTS. THE PHASE I EFFORT WILL PERFORM EXPERIMENTS WITH EXISTING DEVICES TO EVALUATE THE FEASIBILITY AND PRODUCE A DESIGN FOR A MODULE TO BE DEVELOPED IN PHASE II.

SIGNAL ANALYTICS CORP
374 MPLE AVE E - STE 200
VIENNA, VA 22180
Program Manager: DR ROBERT J FONTANA
Contract #:

Title: COMMUNICATIONS SIGNAL RECOGNITION AND DEMODULATION VIA NEURAL NETWORKS

Topic #: AF90-049

Office: RADC/XPX

ID #: 39718

THE GOAL OF THIS PROGRAM IS TO IDENTIFY SPECIFIC NEURAL NETWORK ARCHITECTURES AND

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ALGORITHMS WHICH ARE APPLICABLE TO COMMUNICATIONS PROBLEMS AND EVALUATE THOSE ARCHITECTURES AND ALGORITHMS VIA SIMULATION AND MODELING. WE DEFINE HEREIN A SYSTEM CONSISTING OF TWO DIFFERENT NEURAL NETWORK PARADIGMS WHICH ARE INTEGRATED TO PERFORM AUTOMATIC IDENTIFICATION AND DEMODULATION OF DIGITAL COMMUNICATIONS SIGNAL DATA. THE COMPOSITE NEURAL STRUCTURE WILL MAKE USE OF (a) A SELF ORGANIZING CLUSTERER NETWORK WHICH WILL MONITOR THE FORMATION OF THE DEMODULATED SIGNAL CONSTELLATION AND (b) A MULTILAYERED PERCEPTRON FOR DEMODULATION PARAMETER EXTRACTION. THE TWO NETWORKS THAT WE HAVE CHOSEN TO USE ARE BASED ON WIDELY ACCEPTED PARADIGMS. FURTHERMORE, OUR PHASE I APPROACH MAKES USE OF COMMERCIAL OFF-THE-SHELF SOFTWARE WHICH MAY BE DIRECTLY EMBEDDED IN OFF-THE-SHELF INTEGRATED CIRCUITS IN PHASE II.

TECHNICAL RESEARCH ASSOCS INC
410 CHIPETA WY - STE 222
SALT LAKE CITY, UT 84108
Program Manager: GAIL BOWERS-IRONS
Contract #:

Title: THE BIODEGRADATION OF UNCURED FIBER-REINFORCED POLYMERS
Topic #: AF90-052 Office: AFESC/RDXP ID #: 39727

FIBER-REINFORCED POLYMERS COMPRISE A SIGNIFICANT FRACTION OF THE MATERIALS USED IN THE FABRICATION OF RECENT AND DEVELOPING AIR FORCE WEAPON SYSTEMS. EPOXY, POLYIMIDE, PHENOLIC AND POLYESTER RESIN BASES, IN CONJUNCTION WITH KEVLAR 49 ARAMID, CARBON AND GLASS SUPPORTS, PROVIDE HIGH-PERFORMANCE WITH LIGHTWEIGHT, HIGH STRENGTH AND STIFFNESS, DAMAGE (FATIGUE AND STRESS) RESISTANCE AND VIBRATION DAMPING PROPERTIES. OFTEN, WHEN THESE PRODUCTS ARE MANUFACTURED, THERE ARE RESIDUAL OR NON-SPEC WASTE MATERIALS GENERATED. INCINERATION, AUTOCLAVING OR LANDFILLING ARE THE CURRENT DISPOSAL METHODS. THE WASTES, CONSIDERED HAZARDOUS AND ENVIRONMENTALLY UNSAFE, MAY INCLUDE UNCURED RESIN, INITIATOR, UNCAST POLYMER OR COMPOSITE, MOLD TRIMMINGS, FINISHING DUST AND REJECTS AT ALL STEPS OF THE FABRICATION PROCESS. IN RESPONSE TO THIS PROBLEM, TECHNICAL RESEARCH ASSOCIATES (TRA) PROPOSES TO FULLY STUDY AND DEVELOP A NON-POLLUTING, EFFICIENT, COST-EFFECTIVE BIODEGRADATION PROCESS WHICH WOULD ELIMINATE OR MINIMIZE THE ENVIRONMENTAL AND HEALTH HAZARDS CAUSED BY PRESENT DISPOSAL SYSTEMS. THE APPROACH WILL BE DIRECTED TOWARDS BIODEGRADING THE UNCURED RESINS, ALLOWING THE FREED FIBER REINFORCEMENTS TO BE EITHER RECYCLED OR SECURELY LANDFILLED. THIS WORK WILL FOLLOW AND BE BASED UPON THE PROVEN DEGRADATION APPROACH SHOWN IN PREVIOUS TRA WORK INVOLVING THE BIODEGRADATION OF POLYURETHANES, EPOXIES, POLYSULFIDES, FLUOROCARBONS AND FLUOROSILICONES.

CERMAK PETERKA PETERSEN INC
1415 BLUE SPRUCE DR
FORT COLLINS, CO 80524
Program Manager: RONALD L PETERSEN
Contract #:

Title: DEVELOPMENT OF HYBRID MODEL FOR ASSESSING CONCENTRATIONS OF TOXIC EFFLUENT AT AIR FORCE INSTALLATIONS
Topic #: AF90-053 Office: AFESC/RDXP ID #: 39723

PRESENT COMPUTER MODELS USED TO PREDICT VAPOR CLOUD LENGTH, CONCENTRATION AND DURATION AT AIR FORCE INSTALLATIONS DO NOT PROPERLY ACCOUNT FOR THE EFFECTS OF STRUCTURES. STRUCTURES CAN ACT TO TRAP THE CLOUD AND INCREASE THE CLOUD DIMENSIONS, THEREBY POSSIBLY REDUCING DOWNWIND CONCENTRATIONS AND INCREASING THE CLOUD'S LATERAL EXTENT. RECENT RESEARCH CONDUCTED BY CPP HAS SHOWN THAT THE TRAPPING AND INCREASED DISPERSION EFFECT VARIES SIGNIFICANTLY WITH SITE GEOMETRY. USE OF NUMERICAL MODELS ALONE WILL NOT LIKELY PROVIDE SUFFICIENTLY ACCURATE CONCENTRATION ESTIMATES. TO PROVIDE ACCURATE ESTIMATES, CPP

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IS PROPOSING TO DEVELOP A HYBRID MODELING APPROACH. THE HYBRID MODEL IS DEVELOPED USING WIND TUNNEL MODELING FOR NEAR- FIELD DISPERSION ESTIMATES AND STANDARD REGULATORY OR HEAVIOR-THAN- AIR MODELS FOR FARFIELD ESTIMATES. THE FARFIELD ESTIMATES ARE OBTAINED BY INITIALIZING THE NUMERICAL MODELS USING THE WIND TUNNEL MEASUREMENTS AT THE POINT WHERE THE CLOUD IS SIGNIFICANTLY LARGER THAN THE STRUCTURES ASSOCIATED WITH THE INSTALLATION.

SIGMA RESEARCH CORP

234 LITTLETON RD - STE 2E

WESTFORD, MA 01886

Program Manager: STEVEN R HANNA

Contract #:

Title: EFFECTS OF STRUCTURES ON TOXIC VAPOR DISPERSION

Topic #: AF90-053

Office: AFESC/RDXP

ID #: 39725

CURRENTLY AVAILABLE TOXIC VAPOR DISPERSION MODELS AT AIR FORCE FACILITIES DO NOT ADEQUATELY INCLUDE THE EFFECTS OF STRUCTURES ON THE RATE OF DISPERSION. SOME RELEVANT MODELS AND DATA SETS ARE AVAILABLE IN THE LITERATURE AS A RESULT OF RESEARCH BY OTHER ORGANIZATIONS. THE LITERATURE WILL BE REVIEWED AND AN ASSESSMENT MADE OF THE FEASIBILITY OF PRODUCING A VIABLE MODELING SYSTEM AND WHETHER THE EFFECTS OF STRUCTURES ARE LIKELY TO BE SIGNIFICANT RELATIVE TO OVERALL DISPERSION MODEL UNCERTAINTY. THE MICROCOMPUTER-BASED MODELING SYSTEM WILL ACCOUNT FOR AERODYNAMIC EFFECTS AROUND ONE BUILDING OR GROUPS OF STRUCTURES, INCLUDING DOWNWASH AND VAPOR TRAPPING. BOTH NEUTRALLY-BUOYANT AND DENSE GAS CASES WILL BE CONSIDERED, AND THE MODEL WILL BE CONSTRUCTED SUCH THAT IT IS CAPABLE OF A SMOOTH TRANSITION TO OTHER DISPERSION MODELS AT DOWNWIND DISTANCES WHERE THE EFFECTS OF THE STRUCTURES BECOME INSIGNIFICANT.

SULLIVAN ENVIRONMENTAL CONSULTING INC

1900 ELKIN ST - STE 280C

ALEXANDRIA, VA 22308

Program Manager: DAVID A SULLIVAN

Contract #:

Title: EFFECTS OF STRUCTURES ON TOXIC VAPOR DISPERSION

Topic #: AF90-053

Office: AFESC/RDXP

ID #: 39726

THE HANDING AND STORAGE OF AIRCRAFT FUELS, ROCKET PROPELLANTS AND SOLVENTS AT AIR FORCE INSTALLATIONS CREATES THE POTENTIAL FOR ACCIDENTIAL RELEASE OF AIRBORNE POLLUTANTS. CURRENTLY AVAILABLE DISPERSION MODELS FOR PLANNING AND RESPONSE ACTIONS DO NOT EFFECTIVELY ADDRESS BUILDING EFFECTS. THE OBJECTIVES OF THIS STUDY, THEREFORE, ARE TWOFOLD: (1) TO ASSESS FOR A RANGE OF RELEASE SCENARIOS THE SIGNIFICANCE OF BUILDING EFFECTS RELATIVE TO OVERALL MODELING UNCERTAINTY, AND (2) TO ASSESS THE FEASIBILITY OF PRODUCING A PRACTICAL MODEL TO ACCOUNT FOR BUILDING EFFECTS FOR NON-DENSE AND DENSE GAS RELEASES. THE MAJOR STEPS OF THIS STUDY INCLUDE: (1) PRIORITIZE RELEASE SCENARIOS, (2) ASSESS BUILDING EFFECTS RELATIVE TO OVERALL MODELING UNCERTAINTY, (3) SELECT AN AVAILABLE DISPERSION MODEL TO ADAPT FOR THE BUILDING TERMS, (4) ASSESS THE FEASIBILITY OF ADAPTING THE SELECTED MODEL TO ACCOUNT FOR BUILDING EFFECTS FOR NON-DENSE AND DENSE GASES, AND (5) ASSESS THE FEASIBILITY OF FIELD TESTING THE REVISED MODEL.

AMERICAN RESEARCH CORP OF VA

PO BOX 3406

RADFORD, VA 24143

Program Manager: JOHN A NEAL III

SMALL BUSINESS INNOVATION RESEARCH PROGRAM - PHASE I
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Contract #:

Title: APPLICATION OF ARTIFICIAL NEURAL NETWORKS TO MACHINE VISION FLAME DETECTION

Topic #: AF90-056

Office: AFESC/RDXP

ID #: 39722

CURRENT TECHNIQUE OF OPTICAL FLAME DETECTION RELY ON THE USE OF NARROW BANDWIDTH SENSORS WHICH HAVE BEEN DEMONSTRATED TO BE PRONE TO FALSE ALARMS. TO ADDRESS THIS NEED, AMERICAN RESEARCH CORPORATION OF VIRGINIA (ARCOVA) PROPOSES TO DEVELOP AN INTELLIGENT MACHINE VISION INTERFACE FOR THE DETECTION AND CLASSIFICATION OF SPECTRAL FLAME SIGNATURES. THE APPROACH BEING PROPOSED WOULD USE MACHINE VISION TECHNIQUES TO GENERATE HSI FORMATTED DIGITIZED VIDEO DATA THAT WOULD BE PRESENTED TO AN ARTIFICIAL NEURAL NETWORK FOR ANALYSIS. DEVELOPMENT OF A SILICON-BASED NEURAL NETWORK VIDEO CLASSIFICATION SYSTEM WOULD ALLOW ON-LINE MONITORING, DETECTION, AND CLASSIFICATION OF FLAME PATTERNS AS DERIVED FROM MACHINE VISION DATA. THE IMPROVEMENTS THE HSI VIDEO/NEURAL NETWORK SYSTEM OVER STANDARD FLAME DETECTION TECHNIQUES WOULD BE APPARENT IN AN IMPLEMENTATION OF AN ARTIFICIAL NEURAL NETWORK SIMULATION. HSI TECHNIQUES ARE CURRENTLY BEING IMPLEMENTED TO REDUCE IMAGE PROCESSING EFFORTS AND ARTIFICIAL NEURAL NETWORKS HAVE BEEN REPEATEDLY USED WITH SUCCESS IN THE CLASSIFICATION AND REDUCTION OF COMPLEX DATA INPUTS AND IN THE RECOGNITION OF PATTERNS BETWEEN DIFFERENT INPUT DATA. THEREFORE, ARCOVA ANTICIPATES POSITIVE RESULTS IN THE APPLICATION OF NEURAL NETWORKS IN AN INTELLIGENT VIDEO DATA CLASSIFICATION AND PATTERN RECOGNITION SYSTEM FOR MONITORING AND FLAME DETECTION PURPOSES.

DONMAR LTD

901 DOVER DR - STE 120

NEWPORT BEACH, CA 92660

Program Manager: DR A DONALD GOEDEKE

Contract #:

Title: DEVELOPMENT OF MACHINE VISION OPTICAL FIRE DETECTOR SYSTEM

Topic #: AF90-056

Office: AFESC/RDXP

ID #: 39724

THE CONCEPT PROPOSED UTILIZES MACHINE VISION TECHNOLOGY, PATTERN RECOGNITION AND ARTIFICIAL INTELLIGENCE TO IDENTIFY "CHANGES" IN VISUAL SCENES THAT HAVE BEEN STORED IN A COMPUTER. CHARACTERISTICS OF EACH LABELED "CHANGE" AREA, SUCH AS GROWTH AND INTENSITY (BRIGHTNES) ARE MONITORED ALONG WITH THE SPECIAL SIGNATURES IN THE VISIBLE. THE SYSTEM IS DEIGNED TO BE IMMUNE TO IR AND UV FALSE ALARM SOURCES AND CAN LOCATE AND DETERMINE THE SIZE OF POSSIBLE FIRE EVENTS. THE RESPONSE TIMES TO "FIRE DECISIONS" AND SCENE CHANGE/EDGE DETECTION ANALYSIS ARE IN THE MILLISECONDS RANGE, THUS INCREASING CONSIDERABLY THE RELIABILITY OF PRESENT UV/IR DETECTORS AND PROVIDING VERY FAST REACTION TIMES. THE SYSTEM OPERATES IN THE SAME "VISUAL AND REASONING PROCESS" AS A HUMAN. THE FIRE IS SEEN IN THE VISIBLE AND OBSERVED FOR SOME BRIEF PERIOD TO DETERMINE ITS CHARACTERISTICS IN COLOR, GROWTH, SIZE, AND OTHER FEATURES AND TO COMPARE THESE ATTRIBUTES/FEATURES AGAINST KNOWN EXPERIENCE/STORED KNOWLEDGE. COMPARISONS ARE DONE ON WHAT OTHER ITEMS MAY CAUSE SUCH AN EVENT, TO REDUCE POSSIBILITIES OF A WRONG DECISION. THE SYSTEM USES OTHER SPECTRAL DATA INPUT IN ITS DECISION-MAKING PROCESS TO FURTHER ASSURE A HYDROCARBON FIRE IS PRESENT. IT CAN ALSO DISTINGUISH IF THE EVENT IS ASSOCIATED WITH THE AIRCRAFT AND WHERE IT IS LOCATED, THUS ALLOWING ZONAL SUPPRESSION TO BE APPLIED.

MICRO-OPTICS TECHNOLOGIES INC

PO BOX 377 - 8608 UNIVERSITY GREEN/#5

MIDDLETON, WI 53562

Program Manager: JEFFREY C BUCHOLZ

Contract #:

Title: FIBER OPTIC MICROPHONE DEVELOPMENT

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Topic #: AF90-057

Office: HSD/XART

ID #: 39728

COMMUNICATION SYSTEMS THAT USE ELECTRO-ACOUSTICAL TRANSDUCERS ARE SUSCEPTIBLE TO DISTORTION OR INTERRUPTION BY ELECTROMAGNETIC INTERFERENCE, ELECTROMAGNETIC PULSES AND RADIO FREQUENCY INTERFERENCE. SHIELDING THE WIRE CARRYING THE ELECTRICAL SIGNAL TO PREVENT INTERFERENCE IS NOT ALWAYS EFFECTIVE OR DESIRABLE. THE OBJECTIVE OF THE WORK PROPOSED HERE IS THE DEVELOPMENT OF A FIBER OPTIC MICRO- PHONE. THE TRANSDUCER OF THE MICROPHONE WOULD CONVERT ACOUSTIC SIGNALS DIRECTLY TO A MODULATING LIGHT SIGNAL WHICH WOULD BE TRANSMITTED THROUGH A FIBER OPTIC CABLE. THIS SIGNAL WOULD BE IMMUNE TO ANY ELECTROMAGNETIC INTERFERENCE. THIS WORK WILL DESIGN A TRANSDUCER THAT CAN BE PRODUCED BY MICRO-MACHINING OF SILICON. THE DIFFERENT GEOMETRIES POSSIBLE FOR THE TRANSDUCER WILL BE INVESTIGATED AND THE MOST PROMISING SHAPE WILL BE CONSTRUCTED. A MICROPHONE USING THIS TRANSDUCER WILL BE ASSEMBLED AND TESTED.

PACER SYSTEMS

900 TECHNOLOGY PARK DR

BILLERICA, MA 01821

Program Manager: PETER F BECKSCHI

Contract #:

Title: BRIDGING COGNITIVE TASK ANALYSIS TO ISD TRAINING DESIGN

Topic #: AF90-057

Office: HSD/XART

ID #: 39729

COGNITIVE SCIENCE HAS PROVIDED A NUMBER OF APPROACHES AND TECHNIQUES WHICH HAVE BEEN SUCCESSFULLY EMPLOYED IN TRAINING PROGRAMS. ANALYSIS OF COGNITIVE CONTENT OF SPECIFIC DOMAINS HAS PROVEN TO BE VALUABLE IN THE DESIGN AND DEVELOPMENT OF TRAINING PROGRAMS. UNFORTUNATELY, NO SYSTEMATIC APPROACH HAS BEEN SUGGESTED TO INCORPORATE THESE COGNITIVE ELEMENTS INTO THE MILITARY INSTRUCTIONAL SYSTEMS DEVELOPMENT METHODOLOGY. IT WOULD BE THE PURPOSE OF THIS PROPOSAL TO INVESTIGATE JUST HOW EXISTING METHODOLOGIES AND OUTCOMES IN COGNITIVE TASK ANALYSIS CAN BE BRIDGED TO THE DESIGN FUNCTION OF THE ISD MODEL AND MAKE SPECIFIC RECOMMENDATIONS FOR DEVELOPING GUIDELINES TO ASSIST INSTRUCTIONAL DEVELOPERS FOR APPLICATION. THIS PROJECT WOULD ENHANCE THE ISD MODEL BY INCLUDING THE CURRENT WORK BEING PERFORMED IN COGNITIVE INSTRUCTION AND MODELING.

BURGE & ASSOCS

8869 S MYRTLE

TEMPE, AZ 85284

Program Manager: DR SCOTT R BURGE

Contract #:

Title: INTEGRATED REAL-TIME GROUND-WATER/SOIL-GAS MONITORING SYSTEM FOR ANALYSIS OF VOLATILE ORGANIC CHEMICALS

Topic #: AF90-058

Office: HSD/XART

ID #: 39731

AN INTEGRATED GROUND-WATER/SOIL-GAS MONITORING SYSTEM WILL BE DESIGNED, CONSTRUCTED AND TESTED. THE BASIS OF THE INTEGRATED SYSTEM WILL BE TO PLACE THE VOLATILE ORGANIC CHEMICALS (VOCs) INTO THE SAME SAMPLE FORM, I.E. VOCs IN AN INERT GAS SUCH AS NITROGEN, FOR ANALYSIS. TO ACCOMPLISH THIS A GROUND-WATER SAMPLER WILL BE DESIGNED WHICH WILL COLLECT A GROUND-WATER SAMPLE WITHOUT PURGING THE WELLS. THE WATER SAMPLE WILL BE STRIPPED OF VOCs USING A STREAM OF NITROGEN GAS WITHIN THE BODY OF THE SAMPLER. THE VOCs IN A STREAM OF NITROGEN WILL BE CONDUCTED BY PIPING TO THE SURFACE FOR REAL-TIME ANALYSIS BY A GAS CHROMATOGRAPH. THE SAME GAS CHROMATOGRAPH WILL BE USED TO ANALYSIS SOIL-GAS. THE FIRST PART OF THE WORK PLAN WILL INCLUDE DESIGNING, CONSTRUCTING AND TESTING THE GROUND-WATER SAMPLER. THE SECOND PART OF THE WORK PLAN WILL INTEGRATE THE GROUND-WATER SAMPLER WITH

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SOIL-GAS MONITORING WELLS TO CREATE A REAL-TIME MONITORING SYSTEM IN WHICH SOIL-GAS DATA MAY BE DIRECTLY CORRELATED WITH GROUND-WATER DATA.

TRANSDUCER RESEARCH INC
1228 OLYMPUS DR
NAPERVILLE, IL 60540
Program Manager: JOSEPH R STETTER
Contract #:

Title: A PORTABLE LIQUID CHROMATOGRAPH TO MONITOR ISOCYANATES IN AIR
Topic #: AF90-058 Office: HSD/XART ID #: 39730

ORGANIC ISOCYANATES, FOUND IN PLASTICS, PAINTS, AND EXPLOSIVES, ARE ALSO HIGHLY TOXIC. THEY POSE AN INDUSTRIAL HYGIENE PROBLEM BECAUSE THE LOW TOXIC CONCENTRATIONS ARE NOT EASILY MONITORED IN REAL TIME. WE PROPOSE TO COMBINE A RECENTLY-DEVELOPED PORTABLE LIQUID CHROMATOGRAPH WITH A PERMEATION ABSORBER TO EXTRACT ISOCYANATES FROM THE AIR AND MEASURE THEM UNDER FULLY AUTOMATIC CONTROL. THE PERMEATION ABSORBER WILL CONTAIN TRAPPING REAGENTS THAT FORM ELECTROCHEMICALLY-ACTIVE PRODUCTS FOR HIGH SENSITIVITY OF 20 ppb TOLUENE DIISOCYANATE, WILL WEIGH UNDER 15 LBS., AND WILL OPERATE FOR A WEEK ON A BATTERY CHARGE.

MYSTECH ASSOCS INC
5205 LEESBURG PIKE - STE 1200
FALLS CHURCH, VA 22041
Program Manager: THEODORE D RAPHAEL
Contract #:

Title: KNOWLEDGE TRANSFERENCE AND INNOVATIVE DECISION MAKING IN DISTRIBUTED COMMAND AND CONTROL ENVIRONMENTS
Topic #: AF90-059 Office: HSD/XART ID #: 39732

PREVIOUS RESEARCH EFFORTS CONCERNING THE COGNITIVE PERFORMANCE OF THE MEMBERS OF COMMAND AND CONTROL (C2) TEAMS IN DISTRIBUTED, COMPUTER-MEDIATED SYSTEMS HAVE FOCUSED ON MODIFICATIONS OF SYSTEM DESIGN TO ENHANCE COGNITIVE PERFORMANCE. MYSTECH PROPOSES A COMPLEMENTARY EFFORT THAT FOCUSES ON INNOVATIVE C2 TEAM TRAINING METHODS TO IMPROVE COGNITIVE PERFORMANCE. THE RESEARCH WILL FOCUS ON A SPECIFIC C2 ENVIRONMENT-BATTLE MANAGEMENT IN A RAPIDLY CHANGING BATTLE SITUATION. GIVEN THIS CONTEXT, "STRESS" WILL BE INTRODUCED AS AN IMPORTANT INDEPENDENT VARIABLE, IN ADDITION TO DISPERSION AND COMPUTER-MEDIATION. THE EFFORT WILL THEN TURN TO THE IDENTIFICATION OF PROCESSES IN THIS ENVIRONMENT, PARTICULARLY THOSE DUE TO STRESS, THAT MITIGATE AGAINST THE SHARING OF MENTAL MODELS AND THE MAINTENANCE OF A FLEXIBLE AND INNOVATIVE COGNITIVE STANCE IN BATTLE PLANNING. OF THE IDENTIFIED PROCESSES, THOSE THAT MAY BE ADDRESSED BY TRAINING WILL FORM THE BASIS OF A TEAM TRAINING PROGRAM TO IMPROVE THE SYNCHRONOUS SHARING THE MENTAL MODELS AND THE MAINTENANCE OF COGNITIVE FLEXIBILITY AND INNOVATION IN DYNAMIC BATTLE PLANNING.

BEGEJ CORP
5 CLARET ASH RD
LITTLETON, CO 80127
Program Manager: STEFAN BEGEJ
Contract #:

Title: TELEPRESENT MASTER/SLAVE TOOLS WITH FORCE AND TACTILE FEEDBACK
Topic #: AF90-060 Office: HSD/XART ID #: 39734

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THE OVERALL OBJECTIVE OF THE PHASE I WORK SHALL BE TO DESIGN AND FABRICATE TELEPRESENT MASTER/SLAVE (M/S) TOOLS CAPABLE OF PROVIDING FORCE AND TACTILE FEEDBACK TO THE HAND OF A HUMAN OPERATOR. THIS WORK SHALL INCORPORATE THE EXTENSIVE PREVIOUS DEVELOPMENT ACTIVITIES AT BEGEJ CORPORATION IN THE AREAS OF TACTILE SENSORS AND TACTILE DISPLAYS. THE SCOPE OF THE PHASE I WORK INCLUDES: (1) DESIGN AND FABRICATION OF MINIATURE, TOOL-MOUNTED FORCE/TORQUE (F/T) SENSORS CAPABLE OF MEASURING SIX COMPONENTS OF FORCE; (2) FABRICATION OF A HIGH-DENSITY OPTICAL TACTILE SENSOR FOR THE SLAVE TOOL HANDLE; (3); FABRICATION OF A 128-ELEMENT TACTILE DISPLAY FOR THE MASTER TOOL HANDLE, AND; (4) PRELIMINARY EVALUATION OF THE MASTER/SLAVE TOOLS. FOLLOW-ON WORK DURING PHASE II WOULD CONCERN: (1) THE IMPLEMENTATION OF FORCE FEEDBACK TO THE MASTER TOOL HOLDER BY A DEDICATED 6-DOF ROBOT ARM CONTROLLED BY THE F/T SENSORS ON THE TOOLS; (2) PERFORMANCE OF A MORE COMPLETE EVALUATION OF THE TELEPRESENT M/S TOOL CONCEPT USING A MODIFIED MECHANICAL M/S MANIPULATOR AND A THREE-FINGERED, FULLY-TELEPRESENT GLOVE CONTROLLER WITH ASSOCIATED ROBOT HAND (CURRENTLY UNDER DEVELOPMENT); AND (3) DESIGN, DEVELOP, AND FABRICATE SECOND-GENERATION TELEPRESENT M/S TOOL COMPONENTS FOR DELIVERY TO THE SPONSOR.

HUMAN MACHINE INTERFACES INC
PO BOX 22446
KNOXVILLE, TN 37933

Program Manager: DR JOHN V DRAPER

Contract #:

Title: STANDARDIZED TASK BATTERY FOR ASSESSMENT OF HUMAN-CONTROLLED ROBOTIC SYSTEM PERFORMANCE

Topic #: AF90-060

Office: HSD/XART

ID #: 39733

THIS PROJECT WILL HAVE TWO PRODUCTS. IT WILL PROVIDE 1) AN INSTRUMENTED TASK BATTERY FOR ASSESSING THE PERFORMANCE OF HUMAN- CONTROLLED ROBOTIC SYSTEMS (HCRS) AND 2) A STANDARDIZED PERFORMANCE ASSESSMENT SYSTEM FOR HCRS'S. THE TASK BATTERY WILL BE USEFUL FOR INVESTIGATING ALL ASPECTS OF HCRS PERFORMANCE. THE RESULTS OF THE PERFORMANCE EVALUATION SYSTEM WILL BE INDEPENDENT OF USER SKILL, AND THE PROCEDURE WILL BE APPLICABLE TO ROBOTIC SYSTEMS FEATURING ALL CURRENTLY AVAILABLE CONTROLLERS (MASTER CONTROLLERS, RESOLVED-MOTION RATE CONTROLLERS, AND JOINT-BY-JOINT CONTROL). THE TASK BATTERY AND PERFORMANCE ASSESSMENT SYSTEM WILL INCLUDE 1) HARDWARE COMPONENTS INCLUDING INSTRUMENTED TASKS AND DATA COLLECTION EQUIPMENT, 2) SOFTWARE NECESSARY FOR DATA COLLECTION AND PERFORMANCE CALCULATION, AND 3) WRITTEN PROCEDURES FOR CONDUCTING PERFORMANCE ASSESSMENTS. THE TASK BATTERY WILL BE VALID FOR ASSESSMENT OF ROBOTIC MANIPULATORS, BUT NOT APPLICABLE TO ROBOTIC VEHICLES. PHASE I OF THE PROJECT WILL 1) IDENTIFY POTENTIAL CRITERIA AND 2) PROVIDE CONCEPTUAL DESIGNS OF TASKS FOR USE IN PHASE II. PHASE II WILL INCLUDE DESIGN, FABRICATION, AND TESTING OF TASK BATTERY AND PERFORMANCE ASSESSMENT SYSTEM HARDWARE AND SOFTWARE. TESTING WILL USE EXISTING HUMAN-CONTROLLED ROBOTIC SYSTEMS. THE PERFORMANCE ASSESSMENT SYSTEM WILL BE VALIDATED BY COMPARING PERFORMANCE ASSESSMENTS TO HOW WELL USERS COMPLETE THE TASK BATTERY USING HUMAN-CONTROLLED ROBOTS.

KINOPHASE
14 HOLLY HILL DR
AMHERST, NH 03031

Program Manager: GENE C KOCH

Contract #:

Title: LIQUID CRYSTAL SWITCHABLE KINOFORM LENSES FOR COMBINER DISPLAYS

Topic #: AF90-061

Office: HSD/XART

ID #: 39736

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THIS PROPOSAL IS TO DETERMINE THE FEASIBILITY OF A SWITCHABLE LIQUID CRYSTAL LENS TO BE USED IN A SEE-THROUGH HELMET MOUNTED DISPLAY. SUCH LENS WOULD ALLOW THE HELMET WEARER TO FUSE DISPLAYED INFORMATION ON A SEE-THROUGH DOT-MATRIX DISPLAY AND THE OUTSIDE WORLD SCENE. THE LENS UTILIZES A LIQUID CRYSTAL SWITCHABLE, COMPUTER GENERATED, PHASE ONLY, HOLOGRAM (ALSO CALLED A KINOFORM OR BINARY OPTIC ELEMENT). THE PROPOSED WORK WOULD EXAMINE THE REQUIRED LITHOGRAPHIC DESIGN RULES TO PRODUCE SUCH A DEVICE AND ALSO THE ACHROMATIZATION OF SUCH A DEVICE. A REFRACTIVE EQUIVALENT SWITCHABLE PROTOTYPE LENS WOULD BE FABRICATED.

ROCHESTER PHOTONICS CORP
67 NETTLECREEK RD
FAIRPORT, NY 14450

Program Manager: DEAN FAKLIS

Contract #:

Title: APPLICATION OF SURFACE-RELIEF DIFFRACTIVE OPTICS TO HELMET MOUNTED DISPLAYS

Topic #: AF90-061

Office: HSD/XART

ID #: 39735

RECENT ADVANCES IN BINARY OPTICS TECHNOLOGY STRONGLY SUGGEST THAT DIFFRACTIVE OPTICS MAY PROVIDE A REVOLUTIONARY SOLUTION TO THE PROBLEM OF DEVELOPING COMPACT, LIGHTWEIGHT OPTICAL ASSEMBLIES FOR HELMET MOUNTED DISPLAYS. SURFACE-RELIEF DIFFRACTIVE LENSES PROVIDE THE OPTICAL DESIGNER WITH ENOUGH DEGREES OF FREEDOM TO ELIMINATE, IN MANY CASES, THE THIRD-ORDER COMA, ASTIGMATISM, AND FIELD CURVATURE. FABRICATION TECHNIQUES ALSO EXIST TO "BLAZE" OR TAILOR THE PHASE PROFILE OF EACH ZONE; THIS PROVIDES A DIFFRACTIVE LENS THAT EXHIBITS HIGH DIFFRACTION EFFICIENCY, THAT IS, NEARLY ALL OF THE INCIDENT LIGHT GOES TO THE PRINCIPAL FOCUS. FOR MANY CASES OF PRACTICAL INTEREST, WE HAVE SHOWN THAT A SINGLE DIFFRACTIVE LENS ACTUALLY PERFORMS BETTER THAN CONVENTIONAL LENS SYSTEMS CONSISTING OF SEVERAL AIR-SPACED GLASS ELEMENTS. THE OBJECTIVE OF THE PROPOSED RESEARCH IS TO DEMONSTRATE THE FEASIBILITY OF UTILIZING DIFFRACTIVE OPTICS TECHNOLOGY TO ANSWER HEAD-BORN WEIGHT AND CENTER OF GRAVITY CONSTRAINTS IN HELMET MOUNTED DISPLAY DESIGNS. WE PROPOSE TO IDENTIFY INNOVATIVE DESIGNS THAT EMPLOY SIMPLE COMBINERS AND A MINIMUM OF OPTICAL ELEMENTS WITHOUT SACRIFICING PERFORMANCE OR LIGHT EFFICIENCY. BOTH MONOCHROMATIC AND POLYCHROMATIC CONDITIONS WILL BE ADDRESSED. A SIGNIFICANT PORTION OF THE RESEARCH WILL BE CONCERNED WITH COLOR CORRECTION OF THE OPTICAL ASSEMBLY. ONE GOAL IS TO ELIMINATE THE NEED FOR A NOTCH FILTER ON THE CRT PHOSPHOR. THE EFFECTS ON THE SEE-THROUGH TRANSMISSION CHARACTERISTICS OF THE COMBINER WILL ALSO BE INVESTIGATED. THE MANUFACTURABILITY OF THE DIFFRACTIVE COMPONENTS INCLUDING THE COMBINER WILL BE STUDIED. A FIRST-ORDER TOLERANCE ANALYSIS WILL BE UNDERTAKEN FOR THE MOST PROMISING DESIGNS. PHASE II RESEARCH AND DEVELOPMENT WILL CONCENTRATE ON FABRICATING PROTOTYPES OF A DESIGN USEFUL TO THE DOD COMPONENT. IT IS EXPECTED THAT THE PHASE II DEVELOPMENT WILL LEAD TO FLYABLE HARDWARE EARLY IN PHASE III.

EXPERTSOFT
6160 CORNERSTONE CT E
SAN DIEGO, CA 92121
Program Manager: DR ANDREW M JAINE

Contract #:

Title: DESIGN AND DEVELOPMENT OF A HYPERMEDIA INTELLIGENT TUTORING SYSTEM IN AN AIR FORCE DOMAIN

Topic #: AF90-062

Office: HSD/XART

ID #: 39738

ONE OF THE MOST PROMISING APPROACHES TO IMPROVEMENT OF INSTRUCTIONAL METHODS IS THE USE OF INTELLIGENT TUTORING SYSTEMS (ITSs) THAT ACHIEVE A STUDENT-TO-TEACHER RATIO OF ONE-TO-ONE THROUGH THE USE OF COMBINATION OF ARTIFICIAL INTELLIGENCE TECHNOLOGIES AND HYPERMEDIA.

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TO DATE, MOST OF THE PROJECTS TO DEVELOP SUCH SYSTEMS HAVE HAD REDUCED SUCCESS DUE TO A NUMBER OF PROBLEMS THAT ARE INHERENT IN THE HYPERMEDIA TECHNOLOGY PLATFORM. WE PRESENT AN ANALYSIS OF KNOWN WEAKNESSES IN SUCH SYSTEMS, AND A FRAMEWORK FOR DEVELOPMENT OF AN OBJECT-ORIENTED STRUCTURED HYPERMEDIA SYSTEM THAT WILL RESOLVE THESE WEAKNESSES AND FOR IMPLEMENTATION OF A PROOF-OF-CONCEPT SYSTEM TO VALIDATE THE EFFICACY OF THIS TECHNOLOGY. THE TEAM ASSEMBLED FOR THIS TASK HAS PRACTICAL EXPERIENCE IN THE DEVELOPMENT OF OBJECT-ORIENTED SYSTEMS, AND IN THE IMPLEMENTATION OF DEDUCTIVE AND INDUCTIVE ARTIFICIAL INTELLIGENCE TECHNOLOGIES INCLUDING HYPERMEDIA SYSTEMS ACROSS A RANGE OF FIELD ENVIRONMENTS.

TAU CORP
485 ALBERTO WY
LOS GATOS, CA 95032
Program Manager: PETER ROTHMAN
Contract #:
Title: APPLICATION OF NEURAL NETWORKS TO ADAPTIVE TRAINING SYSTEMS
Topic #: AF90-062 Office: HSD/XART ID #: 39737

MUCH RESEARCH AND DEVELOPMENT IS UNDERWAY TO CONSTRUCT INTELLIGENT TRAINING SYSTEMS CAPABLE OF ADAPTING THEMSELVES AUTOMATICALLY TO AN INDIVIDUAL STUDENT'S PERFORMANCE AND LEARNING MODALITIES, AND TO DETERMINE THE FEASIBILITY OF APPLYING OF NEURAL NETWORK TECHNOLOGY TO THE DEVELOPMENT OF THESE SYSTEMS. THIS RESEARCH AND DEVELOPMENT EFFORT WILL SEEK TO APPLY NEURAL NETWORKS TO A DIFFICULT PROBLEM (NAMESLY, "MISCUE ANALYSIS") IN THE DEVELOPMENT OF INTELLIGENT TRAINING SYSTEMS, WHICH HAS PROVEN TO BE INTRACTABLE WITH CONVENTIONAL KNOWLEDGE ENGINEERING APPROACHES, MISCUE ANALYSIS. AS PART OF THE PROPOSED RESEARCH AND DEVELOPMENT EFFORT A PROTOTYPE NEURAL NETWORK SYSTEM WILL BE DEVELOPED WHICH ENABLES THE AUTOMATIC LEARNING OF CAUAL MODELS OF STUDENT FAILURES AND ERRORS, AND WHICH CAN READILY ADAPT TO INDIVIDUAL LEARNING STYLE DIFFERENCES.

HNC INC
5501 OBERLIN DR
SAN DIEGO, CA 92121
Program Manager: DR ROBERT HECHT-NIELSEN
Contract #:
Title: MENTAL WORKLOAD MEASUREMENT USING BRAINWAVE ANALYSIS
Topic #: AF90-066 Office: HSD/XART ID #: 39739

THIS PROJECT WILL DEVELOP A REAL-TIME MENTAL WORKLOAD MEASUREMENT SYSTEM BASED UPON A PROVEN BRAINWAVE ANALYSIS APPROACH THAT IS CURRENTLY IN RESEARCH USE. THE EXISTING APPROACH WILL BE AUGMENTED BY USE OF NEURAL NETWORK TECHNIQUES FOR FEATURE EXTRACTION AND PATTERN RECOGNITION. THE FEATURE EXTRACTION NEURAL NETWORK WILL UTILIZE A SELF-ORGANIZING, UNSUPERVISED TRAINING APPROACH. THE PATTERN RECOGNITION NEURAL NETWORK WILL BE TRAINED VIA SUPERVISED TRAINING. DURING PHASE I OF THE PROJECT THE ABILITY OF THE PRIMARY ANALYSIS APPROACH AND THE AUGMENTED APPROACH TO SUCCESSFULLY MEASURE MENTAL WORKLOAD FOR A FIXED TASK IN A LABORATORY SETTING WILL BE ASSESSED. A DESIGN FOR A REAL-TIME VERSION OF THE SYSTEM WILL ALSO BE DEVELOPED IN PHASE I. IN PHASE II A PROTOTYPE REAL-TIME REAL- WORLD SYSTEM FOR AIR FORCE USE WILL BE BUILT AND DEMONSTRATED. IN PHASE III OF THE PROJECT THE PROTOTYPE REAL-TIME SYSTEM WILL BE PRODUCTIZED IN PREPARATION FOR USE IN OPERATIONAL ENVIRONMENTS BY PHYSICIANS AND HOSPITALS IN CLINICAL PSYCHIATRY (E.G., FOR REAL-TIME MONITORING OF PATIENT RESPONSE DURING PSYCHIATRIC INTERVIEWS).

SMALL BUSINESS INNOVATION RESEARCH PROGRAM - PHASE I
AIR FORCE Solicitation 90.1

MEDICAL LASER RESEARCH & DEV CORP

PO BOX 539

MALDEN, MA 02148

Program Manager: DONNA BOURGELAIS

Contract #:

Title: PREVENTION OF GRAVITY INDUCED LOSS OF CONSCIOUSNESS

Topic #: AF90-066

Office: HSD/XART

ID #: 39740

A NOVEL APPROACH FOR THE PREVENTION OF G-LOC IS PROPOSED. A PROCESS FOR TEMPORARILY INCREASING THE OXYGEN AVAILABLE TO TISSUE IN BLOOD FLOW COMPROMISED AREAS WILL BE DEMONSTRATED IN PHASE I. PHASE II WILL INCLUDE OPTIMIZATION OF THE PROCESS AND THE DESIGN AND FABRICATION OF PROTOTYPE ANTI-G-LOC HELMETS FOR CENTRIFUGAL TESTING.

TECHNOLUBE PRODUCTS CO

5814 E 61ST ST

LOS ANGELES, CA 90040

Program Manager: WEN-HUEY LIN

Contract #:

Title: CHEMICAL MODELING OF HALOCARBON TOXICITY

Topic #: AF90-068

Office: HSD/XART

ID #: 39741

THE OBJECTIVE OF THE PROPOSED INVESTIGATION IS TO DEVELOP AND VALIDATE A PREDICTIVE QUANTITATIVE STRUCTURE/ACTIVITY RELATIONSHIP (QSAR) MODEL FOR THE BIOLOGICAL ACTIVITY (TOXICITY) OF HALOCARBON TYPE MATERIALS. ANOTHER OBJECTIVE IS TO COMPILE THE AVAILABLE DATA FOR THE HALOCARBON COMPOUNDS PRESENTLY KNOWN, AND TO IDENTIFY THE ADDITIONAL DATA NEEDED TO BE GENERATED AND COMPOUND TO BE SYNTHESIZED FOR VALIDATION OF THE DEVELOPED QSAR MODEL. THE ULTIMATE OBJECTIVE IS THE UTILIZATION OF THE MODEL THUS DEVELOPED TO PROVIDE PREDICTIVE CAPABILITY, BOTH FOR BIOLOGICAL AND CHEMICAL ACTIVITY, AND TO PERMIT THE DESIGN AND SYNTHESIS OF NONFLAMMABLE, BIOLOGICALLY INERT MATERIALS TAILORED FOR SPECIFIC AIR FORCE OR INDUSTRIAL APPLICATIONS.

BW TECHNOLOGY INC

3001 S DORCHESTER RD

COLUMBUS, OH 43221

Program Manager: BURTON H WENT

Contract #:

Title: APPLICATION OF G MODEL TECHNOLOGY IN AVIONIC SYSTEMS

Topic #: AF90-069

Office: ASD/XRX

ID #: 39824

G MODELS ARE A METHOD FOR REPRESENTING THE ELEVATION OF THE EARTH'S SURFACE THAT PROVIDE SOME SIGNIFICANT ADVANTAGES OVER THE CON-VENTIONAL MATRIX FORM USED IN DIGITAL TERRAIN ELEVATION DATA (DTED). AVIONIC SYSTEMS CURRENTLY UNDER R&D IN PROGRAMS SUCH AS ITARS IN THE AVIONICS LABORATORY MAKE EXTENSIVE USE OF DTED. ONE OF THE PRIMARY BENEFITS FROM USING G MODELS IN AVIONIC APPLICATIONS IN PLACE OF DTED IS THE FACT THAT THEY MAY USE LESS THAN 10% OF THE STORAGE SPACE REQUIRED BY DTED. SINCE THE G MODELS CONTAIN PROCESSED INFORMATION EXTRACTED FROM THE RAW DTED, THEY CAN IMPROVE THE PERFORMANCE OF CERTAIN FUNCTIONS AND REDUCE THE AMOUNT OF COMPUTATION REQUIRED. THIS PROPOSAL IS FOR A STUDY THAT WILL BETTER QUANTIFY THE POTENTIAL BENEFITS AND DEMONSTRATE THE UTILIZATION OF G MODELS IN SELECTED AVIONICS APPLICATIONS.

EIDETICS INTERNATIONAL INC

3415 LOMITA BLVD

SMALL BUSINESS INNOVATION RESEARCH PROGRAM - PHASE I
AIR FORCE Solicitation 90.1

TORRANCE, CA 90505

Program Manager: URBAN H D LYNCH

Contract #:

Title: INNOVATIVE LOW-COST MANNED MULTI-BOGIE AIR COMBAT SIMULATION

Topic #: AF90-069

Office: ASD/XRX

ID #: 39821

DEPARTMENT OF DEFENSE PROCUREMENT AGENCIES HAVE MADE IT CLEAR THAT THEY EXPECT FUTURE COMBAT AIRCRAFT CONTRACTORS TO BE ABLE TO SIMULATE DESIGN PERFORMANCE IN HIGHLY COMPLEX AND REALISTIC BATTLE ENVIRONMENTS. TODAY SIMULATIONS OF THIS ENVIRONMENT ARE EXPENSIVE TO PROCURE AND OPERATE. AS A RESULT, CURRENT SIMULATORS ARE LIMITED TO A FEW PLAYERS INHIBITING THE SCENARIO SIZE AND OPERATIONAL MEANINGFULNESS OF RESULTS. FORTUNATELY, THE RAPIDLY ADVANCING FIELDS OF MICROPROCESSORS AND VISUAL DISPLAYS OFFER TECHNOLOGICAL OPPORTUNITIES TO BUILD A HYBRID SIMULATOR WITH SUFFICIENT SCENARIO SIZE (E.G. 4v8) TO MEET THE NEEDS AT AFFORDABLE COSTS. RESEARCH AT EIDETICS HAS RESULTED IN AN INNOVATIVE OUT-THE-COCKPIT, GRAPHICS DISPLAY (CALLED AN EXPANDED FIELD OF VIEW - EFOV) THAT PROVIDES SUFFICIENT SITUATIONAL AWARENESS ON A SINGLE CRT TO ALLOW THE PLAYER TO BE A "CREDIBLE" OPPONENT IN CLOSE-IN, MANEUVERING AIR COMBAT. THIS RESEARCH ALLOWS THE DEVELOPMENT AND TEST OF AN AIR COMBAT STATION (ACSO AND THE SUPPORTING SOFTWARE TO PROVIDE A LOW-COST, MULTIPLE AIRCRAFT AIR COMBAT SIMULATION. THE OBJECTIVE OF THIS SBIR IS TO INTEGRATE HARDWARE, SOFTWARE AND DISPLAY CONCEPTS TO CREATE A LOW COST AIR COMBAT STATION THAT ALLOWS CREDIBLE BEYOND VISUAL RANGE (BVR) AND WITHIN VISUAL RANGE (WVR) AIR COMBAT FOR TECHNOLOGY EVALUATION, TACTICS DEVELOPMENT AND PILOT TRAINING.

MERIT TECHNOLOGY INC

5068 W PLANO PKWY

PLANO, TX 75093

Program Manager: S RAYMOND PATRICK

Contract #:

Title: LPI COMMUNICATIONS DETECTION ANALYSIS TOOL

Topic #: AF90-069

Office: ASD/XRX

ID #: 39822

THE QUEST FOR COVERT PENETRATION HAS RESULTED IN VARIOUS TECHNICAL BREAKTHROUGHS. MUCH OF THE RESEARCH DONE HAS BEEN IN THE AREA OF ADVANCED ROUTE PLANNING TO MINIMIZE THE EXPOSURE TO HOSTILE RADAR (TERRAIN, THREAT AND OBSTACLE AVOIDANCE; TERRAIN FOLLOWING, ETC.) AND THE DEVELOPMENT OF TECHNOLOGY TO AVOID DETECTION (STEALTH, RADAR ABSORPTION). IN THE AREA OF LOW PROBABILITY OF INTERCEPT (LPI) COMMUNICATIONS THE BULK OF THE WORK HAS BEEN ACCOMPLISHED AT WRDC/AAAI TO ASSIGN SYSTEM QUALITY FACTORS TO PROVIDE A QUANTITATIVE TECHNIQUE TO ALLOW THE SYSTEM ENGINEERS TO EVALUATE LPI EFFECTIVENESS. THE LPI CDAT BEING PROPOSED BY THIS SBIR WILL BE A PC BASED ANALYSIS TOOL WITH THE CAPABILITY TO DEVELOP A ROUTE PLAN FOR A SINGLE AIRCRAFT, MULTIPLE INDEPENDENT AIRCRAFT OR SEVERAL AIRCRAFT FLYING IN FORMATION. THE USER WILL BE ABLE TO RANDOMLY LOCATE USER DEFINED AIR DEFENSE UNITS (RADAR, JAMMERS, PASSIVE COMMUNICATION DETECTORS, ETC.) WITHIN A GAMING AREA LIMITED ONLY BY THE DTED DATA AVAILABLE TO THE USER. THE SYSTEM WILL BE ABLE TO PREDICT THE PROBABILITY OF DETECTION OF THE COMMUNICATION SYSTEM(S) BEING USED ON-BOARD THE AIRCRAFT AND INDICATE WHERE ALONG THE FLIGHT PATH THAT THE PLANE IS VULNERABLE.

STR CORP

10805 PARKRIDGE BLVD - STE 200

RESTON, VA 22091

Program Manager: W LEON GOODSON

Contract #:

Title: FIGHTER FORCE PLANNING PARAMETRICS WITHIN THE KENT/OME-III ANALYSIS FRAMEWORK

Topic #: AF90-069

Office: ASD/XRX

ID #: 39823

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THE AIR FORCE FACES INCREASING PRESSURES FROM A VARIETY OF DIRECTIONS, INCLUDING INTERNALLY, TO IMPROVE THE COHERENCE AND BALANCE OF ITS FORCE PLANNING PROCESS FOR CONVENTIONAL FORCES. THE ANALYSIS COMMUNITY NEEDS TO BE OF FAR GREATER HELP TO THE LEADERSHIP THAN IN THE PAST. NOW, WITH THE CONCEPTUAL DEVELOPMENT OF GEN GLENN A KENT'S "STRATEGIES TO TASK" ANALYSIS FRAMEWORK, AND THE DEVELOPMENT OF STR CORPORATION'S OME-III METHODOLOGY WHICH TREATS THE ABSOLUTELY DOMINANT "OPERATIONAL ART", WE CAN BE. WE PROPOSE TO DEMONSTRATE THE FEASIBILITY OF IMPLEMENTING THE KENT FORCE PLANNING FRAMEWORK USING OME-III AS THE PRIMARY ANALYTIC ENGINE. A PRODUCTING SYSTEM WILL REQUIRE THREE ELEMENTS OF CLOSELY RELATED RESEARCH: A MASTER ELEMENT TREATING FORCE STRUCTURE, FORCE CHARACTERISTICS, AND OPERATIONAL TASKS, AND TWO LOWER LEVEL ELEMENTS, ONE TREATING NEW FIGHTER AIRCRAFT PERFORMANCE CHARACTERISTICS, ANOTHER TREATING MUNITIONS. WE HAVE SUBMITTED ONE SBIR DIRECTED AT EACH ELEMENT. THIS ONE IS THE MASTER IN THAT IT CAN BE EXTREMELY USEFUL EVEN WHEN DONE INDEPENDENTLY OF THE TWO LOWER LEVEL ELEMENTS. THE CONVERSE IS NOT TRUE.

SUPERCONDUCTOR TECHNOLOGIES INC
460 WARD DR - STE F
SANTA BARBARA, CA 93111
Program Manager: DR ROBERT B HAMMOND
Contract #:

Title: LOW DISPERSION SUPERCONDUCTING DELAY LINES
Topic #: AF90-069

Office: ASD/XRX

ID #: 39825

DELAY LINES FABRICATED FROM HIGH-TEMPERATURE SUPERCONDUCTORS PROMISE BETTER PERFORMANCE WITH MUCH LOWER WEIGHT, VOLUME, POWER, AND COST REQUIREMENTS THAN CONVENTIONAL TECHNOLOGIES. WE PROPOSE TO FABRICATE AND MEASURE THE WIDE-BAND DISPERSION, LOSS, AND POWER-DEPENDENT CHARACTERISTICS OF A SUPERCONDUCTING DELAY LINE IN THE 6GHz TO 18GHz FREQUENCY RANGE FOR USE IN HIGH PERFORMANCE ELECTRONIC WARFARE (EW) SYSTEMS.

AB-TECH CORP
700 HARRIS ST
CHARLOTTESVILLE, VA 22901
Program Manager: KEITH C DRAKE
Contract #:

Title: ABDUCTIVE NETWORKS FOR COMPLEX AERONAUTICAL SYSTEMS DEVELOPMENT
Topic #: AF90-070

Office: ASD/XRX

ID #: 39826

INNOVATIVE ARTIFICIAL INTELLIGENCE TECHNIQUES HAVE THE POTENTIAL TO SOLVE MANY COMPLEX AIR FORCE PROBLEMS. ADVANCES IN COMPUTING SPEED AND EXISTING SOFTWARE TECHNOLOGY ALONE ARE UNLIKELY TO RESULT IN REAL-TIME AERONAUTICAL SYSTEMS CAPABLE OF MEETING THE COMPLEX REQUIREMENTS OF THE AIR FORCE MISSION. RATHER, AN ALTERNATIVE METHODOLOGY SUCH AS ABDUCTIVE TECHNOLOGY, A NEW TECHNOLOGY PRESENTED IN THIS PROPOSAL, IS ABSOLUTELY NECESSARY. ABDUCTIVE TECHNOLOGY IS AN INNOVATIVE POTENTIAL SOLUTION TO MANY CHALLENGES PRESENTED BY THE AIR FORCE MISSION BECAUSE IT ALLOWS COMPUTER SOFTWARE TO REASON EFFECTIVELY UNDER UNCERTAINTY, LEARN, AND RESOLVE COMBINATIONAL EXPLOSIONS OF POSSIBLE SITUATIONS IN A COMPACT AND RAPIDLY EXECUTABLE FORM. THESE CAPABILITIES WILL INCREASE THE PROBABILITY OF SUCCESSFULLY DEVELOPING PRACTICAL AND DEPENDABLE AIR FORCE SYSTEMS, REDUCE SOFTWARE DEVELOPMENT AND SUPPORT COSTS SUBSTANTIALLY, AND ENHANCE SYSTEM CAPABILITIES.

COGNET SYSTEMS INC
PO BOX 6069

SMALL BUSINESS INNOVATION RESEARCH PROGRAM - PHASE I
AIR FORCE Solicitation 90.1

CINCINNATI, OH 45206

Program Manager: DR BARRY C DEER

Contract #:

Title: MACHINE INTELLIGENCE: IMPROVING SPEECH RECOGNITION WITH DYNAMICAL-NEURAL NETWORKS

Topic #: AF90-070

Office: ASD/XRX

ID #: 39827

OUT OF THE MANY PARAMETERS OF SPEECH RECOGNITION BY MACHINE INTELLIGENCE THERE IS ESPECIALLY ONE KEY ELEMENT THAT MUST HAVE A SOLUTION. THIS INVOLVES THE VARIABILITY OF SPEECH. WE HAVE PROPOSED THAT THE RECENTLY DEVELOPED DYNAMICAL-NEURAL NETWORK IS A CLASS OF MACHINE INTELLIGENCE WHICH HAS PROPERTIES THAT WARRANTS FURTHER RESEARCH AND DEVELOPMENT FOR CONTRIBUTING SOLUTIONS TO THE PROBLEMS OF SPEECH RECOGNITION. IN PARTICULAR, DYNAMICAL-NEURAL NETWORKS SHOW OPTIMISTIC PROMISE BECAUSE THEY ARE INHERENTLY FAST, THE NATURE OF THEIR FUNCTIONS SUPPORT GENERALIZATION, AND THEY SHOW POTENTIAL FOR STORING LARGE AMOUNTS OF MEMORY ASSOCIATIVELY. THE ONE AREA OF DEVELOPMENT FOR DYNAMICAL-NEURAL NETWORKS, WHICH WOULD MAKE A LARGE IMPROVEMENT IN THE APPLICATION OF SPEECH RECOGNITION, IS THE LEARNING ALGORITHM. IN THIS DOCUMENT WE DESCRIBE A NEW LEARNING ALGORITHM, BASED ON THE NEURAL MECHANISMS OF LEARNING IN THE HUMAN BRAIN, WHICH WE BELIEVE HAS PROMISE FOR CONTROLLING THE TYPE OF ASSOCIATIVE MEMORY REQUIRED TO MEET THE MANY REQUIREMENTS OF A SPEECH RECOGNITION SYSTEM. IT IS THE PURPOSE OF THE PROPOSED WORK TO TEST THIS ALGORITHM, IN PHASE I, THEN MAKE ADAPTIONS AS THE TESTS INDICATE; AND, IN PHASE II, APPLY THE RESULTING IMPROVED NETWORK TO SPEECH RECOGNITION FOR DEFENSE AND COMMERCIAL APPLICATIONS.

SPARTA INC

23041 AVENIDA DE LA CARLOTA - STE 400

LAGUNA HILLS, CA 92653

Program Manager: OLIVER CATHEY

Contract #:

Title: RISKM COMPUTER MODEL FOR COST/RISK ANALYSIS

Topic #: AF90-071

Office: ASD/XRX

ID #: 39828

THIS SBIR PROPOSES THE FEASIBILITY OF APPLYING ENGINEERING ANALYSIS TECHNIQUES AS A COST/RISK/SCHEDULE ESTIMATING METHODOLOGY FOR COMPLEX DOD FULL SCALE DEVELOPMENT (FSD) PROGRAMS. THE PROPOSED COST ESTIMATING METHODOLOGY TAKES INTO ACCOUNT DEVELOPMENT RISK, RISK ABATEMENT AND ALTERNATE COMPONENT DEVELOPMENT PROGRAMS, DEADLINE MEETING, SUSTAINING ENGINEERING, MILESTONE TESTS AND "FLY OFFS", AND UNEXPECTED EXTERNAL CONSTRAINTS SUCH AS COST CEILINGS AND DEPENDENT PARALLEL DEVELOPMENT PROGRAMS. IT IS NUMERICALLY IMPLEMENTED IN A SPARTA PROPRIETARY COMPUTER PROGRAM CALLED RISKM. THE ENGINEERING ANALYSIS TECHNIQUES APPLIED IN RISKM ARE SIMULATION AND MONTE CARLO METHODS. RISKM COMBINES THESE TECHNIQUES WITH THREE SYSTEM ENGINEERING AND PROJECT MANAGEMENT TECHNIQUES: THE WBS, CRITICAL PATH METHOD (CPM) AND CLASSICAL RISK ANALYSIS.

ANALYSIS GROUP INC

9050 EXECUTIVE PARK DR - STE A-105

KNOXVILLE, TN 37923

Program Manager: TIMOTHY R RUSCH

Contract #:

Title: DETERMINATION OF EFFECTS OF INTEROPERABILITY ISSUES ON INTRATHEATER AIRLIFT

Topic #: AF90-072

Office: ASD/XRX

ID #: 39829

BETTER METHODS TO DELIVER AND DISSEMINATE CARGO ARE NECESSARY TO FULLY EXPLOIT THE CAPABILITIES OF FUTURE INTRATHEATER AIRLIFTERS. THE ARMY'S AND AIR FORCE RENEWED EMPHASIS

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ON MOBILITY WILL REQUIRE GREATER PRODUCTIVITY BY TRANSPORTATION RESOURCES TO ACHIEVE NATIONAL OBJECTIVES. THE NECESSITATES A MORE THOROUGHLY-INTEGRATED TRANSPORTATION NETWORK. ADVANCED TECHNOLOGIES, MATERIALS, AND INNOVATIVE ENGINEERING IDEAS CAN BE EXPLOITED ABOARD INTRATHEATER AIRLIFTERS-WHERE SUPPLIER MEETS USER-TO FACILITATE THE DELIVERY OF SUPPLIED. THIS PROPOSAL OUTLINES AN APPROACH TO IDENTIFY PROMISING TECHNOLOGIES AND MATERIALS, AND DEVELOP INNOVATIVE IDEAS. THIS WILL BE ACCOMPLISHED BY RESEARCHING TO UNCOVER CANDIDATE TECHNOLOGIES/MATERIALS/IDEAS, AND EXERCISING EFFECTIVENESS ANALYSIS TO MODEL THE NEW CAPABILITIES AND COMPARE BENEFITS. THE APPROACH EMPHASIZES ARMY AS WELL AS AIR FORCE INPUT TO MORE FULLY IDENTIFY THE KEY ISSUES IN INTRATHEATER AIRLIFT INTEROPERABILITY. SUCCESSFUL COMPLETION OF PHASE I OBJECTIVES WILL ORGANIZE AND CONSTRUCT THE APPROACH TO DEVELOP EFFECTIVE METHODS OF CARGO TRANSFER BETWEEN AIR FORCE INTRATHEATER AIRLIFT AND ARMY TRANSPORTATION ASSETS. PHASE II WILL IMPLEMENT THIS APPROACH AND ACCOMPLISH THESE GOALS.

FRONTIER TECHNOLOGY INC
4141 COL GLENN HWY - STE 140
BEAVERCREEK, OH 45433

Program Manager: RUSS CRAMER

Contract #:

Title: INNOVATIVE VULNERABILITY ASSESSMENT TECHNIQUES FOR CONCEPTUAL AIRCRAFT

Topic #: AF90-073

Office: ASD/XRX

ID #: 39830

SURVIVABILITY IS A MAJOR FACTOR IN DETERMINING THIS EFFECTIVENESS. ONE OF THE PRIMARY INPUTS FOR AIRCRAFT SURVIVABILITY EVALUATIONS ARE ESTIMATES OF THE AIRCRAFT'S VULNERABILITY. DURING THE COURSE OF THE DESIGN AND EVALUATION PROCESS, MANY AIRCRAFT DESIGNS WILL BE GENERATED AND A NEED EXISTS TO BE ABLE TO EVALUATE ALL OF THOSE DESIGNS CONSISTENTLY AND TO A LEVEL OF FIDELITY THAT ARE SENSITIVE TO THE SALIENT FEATURES OF THE DESIGN. AN INNOVATIVE APPROACH IS REQUIRED TO RAPIDLY ESTIMATE THE VULNERABILITY FOR CONCEPTUAL AIRCRAFT FOR A RANGE OF NON-NUCLEAR WEAPONS. THE OBJECTIVE OF THIS PROGRAM IS TO DERIVE AN INNOVATIVE APPROACH OF COMBINING EXISTING VULNERABILITY ASSESSMENT TECHNIQUES WITH ARTIFICIAL INTELLIGENCE AND AUTOMATION TOOLS TO REDUCE THE TIME AND MANPOWER NEEDED TO GENERATE THE VULNERABILITY ESTIMATES. THE RESULTS OF THIS EFFORT YIELDS TWO SIGNIFICANT PRODUCTS: 1) THE APPROACH USED TO DEVELOP THE TOOLS CAN BE APPLIED TO ANY ANALYSIS PROCESS NOT JUST THE VULNERABILITY ANALYSIS PROCESS. 2) THE RAPID ASSESSMENT TECHNIQUES TOOL CAN BE USED BY ANY ORGANIZATION WHO NEEDS TO EVALUATE THE VULNERABILITY OF MANY AIRCRAFT CONCEPTUAL DESIGNS.

GALAXY MICROSYSTEMS INC
10711 BURNET RD - STE 325
AUSTIN, TX 78758

Program Manager: GREGORY K CASWELL

Contract #:

Title: DETERMINATION OF A GENERIC DEPOT SUPPORT FUNCTION FOR LEADLESS CHIP CARRIER TECHNOLOGY ON THE F15E

Topic #: AF90-074

Office: ASD/VFL

ID #: 39831

LEADLESS CHIP CARRIER PACKAGING IS CURRENTLY IN USE IN SEVERAL LRUs ON THE F15E. EACH SUPPLIER CONFIGURES HIS OWN DEPOT SUPPORT FACILITY WITH PARTICULAR EMPHASIS ON THEIR OWN ASSEMBLIES. THIS RESULTS IN A PROLIFERATION OF DEPOT SUPPORT EQUIPMENT AND AN EXCESSIVE NEED FOR PERSONNEL TRAINING. THE PURPOSE OF THIS PROGRAM IS TO ASCERTAIN AN OVERALL DEPOT SUPPORT FUNCTION FOR LEADLESS CHIP CARRIER IMPLEMENTATION ON THE F15E THAT WILL PERFORM THE REQUISITE REWORK/REPAIR ON ALL AFFECTED LRUs.

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REAL-TIME INTELLIGENT SYSTEMS CORP

16 SUMMERHILL AVE

WORCESTER, MA 01606

Program Manager: PETER E GREEN

Contract #:

Title: MAINTENANCE SYSTEM FOR AI KNOWLEDGE BASES

Topic #: AF90-076

Office: WRDC/AA

ID #: 39832

THIS PROPOSAL IS FOR THE DESIGN OF A SHELL CALLED SKRAM WHICH, WHEN IMPLEMENTED, WILL BE A SOFTWARE TOOL WHICH CAN CONSIDERABLY REDUCE THE DEVELOPMENT AND MAINTENANCE PROBLEMS ASSOCIATED WITH REAL-TIME RTIFICIAL INTELLIGENCE SYSTEMS. THE PROPOSED SHELL WILL INCORPORATE THE RESULTS OF OVER A DECADE OF RESEARCH INTO METHODS FOR DEVELOPING, TESTING, AND MAINTAINING KNOWLEDGE BASED SYSTEMS WHICH FUNCTION IN REAL-TIME ENVIRONMENTS. SKRAM WILL BE BASED ON THE USE OF EVIDENCE FLOW GRAPHS (EFGs) WHICH ARE A COMMON DATA FLOW REPRESENTATION FOR INTELLIGENT SYSTEMS. USERS WILL BE ABLE TO DEVELOP AND MAINTAIN THEIR SYSTEMS DIRECTLY AS EFGs OR TO IMPORT RULES OR OTHER KNOWLEDGE BASES AND HAVE THESE AUTOMATICALLY TRANSLATED TO EFGs. SKRAM WILL HAVE THE CAPABILITY TO TRANSLATE EFGs INTO ADA CODE MODULES AND THEN TO LINK THESE WITH THE ACTIVATION FRAMEWORK EXECUTION ENVIRONMENT TO PRODUCE A RUN-TIME SYSTEM WHICH IS CAPABLE OF EXECUTION IN REAL-TIME ON A PARALLEL PROCESSOR SYSTEM. SKRAM WILL HAVE EXTENSIVE DEBUGGING AND TESTING FEATURES. IT WILL ALSO INCORPORATE THE USE OF A CONSTRAINT BASED TEST LANGUAGE FOR AUTOMATIC TEST GENERATION AND EVALUATION TO SUPPORT PERFORMANCE VALIDATION AND MAINTENANCE VERIFICATION.

AURORA ASSOCS

3350 SCOTT BLVD - BLDG 33

SANTA CLARA, CA 95054

Program Manager: DR I C CHANG

Contract #:

Title: INSTANTANEOUS FREQUENCY MEASUREMENT (IFM) CORRELATOR USING OPTICAL APPROACH

Topic #: AF90-077

Office: WRDC/AA

ID #: 39833

THE IFM IS ALMOST AN IDEAL RECEIVER FOR THE INTERCEPTION OF RADAR THREATS EXCEPT THAT IT CANNOT PROCESS MULTIPLE SIMULTANEOUS SIGNALS. A RECENTLY PROPOSED APPROACH USING CORRELATOR ARRAY SHOWS GOOD POTENTIAL OF RESOLVING THIS MAJOR DEFICIENCY. THIS PROPOSED EFFORT IS TO INVESTIGATE, ACCESS AND COMPARE DIFFERENT OPTICAL SIGNAL PROCESSING TECHNIQUES FOR THE IMPLEMENTATION OF IFM CORRELATORS. SEVERAL INCOHERENT AND COHERENT CONFIGURATIONS USING FIBER-OPTIC, ELECTRO-OPTIC AND ACOUSTO-OPTIC TECHNOLOGIES ARE PROPOSED. SYSTEM ANALYSIS AND EVALUATION WILL BE PERFORMED ON THE FEASIBILITY OF THE PROPOSED CORRELATORS. AN OPTIMUM DESIGN FEASIBILITY DEMONSTRATION MODEL WILL BE PURSUED IN THE SECOND PHASE EFFORT.

MARK RESOURCES INC

2665 - 30TH ST/STE 200

SANTA MONICA, CA 90405

Program Manager: RICHARD L MITCHELL

Contract #:

Title: ENVIRONMENT GENERATOR FOR COHERENT RADAR HYBRID SIMULATOR

Topic #: AF90-078

Office: WRDC/AA

ID #: 39834

RECENT ADVANCES IN DIGITAL TECHNOLOGY HAVE OPENED UP THE POSSIBILITY OF DEVELOPING AN AFFORDABLE ENVIRONMENT SIGNAL GENERATOR BASED ON DISTRIBUTED PROCESSING ELEMENTS. SUCH A SYSTEM, WHICH COULD INTER- FACE WITH THREAT RADAR SIMULATORS AS WELL AS ACTUAL RADAR

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SYSTEMS, WOULD BE MODULAR AND COULD BE DESIGNED TO BE EASILY RECONFIGURED FOR DIFFERENT RADARS AND MODES. IN THIS PROPOSAL WE DESCRIBED THE SYSTEM TRADE ISSUES THAT SHOULD BE CONSIDERED FOR DEVELOPING SUCH A SYSTEM. THE MAJOR ISSUES ARE SIGNAL FIDELITY AND HOW THE SIGNAL GENERATOR SHOULD BE INTERFACED TO THE RADAR SYSTEM UNDER TEST. SINCE THE INTERFACE IS LIKELY TO BE IN AN ANALOG FORMAT AT SOME IF OR RF, THE DIGITAL SIGNALS WILL PROBABLY BE CONVERTED TO ANALOG. IN THE PAST, SUCH CONVERSION HAS BEEN A PROBLEM WITH COMMERCIALY AVAILABLE HARD-WARE. HOWEVER, WE DESCRIBED A NEW DIGITAL QUADRATURE MODULATION TECHNIQUE THAT OVERCOMES SUCH PROBLEMS; THE TECHNIQUE IS CAPABLE OF SUPPRESSING ALL SPURIOUS COMPONENTS TO WELL BELOW -60 dB, WHICH IS REQUIREMENT OF MODERN COHERENT RADARS. MOST THREAT RADAR SIMULATORS ARE OF GROUND BASED RADARS. WE DESCRIBE THE SIGNAL GENERATION ISSUES FOR BOTH GROUND AND AIRBORNE RADARS, BECAUSE WITH A PROPERLY DESIGNED SYSTEM IT WILL BE POSSIBLE TO ACCOMMODATE BOTH, EVEN THOUGH THE TECHNIQUES FOR CREATING CLUTTER SIGNALS ARE VERY DIFFERENT FOR THE TWO SYSTEMS.

ADAPTIVE TECHNOLOGY INC
309 CURTIS ST
SYRACUSE, NY 13208
Program Manager: DONALD R MIEDANER

Contract #:

Title: TACTICAL FIGHTER X-BAND RADAR COHERENT SIDELobe CANCELLER

Topic #: AF90-079

Office: WRDC/AA

ID #: 39835

THIS PROJECT IS AIMED AT THE DEVELOPMENT OF COHERENT SIDELobe CANCELLER (CSLC) TECHNOLOGY IN THE HIGHER MICROWAVE REGION FOR APPLICATION TO THE TACTICAL FIGHTER X-BAND RADAR. IT WILL SPECIFICALLY ADDRESS A NUMBER OF DESIGN ISSUES, INCLUDING AUXILIARY ANTENNA DESIGN, CLUTTER/JAMMER INTERACTIONS, BLINKING JAMMERS, SLOW CONVERGENCE OF LMS ALGORITHMS, APPLICATION OF SMI ALGORITHMS, MOTION EFFECTS, RF-TO-DIGITAL CONVERSION ERRORS, ERROR EFFECTS DUE TO MULTIPATH SCATTERING AND POLARIZATION EFFECTS. A KEY FEATURE OF THE PROGRAM IS THE APPLICATION OF SPACE/TIME ADAPTIVITY TO THE CLUTTER/JAMMER INTERACTION PROBLEM. THIS MAY ALSO IMPROVE OVERALL CLUTTER SUPPRESSION PERFORMANCE OF THE RADAR BY ADAPTIVELY CANCELLING SIDELobe CLUTTER, ALONG WITH SIDELobe JAMMING, USING A CSLC AUXILIARY ARRAY. ANOTHER FEATURE OF THE PROJECT IS THE USE OF A TIME-SAMPLE COMPUTER MODEL, IMPLEMENTED ON A HIGH SPEED ARRAY PROCESSOR IN A SUN WORKSTATION ENVIRONMENT, WHICH WILL CLOSELY REPRESENT REAL HARD-WARE. FINALLY, THE PROJECT WILL DEFINE A PHASE II PROGRAM WHICH WILL DEVELOP AN EXPERIMENTAL X-BAND TEST BED FOR CONDUCTING LABORATORY AND ROOF TOP TESTS.

DISPLAYTECH INC
2200 CENTRAL AVE
BOULDER, CO 80301
Program Manager: MICHAEL J O'CALLAGHAN

Contract #:

Title: OPTICAL BEAM STEERING AND SHAPING USING FERROELECTRIC LIQUID CRYSTAL SPATIAL LIGHT MODULATORS

Topic #: AF90-080

Office: WRDC/AA

ID #: 39836

ONE FACTOR LIMITING THE USE OF OPTICS IN APPLICATIONS SUCH AS COMMUNICATIONS, LASER RADAR, AND OPTICAL PROCESSING IS THE LACK OF A SATISFACTORY TECHNOLOGY FOR THE STEERING AND SHAPING OF OPTICAL BEAMS. SIMILAR PROBLEMS HAVE EXISTED FOR RADAR AND RADIO COMMUNICATIONS SYSTEMS. IN THOSE TECHNOLOGIES, HOWEVER, THE PROBLEMS HAVE LARGELY BEEN SOLVED BY THE USE OF PHASED ARRAY ANTENNA TECHNIQUES. DISPLAYTECH HAS DEMONSTRATED A HIGH SPEED ELECTRICALLY ADDRESSED SPATIAL LIGHT MODULATOR (SLM) CONTAINING BOTH A 64x64 ARRAY AND A 1x128 ARRAY WHICH MAY SERVE AS A PROTOTYPE OPTICAL PHASED ARRAY (OPA). THE SLM WAS BUILT

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BY JOINING FERROELECTRIC LIQUID CRYSTALS (FLCs), A FAST, LOW-VOLTAGE, LOW-POWER ELECTROOPTIC MATERIAL, WITH SILICON INTEGRATED CIRCUITS (ICs). THIS DEVICE HAS A 4.5 kHz FRAME RATE, THEREFORE IT SHOULD BE CAPABLE OF STEERING A BEAM FROM ONE DIRECTION TO ANOTHER IN A TIME OF 220 μ s. IN THIS PHASE I WORK WE PROPOSE TO EVALUATE THE PERFORMANCE OF THE CURRENT DISPLAYTECH FLC-ICSLM USED AS AN OPA, IDENTIFY AND DEVELOP ALGORITHMS FOR BEAM FORMING AND STEERING, AND DO PRELIMINARY DESIGN OF A MORE ADVANCED FLC-ICSLM OPTIMIZED FOR BEAM FORMING AND STEERING. THE AIM OF THE PHASE I WORK WILL BE TO PROVIDE A BASIS FOR THE FABRICATION OF MORE ADVANCED DEVICES IN PHASE II.

SPECTRA SYSTEMS

PO BOX 495

DAYTON, OH 45459

Program Manager: PAUL D ZIDEK

Contract #:

Title: ENGAGEMENT VISUALIZATION FOR ELECTRONIC COMBAT (EC) SIMULATION MODELING

Topic #: AF90-081

Office: WRDC/AA

ID #: 39837

EVALUATION OF THE EFFECTIVENESS OF DEFENSIVE AVIONICS SYSTEMS IS A COMPLEX PROCESS INVOLVING ASSIMULATION OF LITERALLY HUNDREDS OF TEST DATA ELEMENTS ASSOCIATED WITH THE SYSTEM UNDER TEST, ENGAGEMENT SCENARIOS, CONDITIONS, ASSOCIATE MULTI-SPECTUAL AVIONICS, WEAPOS, THREATS, TACTICS, ETC. EC EFFECTIVENESS EVALUATIONS ARE FURTHER COMPLICATED BY A GROWING NUMBER AS WELL AS AN EVER-CHANGING PERCEPTION OF THREAT CAPABILITIES OF THE INTEGRATED AIR DEFENSE INFRASTRUCTURE DEVELOPED THROUGH AN EVOLVING SCIENTIFIC TECHNOLOGY BASE. GRAPHIC VISUALIZATION OF THESE EVALUATIONS INTERACTIONS AND INTERDEPENDENCIES WOULD SUBSTANTIALLY IMPROVE THIS PROCESS AND PROVIDE INSIGHT INTO THE RELATIONSHIPS OF THESE DESIGN VARIABLES WHICH IMPACT OVERALL EW SYSTEM EFFECTIVENESS. SPECTRA SYSTEMS PROPOSES TO SYNTHESIZE A VISUALIZATION EC EFFECTIVENESS SIMULATION EMPLOYING OFF-THE-SHELF DIGITAL MODELS AND GRAPHIC DISPLAYS IN AN OBJECT ORIENTED DESIGN APPROACH TO DEVELOP EARLY OPERATIONAL SIMULATION DEMONSTRATION CAPABILITY WITH LONG TERM GROWTH POTENTIAL.

SO-HA-R INC

1040 S LA JOLLA AVE

LOS ANGELES, CA 90035

Program Manager: DR HERBERT HECHT

Contract #:

Title: SOFTWARE PERFORMABILITY CONCEPTS AND MODELING

Topic #: AF90-082

Office: WRDC/AA

ID #: 39838

PERFORMABILITY FOR AVIONICS SOFTWARE IS DEFINED IN TERMS THAT ARE COMPATIBLE WITH THOSE USED FOR HARDWARE SYSTEMS AND THAT PERMIT GENERATION OF A SYSTEM PERFORMABILITY MEASURE. STOCHASTIC ACTIVITY NETWORKS ARE USED TO TRANSLATE USER LEVEL CAPABILITY MEASURES INTO ACTIVITIES OBSERVABLE AT THE LEVEL OF SOFTWARE TASKS. SINCE TOOLS ARE AVAILABLE FOR THE MANIPULATION AND ANALYSIS OF STOCHASTIC ACTIVITY NETWORKS, THE APPROACH LENDS ITSELF TO A HIGH DEGREE OF AUTOMATION.

ADVANCED DECISION SYSTEMS

1500 PLYMOUTH ST

MOUNTAIN VIEW, CA 94043

Program Manager: DR ROBERT FUNG

Contract #:

Title: EVIDENCE ACCRUAL FOR MODEL BASED VISION

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Topic #: AF90-08*

Office: WRDC/AA

ID #: 39839

SUCCESSFULLY APPLYING MODEL-BASED REASONING TO REAL WORLD VISION PROBLEMS (E.G. AUTOMATIC TARGET RECOGNITION (ATR)) REQUIRES ACCURATE REPRESENTATION OF COMPLEX RELATIONSHIPS AMONG THINGS IN THE WORLD AND OBSERVABLE IMAGE FEATURES. EVIDENCE ACCRUAL TECHNIQUES MUST BE ABLE TO OPERATE OVER THESE RELATIONSHIPS WITH LITTLE LOSS IN INFORMATION. CURRENT TECHNIQUES SUCH AS BAYESIAN NETWORKS SHOW PROMISE, BUT HAVE SOME LIMITATIONS IN THE NATURE OF THE RELATIONSHIPS THEY CAN EASILY REPRESENT. BINARY CONSTRAINT SYSTEMS SEEM TO BE A STRONG CANDIDATE FOR SUPPLEMENTING THIS OR OTHER EVIDENCE ACCRUAL SCHEMES. THE PROPOSED EFFORT WILL INVESTIGATE AND DEVELOP TECHNIQUES FOR PARAMETER ESTIMATION AND EVIDENCE ACCRUAL USING BINARY CONSTRAINT SYSTEMS. THIS DEVELOPMENT WILL TAKE PLACE ON THE SARES TESTBED.

INTELLIGENT SYSTEMS TECHNOLOGY INC

3100 DANNYHILL DR

LOS ANGELES, CA 90064

Program Manager: DR AZAD M MADNI

Contract #:

Title: COMPUTER AIDED SOFTWARE ENGINEERING (CASE) TOOLS FOR TOTAL-INTEGRATION AVIONICS (TIA) SYSTEMS

Topic #: AF90-084

Office: WRDC/AA

ID #: 39840

ADVANCED AVIONICS DEVELOPMENT PROGRAMS SUCH AS ICNIA, INEWS, PAVE PILLAR AND PAVE PACE ARE HEAVILY BASED ON THE CONCEPT OF RESOURCE SHARING KNOWN AS TOTAL-INTEGRATED AVIONICS (TIA). THE SUCCESS OF THESE PROGRAMS IS HIGHLY DEPENDENT ON THE EXTENT TO WHICH TIA CAN BE SUCCESSFULLY IMPLEMENTED IN ADVANCED MILITARY AIRCRAFT. ALTHOUGH TIA INVOLVES BOTH HARDWARE AND SOFTWARE, SOFTWARE ENGINEERING IS GENERALLY ACCEPTED AS THE KEY TO SUCCESSFUL TIA IMPLEMENTATION. THIS PROJECT WILL EVALUATE COMPUTER-AIDED SOFTWARE ENGINEERING (CASE) TOOLS AGAINST THE SOFTWARE ENGINEERING LIFE CYCLE PROCESS AND TOTAL-INTEGRATED AVIONICS REQUIREMENTS. THE OVERALL OBJECTIVE OF THIS EFFORT IS TO DEFINE A CONCEPTUAL FRAMEWORK AND DESIGN FOR AN INTEGRATED SUITE OF CASE TOOLS THAT WILL INCREASE THE COST EFFECTIVENESS OF TIA SOFTWARE DEVELOPMENT, MAINTENANCE AND CONFIGURATION MANAGEMENT.

INTEGRITY SYSTEMS INC

600 MAIN ST - STE 4

WINCHESTER, MA 01890

Program Manager: DR NEAL A CARLSON

Contract #:

Title: DISTRIBUTED MODEL ADAPTIVE ESTIMATION

Topic #: AF90-085

Office: WRDC/AA

ID #: 39841

THIS INVESTIGATION WILL DEVELOP MULTIPLE MODEL ADAPTIVE ESTIMATION (MMAE) TECHNIQUES FOR DISTRIBUTED KALMAN FILTERS (DKFs), WITH THE GOAL OF IMPROVING FILTER ROBUSTNESS WHILE MAINTAINING NEAR-OPTIMAL ACCURACY OF MULTI-SENSOR NAVIGATION SYSTEMS. THE MMAE APPROACH PROVIDES FILTER ROBUSTNESS IN SYSTEMS WITH UNCERTAIN MODEL PARAMETERS OR PARAMETER CHANGES, TYPICALLY RELATED TO SOURCES OF PROCESS NOISE OR MEASUREMENT NOISE. HOWEVER, WITH CONVENTIONAL KALMAN FILTERS, THIS APPROACH IS IMPRACTICAL WHEN MORE THAN TWO OR THREE UNCERTAIN PARAMETERS EXIST. THE DKF METHOD PERMITS A LARGE, MULTI-SENSOR FILTER TO BE PARTITIONED INTO A SET OF SMALLER LOCAL FILTERS OPERATING IN PARALLEL, PLUS A MASTER FILTER PERIODICALLY COMBINING THE LOCAL FILTER SOLUTIONS. THE DKF METHOD PROVIDES OPTIMAL OR NEAR-OPTIMAL ACCURACY, REDUCE PROCESSING BURDEN, AND IMPROVE FAULT TOLERANCE. THE DKF/MMAE (DMAE) TECHNIQUES DEVELOPED HERE WILL ALLOW A LARGE NUMBER OF UNCERTAIN SENSOR

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PARAMETERS TO BE ACCOMMODATED, VIA LOCAL ADAPTATION OF MULTIPLE LOCAL MODELS, PLUS GLOBAL ADAPTATION AT THE MASTER LEVEL. THESE NEW TECHNIQUES WILL EMPLOY DKF PARTITIONING TO REDUCE THE TOTAL NUMBER OF MULTIPLE MODELS REQUIRED, TO REDUCE THE SIZE OF EACH MODEL-SPECIFIC FILTER, AND TO IMPROVE THE OVERALL ADAPTATION PROCESS.

POLYLITHICS INC

3450 CENTRAL EXPWY

SANTA CLARA, CA 95051

Program Manager: DAVID N DEVGAN

Contract #:

Title: 5 na ECL MEMORY MODULE USING POLYLITHICS MULTICHIP MODULES (MCM)

Topic #: AF90-086

Office: WRDC/EL

ID #: 39843

THE THIN FILM INTERCONNECT DESIGNED AND MANUFACTURED BY POLYLITHICS ALLOWS EXTREMELY TIGHT PACKAGING OF BARE INTEGRATED CIRCUIT DIE. DUE TO SHORT WIRE LENGTHS AND A CONTROLLED ELECTRICAL ENVIRONMENT, SIGNALS TRAVEL EFFICIENTLY BETWEEN CHIPS. WITH CHIP TO CHIP COMMUNICATION BOTTLENECKS ELIMINATED, POLYLITHICS MULTICHIP CIRCUITS OFFER DISTINCT PERFORMANCE ADVANTAGED OVER CONVENTIONAL PRINTED CIRCUIT BOARD IMPLEMENTATIONS. PROPRIETARY REACH THROUGH VIA TECHNIQUES (RTV) USING SEMICONDUCTOR PROCESSING CREATE DIRECT CONNECTIONS TO THE CHIP SURFACE WHICH CAN BE 100 TIMES SMALLER THAN CONVENTIONAL BONDING PADS. THIS FEATURE DRAMATICALLY INCREASES THE NUMBER OF POSSIBLE SIGNALS PER CHIP AND ALLOWS DESIGNERS TO BUILD MORE PARALLEL ARCHITECTURES THAT INCREASE SYSTEM PERFORMANCE. SINCE THE JOINTS FORMED BY THIS APPROACH SUBSTANTIALLY RESEMBLE INTERNAL THIN FILM CHIP VIAS IT ADDS TO THE RELIABILITY OF THE SYSTEM. POLYLITHICS DIE ATTACHMENT TECHNIQUES PROVIDE A THERMAL PATH THROUGH THE CHIP BACKSIDE TO A HEAT SINK TOTALLY INDEPENDENT OF THE INTERCONNECT STRUCTURE THUS NO COMPROMISE BETWEEN WIRING CHANNELS AND HEAT PATH ARE REQUIRED. THIS ALLOWS FOR OPTIMIZATION OF BOTH SIGNAL CHANNEL DENSITY AND DIE HEAT REMOVAL.

VISTA TECHNOLOGIES INC

1100 WOODFIELD RD - STE 108

SCHAUMBURG, IL 60173

Program Manager: SOWMITRI SWAMY

Contract #:

Title: A RAPID PROTOTYPING ENVIRONMENT FOR PACKAGING AND OTHER TECHNOLOGY ISSUES

Topic #: AF90-086

Office: WRDC/EL

ID #: 39842

THIS PROPOSAL PRESENTS IDEAS AND A PLAN OF NEW TECHNOLOGY DEVELOPMENT FOR ADDRESSING PACKAGING AND OTHER TECHNOLOGY ISSUES IN ELECTRONIC SYSTEM DESIGN. THE PROPOSED WORK HAS AS ITS OBJECTIVE, THE IMPLEMENTATION OF A RAPID PROTOTYPING ENVIRONMENT THAT CONSISTS OF A SET OF TOOLS SUPPORTING HARDWARE DESIGN MEETING SPECIFIC RELIABILITY, PACKAGING, AND PERFORMANCE CONSTRAINTS. IT SUPPORTS ADDING CHANGES, CHANGING MODULARITY, REUSE, ABSTRACTION, AND CONSTRAINT PROPAGATION, FEATURES THAT ARE NECESSARY IN ANY RAPID PROTOTYPING ENVIRONMENT. THE PROPOSED ENVIRONMENT WILL BE BUILT AROUND A HIERARCHICAL GRAPHICAL TOOL THAT WILL BE USED TO DEVELOP LAYERS OF HARDWARE DESCRIPTIONS INVOLVING INTERCONNECT, PACKAGING, AND PERFORMANCE DATA.

N-CHIP INC

1971 NORTH CAPITOL AVE

SAN JOSE, CA 95132

Program Manager: DAVID B TUCKERMAN

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Contract #:

Title: DEVELOPMENT OF BURN-IN TECHNOLOGIES FOR UNPACKAGED INTEGRATED CIRCUITS (DICE)

Topic #: AF90-087

Office: WRDC/EL

ID #: 39844

THE ABILITY TO MANUFACTURE LARGE MULTICHIP MODULES WITH REASONABLE YIELDS AND COSTS IS HINDERED PRIMARILY BY THE PROBLEM OF BURN-IN LOSSES, WHICH CAN BE AS HIGH AS 5% PER CHIP. ONE SOLUTION WOULD BE TO PERFORM A "BURN-IN" OF THE BARE CHIPS (DICE) PRIOR TO THEIR ASSEMBLY INTO A MULTICHIP MODULE. NO PROVEN MANUFACTURING PROCESSES EXIST YET TO DO THIS. IT IS THE ULTIMATE OBJECTIVE OF THIS PROJECT TO DEVELOP SUCH A CAPABILITY. OUR GENERAL APPROACH IS TO USE A RELATIVELY LOW-COST HIGH-DENSITY INTERCONNECTION SUBSTRATE SUCH AS A "SILICON CIRCUIT BOARD" OR A FLEX-CIRCUIT TO DISTRIBUTE POWER, CLOCK, AND DATA LEVELS TO AN ARRAY OF DIE MOUNTING SITES ON ITS SURFACE. EACH DIE WOULD BE POSITIONED WITH ITS I/O BOND PADS FACING THE INTERCONNECTION SUBSTRATE, WITH MEANS FOR TEMPORARILY ELECTRICALLY CONNECTING THESE BOND PADS TO THE SUBSTRATE FOR THE DURATION OF THE BURN-IN. THE PHASE I EFFORT WILL FOCUS ON EVALUATING THE FEASIBILITY (BOTH ANALYTICALLY AND EXPERIMENTALLY) OF VARIOUS PROPOSED INTER- CONNECTION METHODS, WITH EMPHASIS ON RELIABLE ATTACHMENT AND DETACHMENT TO ALUMINUM BOND PAD METALLURGIES, WHILE AVOIDING ANY DAMAGE OR CONTAMINATION TO THE DIE AND ITS BOND PADS.

AERODYNE RESEARCH INC

45 MANNING RD

BILLERICA, MA 01821

Program Manager: DR ROGER S PUTNAM

Contract #:

Title: MICROWAVE ANALOG TO DIGITAL CONVERTER USING PARALLEL OPTICAL SAMPLING

Topic #: AF90-088

Office: WRDC/EL

ID #: 39845

WE PROPOSE TO DEMONSTRATE AN OPTICAL ANALOG-TO-DIGITAL CONVERTER FOR MICROWAVE ANALOG SIGNALS WHICH UTILIZES A SINGLE ELECTROOPTIC BROADBAND VELOCITY MATCHED TRAVELLING WAVE MODULATOR BUT WITH MULTIPLE PULSED OPTICAL BEAMS TO SAMPLE THE SIGNAL AND MULTIPLE STANDARD ELECTRONIC A/D'S TO ACCOMPLISH THE CONVERSION IN PARALLEL. THE DIGITAL OUTPUT WORDS APPEAR ON MULTIPLE SETS OF LINES APPROPRIATE FOR A MASSIVELY PARALLEL DIGITAL SIGNAL PROCESSOR. THIS DESIGN AVOIDS CERTAIN WEAKNESSES EVIDENT IN PAST OPTICAL AND ELECTRONIC A/D'S SUCH AS NO VELOCITY MATCHING OF THE OPTICAL AND MICROWAVE FIELDS, SERIAL PROBLEMS SUCH AS DIGITAL DATA LINES RUNNING AT MICRO- WAVE SPEEDS, ANY ELECTRONICS WORKING AT THE MICROWAVE SAMPLING SPEEDS, OR AMBIGUITY CAUSED BY USING AN OPTICAL TECHNIQUE THAT DETERMINED THE BIT VALUES IN THE DIGITAL OUTPUT WORD INDEPENDENTLY OF EACH OTHER AND WAS THEREFORE SUBJECT TO GROSS ERRORS FROM SMALL AMOUNTS OF INTERNAL A/D NOISE OR EXTREMELY SMALL MISADJUSTMENTS. THE PROJECT OBJECTIVE IS THE DEMONSTRATION OF A TWO CHANNEL OPTICAL A/D THAT CAN BE EXTENDED IN SPEED BY A SIMPLE PARALLEL EXPANSION.

EMCORE CORP

35 ELIZABETH AVE

SOMERSET, NJ 08873

Program Manager: DR GARY S TOMPA

Contract #:

Title: DEVELOPMENT OF SiGe HETEROJUNCTION BIPOLAR TRANSISTOR (HBT) PRODUCTION TECHNOLOGY

Topic #: AF90-089

Office: WRDC/EL

ID #: 39846

THIS PROPOSAL ADDRESSES THE EPITAXIAL GROWTH OF Si/SiGe HBT DEVICES. THIS WILL BE ACCOMPLISHED USING AN ULTRAHIGH VACUUM EPITAXIAL GROWTH SYSTEM COMBINED WITH THE DEVELOPMENT OF AN ADVANCED, CARRIER GAS BASED, VAPOR TRANSPORT TECHNIQUE OPERATING IN THE 10(-3) - 10(-6) TORR RANGE. THE TECHNIQUE IS CALLED VAPOR TRANSPORT EPITAXY (VTE). GROUP IV

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MATERIALS SUCH AS Si/SiGe ARE OF PARTICULAR INTEREST, SINCE THEY PROMISE TO BE THE NEXT GENERATION IN HIGH SPEED Si BASED DEVICES. IN PHASE I, THE GROWTH AND MATERIALS CHARACTERISTICS OF Si/SiGe STRUCTURES WOULD BE DETERMINED. IN PHASE II DOPING TECHNIQUES WOULD BE ESTABLISHED AND FUNCTIONAL DEVICES WOULD BE FABRICATED AND CHARACTERIZED. ALSO IN PHASE II FET STRUCTURES WILL BE INVESTIGATED.

ZYBRON TECHNOLOGY INC
6012 N DIXIE DR
DAYTON, OH 45414
Program Manager: DR YOU-WEN ZHANG
Contract #:

Title: VIDEO DATA MEMORY: A NEW DESIGN FOR A HIGH SPEED HIGH DENSITY SYSTEM
Topic #: AF90-090 Office: AD/PMR ID #: 40945

A MULTI-HOLOGRAPHIC OPTICAL HEAD MULTI-OPTICAL FIBER CHANNEL ARCHITECTURE IS PROPOSED. EXPECTING TO ACHIEVE A HIGH SPEED (500 FRAMES PER SPEED) HIGH DENSITY (1024x1024x8 BITS) VIDEO DATA MEMORY SYSTEM FOR NEW SOLID STATE IMAGES. THE SYSTEM WOULD BE PROGRAMMABLE; VOLUME WILL STAY WITHIN 200 INCH; OUTPUT CAN BE DIGITAL OR NTSC ANALOG. THE SYSTEM IS INTENDED FOR USE IN EXTREMELY SEVERE AIRBORNE CONDITIONS. UNLIKE CONVENTIONAL ELECTRONIC MEMORY SYSTEMS, THE PROPOSED SYSTEM WOULD HAVE TWO HEADS AND 8 OPTICAL FIBERS (CHANNELS) TO READ AND WRITE ON BOTH SIDES OF A DISK, AND THUS REALIZE HIGHER SPEEDS. ACCESS TIMES ARE MUCH SHORTER, THE SYSTEM WOULD USE A LIGHTWEIGHT HOLOGRAPHIC OPTICAL HEAD WITH A MOVING MASS OF LESS THAN 10 GRAMS. THE DESIGN WOULD USE A SHORT (680 nm) INSTEAD OF A LONG WAVELENGTH (823 nm) LASER DIODE, THEREBY INCREASING THE RECORDING DENSITY AT LEAST 50%. A PHILIPS AIR STANDARD STRUCTURE IS CONSIDERED, WITH A PHASE-CHANGE ERASABLE MATERIAL SUCH AS THE SELENIUM-INDIUM-ANTIMONY ALLOY. A 12 INCH DISK WOULD YIELD AT LEAST 30 SECONDS OF VIDEO DATA.

OPTRA INC
66 CHERRY HILL DR
BEVERLY, MA 01915
Program Manager: DAVID W VOORHES
Contract #:

Title: IMPROVED RTP TEMPERATURE MEASUREMENT TECHNOLOGY
Topic #: AF90-091 Office: WRDC/EL ID #: 39847

OPTRA WILL DEMONSTRATE AN IMPROVED TEMPERATURE MEASUREMENT SYSTEM UTILIZING LASER EXTENSOMETER TECHNOLOGY FOR USE IN THE RAPID THERMAL PROCESSING (RTP) OF SILICON WAFERS. THE SYSTEM WILL DETERMINE REAL-TIME SILICON WAFER TEMPERATURES TO 0.1 DEG C ACCURACY AND RESOLUTION AND WILL HAVE A MEASUREMENT BANDWIDTH OF MORE THAN 200 Hz. THE SYSTEM WILL BE SUITABLE FOR CLOSED LOOP CONTROL OF RTP OVENS AND WILL OFFER IMPROVED PERFORMANCE OVER EXISTING PYROMETRIC TECHNOLOGY IN TERMS OF ACCURACY, RESOLUTION AND RELIABILITY. THE SYSTEM WILL BE ENTIRELY NON-CONTACTING AND WILL BE ADAPTABLE TO EXISTING RTP DESIGNS.

DEACON RESEARCH
2440 EMBARCADERO WY
PALO ALTO, CA 94303
Program Manager: ANTHONY O'KEEFE
Contract #:

Title: TUNABLE VISIBLE SOLID STATE LASERS BASED ON DOPED DIAMOND SUBSTRATES
Topic #: AF90-092 Office: WRDC/EL ID #: 39848

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RECENT SCIENTIFIC AND TECHNICAL ADVANCES IN THE FIELD OF SYNTHETIC DIAMOND DEPOSITION HAVE MADE IT POSSIBLE TO GROW HIGH PURITY OR DOPED DIAMOND FILMS AND OFFER THE POTENTIAL FOR THE TAILORED GROWTH OF LASER QUALITY CRYSTALS. THE UNIQUE PROPERTIES OF DIAMOND, SUCH AS ITS CHEMICAL STABILITY, HIGH THERMAL CONDUCTIVITY AND ITS WIDE OPTICAL TRANSMISSION RANGE, MAKE IT ATTRACTIVE AS A SUBSTRATE FOR SOLID STATE LASER SYSTEMS. THE PRODUCTION OF HIGH QUALITY, SYNTHETIC DIAMONDS OFFERS THE POTENTIAL FOR GROWING SELECT CRYSTALS TO CREATE TAILORED LASER SUBSTRATES. SEVERAL PROPOSED DOPED DIAMOND SYSTEMS COULD RESULT IN NEW SOLID STATE LASERS WITH TUNABLE OUTPUT FREQUENCIES IN THE VISIBLE. WE PROPOSE A PROOF-OF-PRINCIPLE EXPERIMENT TO TEST THIS CAPABILITY. THE EXPERIMENTS PROPOSED IN THIS PHASE I STUDY WILL TEST THE FEASIBILITY OF THIS APPROACH BY PRODUCING AND CHARACTERIZING SELECTIVELY DOPED CRYSTALS THROUGH PHYSICAL MODIFICATION OF NATURAL DIAMONDS. THE FINAL EVALUATION WILL BE BASED UPON THE EXTENT OF DOPING WHICH CAN BE ACHIEVED, AS WELL AS A SPECTROSCOPIC ANALYSIS OF THE DOPED CRYSTALS. THIS EVALUATION WILL DETERMINE THE POTENTIAL OF SUCH DOPED DIAMONDS AS ADVANCED LASER MATERIALS.

FOSTER-MILLER INC
350 SECOND AVE
WALTHAM, MA 02254
Program Manager: PHILIP STARK
Contract #:
Title: NEW STRAIN MEASUREMENT SYSTEM FOR HIGH TEMPERATURE MATERIALS
Topic #: AF90-093 Office: WRDC/FI ID #: 39849

A MAJOR PROBLEM FACING DESIGNERS OF HIGH TEMPERATURE STRUCTURAL COMPONENTS IS THE LACK OF ACCURATE HIGH TEMPERATURE MECHANICAL PROPERTY DATA. ONE OF THE CENTRAL CAUSES OF THIS PROBLEM IS THE DIFFICULTY IN ATTACHING STRAIN GAUGES IN A MANNER WHICH WILL ENSURE SURVIVAL UNDER SEVERE THERMAL STRESSES AND NOT INTERFERE WITH STRAIN MEASUREMENT. FOSTER-MILLER IS PROPOSING AN INNOVATIVE NEW CONCEPT IN STRAIN MEASUREMENT WHICH WILL BE APPLICABLE TO A VARIETY OF MATERIALS AND WILL BE USABLE TO TEMPERATURES OVER 2,000 DEG F. THE CONCEPT INVOLVES CREATION OF A NEW TYPE OF CAPACITANCE GAUGE AND A NEW ATTACHMENT TECHNIQUE, WITH SIGNIFICANT ADVANTAGES OVER PRESENT TECHNOLOGY. THESE ADVANTAGES INCLUDE: GAUGE DOES NOT NEED TO BE ELECTRICALLY ISOLATED FROM THE TEST SPECIMEN; BRAZE AND WELD ATTACHMENT TECHNIQUES CAN BE EMPLOYED; THIN FILM TECHNOLOGY REDUCES ATTACHMENT STRESS, INCREASES GAUGE STRAIN CAPABILITY, ENSURES ACCURACY OF STRAIN MEASUREMENT; INCREASED DURABILITY AND RESISTANCE TO OPEN CIRCUIT FAILURES. UNAFFECTED BY CHANGE IN GAUGE RESISTANCE WITH TEMPERATURE.

SYSTEMS CONTROL TECHNOLOGY INC
2300 GENG RD
PALO ALTO, CA 94303
Program Manager: MARK R ANDERSON
Contract #:
Title: DESIGN GUIDELINES FOR MULTIVARIABLE FLIGHT CONTROL
Topic #: AF90-094 Office: WRDC/FI ID #: 39850

THE OBJECTIVE OF THIS RESEARCH IS TO DEVELOP EVALUATION GUIDELINES FOR MULTIVARIABLE FLIGHT CONTROL SYSTEMS. SCT PROPOSES THE USE OF STRUCTURED SINGULAR VALUE ANALYSIS TECHNIQUES TO OBTAIN EVALUATION GUIDELINES FOR MULTIVARIABLE FLIGHT CONTROL SYSTEMS. STRUCTURED SINGULAR VALUE ANALYSIS TECHNIQUES ARE THE MOST PROMISING TOOLS FOR MULTIVARIABLE FLIGHT CONTROL SYSTEM EVALUATION BECAUSE BOTH STABILITY AND PERFORMANCE GUIDELINES CAN BE ADDRESSED. STRUCTURED SINGULAR VALUE ANALYSIS REQUIRES SPECIFICATION OF A BLOCK DIAGRAM STRUCTURE WHEREIN EACH EVALUATION GUIDELINE IS REPRESENTED BY A WEIGHTING FILTER. THE PRIMARY OBJECTIVE OF THIS PHASE I EFFORT WILL BE TO CONSTRUCT A COMPLETE ANALYSIS BLOCK

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STRUCTURE FOR A SELECTED CONTROL TASK AND AIRCRAFT CLASSIFICATION. THE EVALUATION GUIDELINES INCLUDED IN THE ANALYSIS BLOCK STRUCTURE WILL BE COMPILED FROM MILITARY SPECIFICATIONS, CONTROL THEORY LITERATURE, AND DOCUMENTED FLIGHT CONTROL DESIGN STUDIES.

HIGH TECHNOLOGY CORP
28 RESEARCH DR
HAMPTON, VA 23666

Program Manager: MUJEEB R MALIK

Contract #:

Title: ADVANCED COMPUTATIONAL TECHNIQUES IN STUDIES OF HYPERSONIC BOUNDARY-LAYER TRANSITION

Topic #: AF90-095

Office: WRDC/FI

ID #: 39851

THE OBJECTIVE OF THE PROPOSED WORK IS TO USE ADVANCED THEORETICAL AND COMPUTATIONAL TECHNIQUES FOR STUDIES OF HYPERSONIC BOUNDARY LAYER STABILITY AND TRANSITION TO TURBULENCE. THESE STUDIES WILL ENHANCE OUR UNDERSTANDING OF THE TRANSITION PHENOMENA AND THUS HELP PREDICT AND CONTROL TRANSITION WITH A HIGH DEGREE OF CONFIDENCE. TO ACHIEVE OUR GOAL, WE USE LINEAR STABILITY THEORY, SECONDARY INSTABILITY AND WEAKLY NONLINEAR THEORIES AND FULL NUMERICAL SIMULATIONS INVOLVING STATE-OF-THE-ART COMPUTATIONAL TECHNIQUES (MULTI-DOMAIN SPECTRAL COLLOCATION METHODS, HIGHER-ORDER FINITE- DIFFERENCE METHODS). OF PARTICULAR INTEREST TO US IS THE INVESTIGATION OF THE EFFECT OF ADVERSE PRESSURE GRADIENT AND THE QUESTION OF NONLINEAR BREAKDOWN. A LONG-TERM GOAL IS TO COUPLE THE LINEAR AND NONLINEAR STAGES WITH RECEPTIVITY PHENOMENON IN ORDER TO DEVELOP A TRULY PREDICTIVE TECHNIQUE WHICH IS NEEDED FOR THE DESIGN OF HYPERSONIC VEHICLES.

ULTRAMET
12173 MONTAGUE ST
PACOIMA, CA 91331

Program Manager: ANDREW J SHERMAN

Contract #:

Title: LIGHTWEIGHT THERMAL PROTECTION SYSTEM FOR HYPERSONIC VEHICLE CREW ESCAPE

Topic #: AF90-096

Office: WRDC/FI

ID #: 39852

A MAJOR BARRIER TO THE DEVELOPMENT OF EMERGENCY CREW ESCAPE SYSTEMS FOR HYPERSONIC SPACE-CAPABLE VEHICLES (I.E. NASP) IS THE EXCESSIVE WEIGHT ASSOCIATED WITH THE REQUIRED THERMAL PROTECTION HEAT SHIELD. IN THIS PHASE I PROGRAM, ULTRAMET PROPOSES TO UTILIZE ITS EXTENSIVE EXPERIENCE AND EXPERTISE IN THE FABRICATION OF LIGHTWEIGHT REFRACTORY FOAM STRUCTURES TO REDESIGN THE HEAT SHIELD USING NEW MATERIALS TO REDUCE THE WEIGHT BY AT LEAST 50%. A RETICULATED VITREOUS CARBON FOAM WILL BE INFILTRATED WITH HAFNIUM CARBIDE (HfC) BY CHEMICAL VAPOR INFILTRATION (CVI). THIS LIGHTWEIGHT REFRACTORY STRUCTURE WILL THEN BE TESTED FOR THERMAL INSULATION CAPACITY USING A FLAME IMPINGEMENT APPARATUS. FABRICATION AND STRUCTURAL ATTACHEMENT APPROACHES WILL ALSO BE INVESTIGATED AND EVALUATED. IN PHASE I, COUPONS OF REPRESENTATIVE MATERIALS WILL BE FABRICATED, TESTED, AND DELIVERED. IN PHASE II, A LARGER SUBSCALE PORTION OF THE HEAT SHIELD WILL BE CONSTRUCTED AND SUBJECTED TO MECHANICAL AND THERMAL TESTING IN SIMULATED TYPICAL OPERATING ENVIRONMENTS.

CSA ENGINEERING INC
560 SAN ANTONIO RD - STE 101
PALO ALTO, CA 94306

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Program Manager: DR WARREN C GIBSON

Contract #:

Title: DESIGN CRITERIA FOR MULTIDISCIPLINARY OPTIMIZATION

Topic #: AF90-097

Office: WRDC/FI

ID #: 39853

ADVANCED AIR FORCE AIRCRAFT WILL REQUIRE EXTENSIONS OF PRESENT ANALYSIS AND OPTIMIZATION SOFTWARE. MULTIDISCIPLINARY OPTIMIZATION, IN PARTICULAR, WILL BE REQUIRED SO THAT SOME OF THE DESIGN PROCESS CAN BE AUTOMATED IN A WAY THAT TAKES INTO ACCOUNT FACTORS SUCH AS MATERIAL PROPERTIES, LOADS, FATIGUE AND FRACTURE, IMPACT DAMAGE, AEROELASTICITY, AND CONTROL SYSTEMS. EACH OF THESE AREAS REQUIRES DESIGN CRITERIA TO INSURE PERFORMANCE AND SAFETY. THE CRITERIA MAY BE IMPLEMENTED BY FORMULAS, DESIGN CHARTS, COMPUTER PROGRAMS, ETC. THE CHALLENGE IS TO ADAPT THESE CRITERIA IN A MANNER THAT MAKES THEM SUITABLE FOR AN OPTIMIZATION CODE. THERE ARE SEVERAL WAYS TO DEAL WITH THESE CRITERIA, DEPENDING ON THEIR NATURE: THEY COULD BE FULLY INTEGRATED WITH THE STRUCTURAL OPTIMIZATION OR TREATED IN A SUB-SIDIARY OPERATION. PHASE I IS INTENDED TO EXPLORE DESIGN CRITERIA FOR VARIOUS DISCIPLINES AND TO PROPOSE METHODS FOR ADAPTING THEM FOR OPTIMIZATION. PHASE II WILL ACTUALLY IMPLEMENT UP TO THREE OF THESE CRITERIA.

BARRON ASSOCS INC

RTE 1 - BOX 159

STANARDSVILLE, VA 22973

Program Manager: ROGER L BARRON

Contract #:

Title: ON-LINE ADAPTIVE NETWORKS APPLIED TO AIRCRAFT CONTROL

Topic #: AF90-098

Office: WRDC/FI

ID #: 39854

RECONFIGURABLE, FLIGHT CONTROL SYSTEMS OFFER SIGNIFICANT IMPROVEMENTS IN SURVIVABILITY, RELIABILITY, AND MAINTAINABILITY OF MILITARY AIRCRAFT AND IN THE SAFETY OF FLIGHT OPERATIONS OF BOTH MILITARY AND COMMERCIAL AIRCRAFT. HOWEVER, ON-LINE LEARNING MUST BE INCLUDED TO REALIZE THE FULL POTENTIAL OF THESE SYSTEMS BECAUSE IT IS IMPRACTICAL TO DESIGN IN ADVANCE FOR THE VARIETY AND COMBINATORIAL COMPLEXITY OF THE UNFORESEEN CONTROL EFFECTOR AND AIRFRAME IMPAIRMENTS THAT CAN OCCUR. BARRON ASSOCIATES, INC. (BAI) PROPOSES TO EXPAND UPON CURRENT DEVELOPMENTS IN ALGORITHMS FOR ON-LINE ADAPTATION OF POLYNOMIAL NETWORK CONTROLLERS TO SOLVE THE PROBLEM OF COMPENSATION FOR THESE IMPAIRMENTS. UNDER CONTRACT F33615-88-C-3615, BAI HAS ESTABLISHED THE ADVANTAGES IN ACCURACY, DECISION SPEED, AND REDUCED COMPUTATION OF FIXED POLYNOMIAL NETWORKS SYNTHESIZED OFF-LINE FOR GLOBAL FAILURE DETECTION, ISOLATION, AND ESTIMATION. BAI IS ALSO APPLYING FIXED NETWORKS TO SUPERVISORY CONTROLLER CONFIGURATIONS IN WHICH CONTROL GAINS ARE ADJUSTED ON-LINE. IN THE PROPOSED WORK, BAI WILL REFINE ALGORITHMS CURRENTLY BEING DEVELOPED FOR ON-LINE ADAPTATION OF POLYNOMIAL NETWORKS, USE THESE ALGORITHMS IN PREDICTIVE MODELS OF AIRCRAFT RESPONSE AND IN SUPERVISORY CONTROLLERS, INTEGRATE THE ON-LINE ADAPTATION METHODS INTO EXISTING SYNTHESIS ALGORITHMS, AND DEMONSTRATE VIA SIMULATIONS (WITH A NONLINEAR AIRCRAFT MODEL) THE USE OF ON-LINE ADAPTIVE NETWORKS IN THE CRCA OR F-15.

VIGYAN INC

30 RESEARCH DR

HAMPTON, VA 23666

Program Manager: PARESH PARIKH

Contract #:

Title: POSTPROCESSING OF CFD DATA

Topic #: AF90-099

Office: WRDC/FI

ID #: 39855

A RAPID, USER-FRIENDLY AND INTERACTIVE GRAPHICS POST PROCESSOR PROGRAM FOR THE ANALYSIS

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OF CFD DATA IS PROPOSED. THE PROGRAM WILL BE ABLE TO HANDLE STRUCTURED AND/OR UNSTRUCTURED GRIDS OF SINGLE-OR MULTI-BLOCK FORMAT. IT WILL BE FLEXIBLE ENOUGH TO PLOT FLUID DYNAMIC DATA AT USER SPECIFIED ARBITRARY LINES, PLANES OR SURFACES. THIS WILL BE ACCOMPLISHED BY MODIFYING AN EXISTING PROGRAM, FOR UNSTRUCTURED GRIDS. INITIALLY, THE PROGRAM WILL BE DEVELOPED FOR SILICON GRAPHICS IRIS WORKSTATION UTILIZING FULL CAPABILITIES OF ITS HARDWARE. DURING PHASE II, THE PROGRAM CAPABILITIES WILL BE ENHANCED TO MAKE IT MORE ROBUST AND GENERAL PURPOSE. IT IS ANTICIPATED THAT, ON SUCCESSFUL COMPLETION, AN ENHANCED LEVEL OF EXPERTISE IN INTERPRETING CFD RESULTS WILL BE AVAILABLE RESULTING IN AN ENORMOUS SAVING OF ENGINEER'S TIME.

NEW HAMPSHIRE MATERIAL LAB
62A LITTLEWORTH RD
DOVER, NH 03820
Program Manager: JAMES A SHERWOOD
Contract #:

Title: AIRCRAFT TIRE/WHEEL INTERFACE-LOAD MEASUREMENT
Topic #: AF90-100 Office: WRDC/FI ID #: 39856

IN LATE 1986, WRDC/FIEVA INITIATED AN IN-HOUSE PROGRAM TO INVESTIGATE EXPERIMENTAL AND ANALYTICAL METHODS FOR AIRCRAFT-WHEEL-LIFE ESTIMATION AND VERIFICATION. AS PARTIAL FULFILLMENT OF THIS PROGRAM, STRUCTURAL MODELS OF TIRES AND A NEW STOCHASTIC CRACK GROWTH MODEL FOR THE WHEEL FRACTURE BEHAVIOR ARE BEING DEVELOPED. TO COMPLEMENT THESE RESEARCH EFFORTS A TIRE-WHEEL INTERFACE MODEL THAT YIELDS A DESCRIPTION OF THE WHEEL FLANGE AND BEADSEAT LOADS IS REQUIRED. PRESENTLY, THE BOUNDARY CONDITIONS AT THE TIRE-WHEEL INTERFACE ARE UNKNOWN. THE OBJECTIVE OF THIS RESEARCH PROPOSAL IS TO INVESTIGATE THE FEASIBILITY OF DEVELOPING A METHODOLOGY FOR ACCURATELY MEASURING THE LOAD DISTRIBUTION AT THE TIRE/WHEEL INTERFACE. A VARIETY OF COMMERCIALY AVAILABLE PRODUCTS INCLUDING CONDUCTIVE RUBBER, FERRITE FLUID, PIEZOELECTRIC CRYSTALS AND CAPACITIVE DEVICES WILL BE STUDIED FOR USE IN A TOTALLY NEW INSTRUMENTATION DEVICE. THE LOADS MEASURED WITH THE PROPOSED DEVICE WILL BE USED IN EXISTING FINITE-ELEMENT MODELS OF AIRCRAFT WHEELS TO EVALUATE THE WHEEL'S COMPLETE STRUCTURAL RESPONSE TO THESE LOADS.

TECH-QUEST
3315 BOB WALLACE AVE - STE 101
HUNTSVILLE, AL 35805
Program Manager: DR HENRY G LEW
Contract #:

Title: FLUCTUATING PRESSURE LOADS DEFINITION FOR HYPERSONIC VEHICLE STRUCTURES
Topic #: AF90-101 Office: WRDC/FI ID #: 39857

A RESEARCH PROGRAM IS PROPOSED TO INVESTIGATE THE PREDICTION CAPABILITY FOR AEROACOUSTIC LOADS SUBJECT TO HYPERSONIC FLOW CONDITIONS. IN PARTICULAR, THIS INVESTIGATION WILL FOCUS ON HYPERSONIC FLOW STRUCTURES FEATURING CONTROL SURFACES THAT EXPERIENCE 2D AND 3D SHOCK/BOUNDARY LAYER INTERACTIONS. REGIONS SUBJECT TO THESE FLOW INTERACTIONS CONSIST OF INLETS (COWL) OF AIR BREATHING SYSTEMS, BOW SHOCK/TAIL BOUNDARY LAYERS, VERTICAL/HORIZONTAL TAIL SHOCK/BOUNDARY LAYERS, WING SHOCK/FUSELAGE BOUNDARY LAYER, AND RAMPS LEADING TO THE INLETS. AS A CONSEQUENCE OF THE LIMITED DATA BASE ($M < 3$) AVAILABLE FOR THESE INTERACTIONS, A DETAILED INVESTIGATION IS PROPOSED THAT CONSISTS OF REVIEWING AEROACOUSTIC LITERATURE (BOTH CLASSIFIED/ UNCLASSIFIED), CRITIQUE TO PREDICTION TECHNIQUES RELATIVE TO FUNDAMENTAL PHYSICS AND SCALING LAWS, USE OF AEROACOUSTIC DATA (KNOWN TO THE AUTHORS AND EXISTING IN OUR LIBRARY) THAT ALLOWS FURTHER VALIDATION OF EXISTING PREDICTION TECHNIQUES (DEVELOPED BY THE PROPOSED TEAM) TO MACH 8, AND FINALLY TO RECOMMEND A FUNDAMENTAL EXPERIMENTAL PROGRAM TO EXTEND THE DATA BASE AS WELL AS ENHANCE PREDICTION

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TECHNIQUES.

TE-SCO INC

PO BOX 895 - 110 MITCHELL BLVD

TULLAHOMA, TN 37388

Program Manager: LEE F WEBSTER

Contract #:

Title: MODEL - BOURNE DATA MANAGEMENT SYSTEM

Topic #: AF90-102

Office: WRDC/FI

ID #: 39858

THIS PROPOSAL DESCRIBES THE DEVELOPMENT OF A STAND ALONE WIND TUNNEL DATA PROCESSING AND ACQUISITION SYSTEM WHICH WHEN INTEGRATED INTO AN INSTRUMENTED WIND TUNNEL MODEL WILL ALLOW DATA TRANSMISSION AND CONTROL THROUGH A PAIR OF CABLES DESIGNED TO FIT SMALL DIAMETER STINGS AND FORCE BALANCES. THE SYSTEM USES A DESK TOP COMPUTER WHICH CAN BE SET UP PRIOR TO INSTALLATION OF THE MODEL IN THE TUNNEL AND IS USED TO CONTROL THE TESTING, RECORD DATA, MONITOR THE TEST PROGRESS AND PROVIDE NEAR REAL TIME TEST RESULTS WHICH CAN BE COMPARED DURING TESTING WITH CFD PREDICTIONS. THIS SYSTEM ALLOWS FOR CHANGES IN GAIN, SCAN RATE AND SEQUENCE OF SCAN DURING TESTING. THE SMALL SIZE AND MODULAR DESIGN OF THE MODEL BOURNE PROCESSOR RESULTING FROM THE USE OF MICRO COMPONENT TECHNOLOGY WILL ALLOW TESTING FLEXIBILITY AND ACCOMMODATION IN ALL BUT THE SMALLEST MODEL. THIS DESIGN FEATURE ALSO REDUCES POWER REQUIREMENTS, INCREASES RELIABILITY AND RESULTS IN A RUGGED TEST UNIT. PHASE I DEVELOPMENT WILL PROVIDE ANALYSIS OF SYSTEM REQUIREMENTS, CIRCUIT DESIGN, PACKAGING, BREAD BOARDING, COMPONENT IDENTIFICATION AND SOFTWARE CONCEPTUAL DESIGN. FOLLOW ON PHASE II WORK WILL INVOLVE MANUFACTURING, INSTALLATION IN AN EXISTING HYPERSONIC WIND TUNNEL MODEL AND DEMONSTRATION TESTING.

TERRA TEK INC

420 WAKARA WY

SALT LAKE CITY, UT 84108

Program Manager: DR JIAN-JUEI WANG

Contract #:

Title: ANALYTICAL MODELING OF FATIGUE LIFE ON ROD END BEARING SYSTEM

Topic #: AF90-103

Office: WRDC/FI

ID #: 39859

CURRENTLY, AS REPORTED IN PROGRAM SOLICITATION 90.1 BY THE AIR FORCE, THE SPECTRUM OF BEARING AND BEARING LINER MATERIALS USED IN THE AIR- CRAFT BEARING SYSTEMS BEHAVE IN AN UNEXPECTED WAY WHEN SUBJECTED TO CYCLIC LOADINGS. TO INVESTIGATE THE PROBLEM AND BETTER PREDICT THE FATIGUE LIFE OF THIS ROD AND BEARING SYSTEM, FUNDAMENTAL ANALYSES OF STRESS DISTRIBUTIONS, STRESS INTENSITY FACTORS, FATIGUE CHARACTERISTICS, AND WEAR AND FRACTURE ARE REQUIRED. AN ANALYTICAL MODEL TO PREDICT THE FATIGUE LIFE OF ROD END BEARING SYSTEM IS PROPOSED FOR THE PHASE I WORK. SPECIFICALLY, THE STRESS FIELD FOR THE ASSUMED HERTZIAN LOADING AROUND AN ASPERITY IS CALCULATED, ALONG WITH A CORRECTION FACTOR TO ACCOUNT FOR THE THREE-DIMENSIONAL EFFECTS; THE MODE II (SHEARING MODE) STRESS INTENSITY FACTORS ARE THEN CALCULATED FROM THE OBTAINED STRESS FIELD; THE FATIGUE LIFE IS FINALLY MODELED BASED ON THE CHARACTERISTICS OF CYCLIC LOADING AND FRACTURE GROWTH BY USING THE CALCULATED STRESS INTENSITY FACTORS. FEASIBILITY OF THIS MODEL WILL BE EXAMINED AND DEMONSTRATED FOR VARIOUS TYPES OF INITIAL MICRO-CRACKS, E.G. THE VERTICAL EDGE CRACK, THE INCLINED EDGE CRACK, THE INTERIOR HORIZONTAL CRACK, THE INTERIOR VERTICAL CRACK AND THE INTERIOR INCLINED CRACK.

COLORAY DISPLAY CORP

1045 MISSION CT

SMALL BUSINESS INNOVATION RESEARCH PROGRAM - PHASE I
AIR FORCE Solicitation 90.1

FREMONT, CA 94539

Program Manager: CHRIS CURTIN

Contract #:

Title: LCD BACKLIGHT USING COLD-CATHODE FIELD EMISSION

Topic #: AF90-105

Office: WRDC/KT

ID #: 39861

IN RECENT YEARS THE ACTIVE MATRIX LIQUID CRYSTAL DISPLAY (LCD) HAS BEEN DEVELOPED TO REPLACE THE CATHODE RAY TUBE (CRT) IN NUMEROUS APPLICATIONS, INCLUDING THE COMBAT FIGHTER COCKPIT. THE LCD IS A LIGHT MODULATION TECHNIQUE THAT REQUIRES AN ADDITIONAL ELEMENT, A LIGHT SOURCE, IN ORDER TO BE VIEWABLE UNDER ALL LIGHTING CONDITIONS. HOWEVER, THE AVAILABLE LIGHT SOURCES HAVE PROVEN DEFICIENT IN POWER EFFICIENCY AND RELIABILITY WHEN MEASURED AGAINST THE ENVIRONMENTAL SPECIFICATIONS OF MILITARY COCKPITS. THIS PROPOSAL WILL PROVE THE FEASIBILITY OF A NEW TECHNOLOGY, THE FIELD EMISSION DISPLAY (FED), SUITABLE TO MEET ALL THE REQUIREMENTS OF AN LCD BACKLIGHT. BASED UPON THE FUNDAMENTAL WORK AT SRI INTERNATIONAL, AN LCD BACKLIGHT DESIGN WILL BE PROPOSED; INCLUDING BRIGHTNESS, EFFICIENCY, RELIABILITY, OPERATING VOLTAGES, AND COST. AN ALTERNATIVE DESIGN SUITABLE FOR FIELD SEQUENTIAL COLOR OPERATION WILL ALSO BE PROPOSED. THE SUCCESS OF THIS PROPOSAL, AND THE PHASE II FOLLOW-ON, WILL RESULT IN THE COMMERCIALIZATION OF THE FED TECHNOLOGY. EFFICIENCIES OF 20 LUMENS/WATT AND LIFETIMES BEYOND 10,000 HOURS UNDER SEVERE ENVIRONMENTAL CONDITIONS ARE EXPECTED FROM THIS TECHNOLOGY.

IMAGING & SENSING TECHNOLOGY CORP

WESTINGHOUSE CIR

HORSEHEADS, NY 14845

Program Manager: THOMAS A DUNBAR

Contract #:

Title: UNIQUE LIGHT SOURCE FOR FULL COLOR DOT MATRIX COCKPIT DISPLAY

Topic #: AF90-105

Office: WRDC/KT

ID #: 39860

PRELIMINARY STUDIES HAVE REVEALED THE TECHNICAL FEASIBILITY TO MAKE A LIGHT SOURCE, FOR FULL COLOR, DOT MATRIX COCKPIT DISPLAYS, THAT OVERCOMES MOST LIMITATIONS OF SYSTEMS PRESENTLY IN USE. THIS LIGHT SOURCE IS BASED UPON AN INNOVATIVE ADAPTATION OF EXISTING TECHNOLOGY AND IS READILY AVAILABLE FOR USE WITH MODIFICATION. THESE MODIFICATIONS WILL BEGIN BY ENHANCING THE PROGRAMMING OF AN INTER- ACTIVE ELECTRON-OPTICS COMPUTER AIDED DESIGN SYSTEM PRESENTLY IN USE. THE REPROGRAMMED CAD SYSTEM WILL BE USED FOR DESIGN AND ANALYSIS OF ELEMENTAL ELECTRON GUNS THAT WILL BE A SOURCE OF ELECTRONS USED TO EXCITE THE PHOSPHOR OF THE RESULTING DEVICE. PHASE II WILL PURSUE THE FABRICATION AND CHARACTERIZATION OF SAMPLES FOR THE NEW LIGHT SOURCE, WHICH IS EXPECTED TO PRODUCE AT LEAST 10,000 FOOT-LAMBERTS OF LIGHT WITH A SPECTRUM YIELDING FULL COLOR AND WITH LESS THAN TWENTY PERCENT TOTAL NON-UNIFORMITY IN OUTPUT. PHASE III WILL EXPLOIT AN EXISTING READILY ACCESSIBLE MARKET.

DIMENSION TECHNOLOGIES INC

176 ANDERSON AVE

ROCHESTER, NY 14607

Program Manager: JESSE B EICHENLAUB

Contract #:

Title: AUTOSTEREOSCOPIC THREE-DIMENSIONAL (3-D) COCKPIT DISPLAY

Topic #: AF90-106

Office: WRDC/KT

ID #: 39862

DURING THIS PHASE I PROJECT, DTI PROPOSES TO BUILD AN AUTO- STEREOSCOPIC DISPLAY USING A VERSION OF ITS PROPRIETARY OPTICAL SYSTEM IN COMBINATION WITH A MULTI PIXEL LAYER LCD WHICH ACHIEVES COLOR THROUGH AN ELIMINATION TECHNIQUE. SUCCESSFUL COMPLETION OF PHASE I WOULD

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DEMONSTRATE AN AUTOSTEREOSCOPIC DISPLAY WITH UP TO FIVE TIMES THE BRIGHTNESS OF A CONVENTIONAL COLOR DISPLAY WITH ANY GIVEN LIGHT SOURCE. THIS WILL HAVE A HIGHLY FAVORABLE IMPACT ON THE TOTAL BRIGHTNESS THAT CAN BE ACCOMPLISHED WITH A COLOR DISPLAY, THE LIFE TIME OF THE LIGHT SOURCES, MAINTENANCE FREQUENCY AND PROCEDURES, POWER REQUIREMENTS, DISPLAY VOLUME, AND HEAT OUTPUT. THE PHASE I WORK WILL PROVIDE A SOUND BASIS FOR PROTOTYPE CONSTRUCTION OF A HIGH BRIGHTNESS FULL COLOR TFT AUTOSTEREOSCOPIC COCKPIT DISPLAY IN A PHASE II SBIR CONTRACT.

THINK-ALONG SOFTWARE INC
PO BOX 359

BROWNSVILLE, VA 95919

Program Manager: DAN WOOD

Contract #:

Title: DISCOVERY SYSTEM FOR MANUFACTURING

Topic #: AF90-107

Office: WRDC/ML

ID #: 39863

THINK-ALONG SOFTWARE PROPOSES TO DEMONSTRATE AN APPLICATION OF ITS INTERACTIVE SCIENTIFIC DISCOVERY SYSTEM--THE SCHOLAR'S COMPANION-- IN THE REALM OF MANUFACTURING, AS A COMPUTER SYSTEM WHICH IS CAPABLE OF PERFORMING SOME OF THE DUTIES OF A SCIENTIST LOOKING TO DISCOVER NEW AND IMPORTANT IDEAS (E.G. FORD'S PRODUCTION LINE) WITH POTENTIAL VALUE TO USERS IN THE COMMUNITY OF MANUFACTURING SCIENTISTS. THIS PROPOSAL IS BASED ON AN AWARENESS OF AN EVER-INCREASING NEED TO HANDLE, STUDY, AND GENERALIZE A RAPIDLY GROWING BODY OF DATA RESULTING FROM VIRTUALLY EVERY HUMAN ENDEAVOR, AN IMPORTANT EXAMPLE BEING YEARS OF EMPIRICAL RESULTS OF RUNNING DAY-TO-DAY MANUFACTURING OPERATIONS. THE INTENT OF THIS PROJECT IS TO EXPLORE AND TEST APPLICATIONS OF A DATA EXPLORATION AND THEORY FORMATION SYSTEM IN THE MANUFACTURING DOMAIN.

MARBLE ASSOCS INC

38 EDGE HILL RD - STE 201

WALTHAM, MA 02154

Program Manager: FRANCES FEIGL

Contract #:

Title: COMPUTER AIDED ABSTRACT REASONING FOR CONCEPTUAL DESIGN

Topic #: AF90-108

Office: WRDC/ML

ID #: 39864

THERE IS LITTLE OR NO COMPUTER SUPPORT FOR THE CONCEPTUAL DESIGN PROCESS, SINCE THIS PROCESS HAS TRADITIONALLY BEEN CATEGORIZED AS "ART." THE ARTIST IS UNLIMITED IN HIS CREATIVITY, AND ANY CONCEPTUAL DESIGN SOFTWARE MUST NOT LIMIT THE CREATIVE PROCESS. FOR THIS REASON, THE CONCEPTUAL DESIGN PROCESS HAS NOT YET BENEFITED FROM RECENT RAPID ADVANCES IN COMPUTER TECHNOLOGY. WE BELIEVE THAT FLEXIBLE ENOUGH SOFTWARE WOULD NOT ONLY ENABLE THE DESIGNER TO BE MORE EFFICIENT WITH HIS IDEAS, BUT WOULD ALSO STIMULATE THE CREATIVE PROCESS IN WAYS NOT TRADITIONALLY AVAILABLE. MARBLE ASSOCIATES, INC., PROPOSES TO CONSIDER THE POSSIBILITIES OF USING COMPUTERS TO SUPPORT THE CONCEPTUAL DESIGN PROCESS. WE WILL PROVIDE A SUMMARY OF THE CURRENT STATE OF THE ART IN THE CONCEPTUAL DESIGN PROCESS, FOLLOWED BY A FUNCTIONAL SPECIFICATION FOR A COMPUTER GRAPHICS- ORIENTED WORKSTATION BASED CONCEPTUAL DESIGN STUDIO.

TECHNICAL RESEARCH ASSOCS INC

410 CHIPETA WY - STE 222

SALT LAKE CITY, UT 84108

Program Manager: GAIL BOWERS-IRONS

Contract #:

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AIR FORCE Solicitation 90.1

Title: THE BIODEGRADATION OF CONFORMAL COATINGS

Topic #: AF90-109

Office: WRDC/ML

ID #: 39865

PRINTED BOARDS AND COMPONENTS ARE COATED WITH A PROTECTIVE FILM, CALLED CONFORMAL COATINGS, PRIMARILY TO PREVENT, OR AT LEAST TO MINIMIZE, DEGRADATION IN ELECTRICAL PERFORMANCE WHEN SUBJECTED TO ENVIRONMENTAL STRESSES. THESE CONFORMAL COATINGS ARE SYSTEMS OF SYNTHETIC RESINS THAT ARE DISSOLVED IN BALANCED VOLATILE SOLVENT VEHICLES. OF THE VAST NUMBERS OF SYNTHETIC RESINS NOW AVAILABLE, A SELECTED FEW TYPES OF ACRYLICS, POLYURETHANES, AND EPOXIES HAVE BEEN FOUND TO HAVE THE BEST ALL-ROUND PROPERTIES AND ARE CURRENTLY BEING USED AS THE BASIS FOR MOST GENERAL PURPOSE CONFORMAL COATINGS. THE ENVIRONMENTAL STRESSES OFTEN PRECIPITATE THE NEED FOR PARTIAL BOARD REPAIR OR REPLACEMENT. THE ONLY RESIN EASILY REMOVED IS THE ACRYLIC AND THAT ONLY BY CHLORINATED SOLVENTS, NOW CONSIDERED POTENTIAL CARCINOGENS. THE OTHER RESINS REQUIRE BURN-THROUGH OR MECHANICAL REMOVAL WHICH MAY DAMAGE THE ELECTRONICS AND/OR BOARDS. IN RESPONSE TO THESE REPAIRABILITY AND/OR REPLACEMENT PROBLEMS, TECHNICAL RESEARCH ASSOCIATES (TRA) PROPOSES TO FULLY STUDY AND DEVELOP A CONFORMAL COATING BIODEGRADATION PROCESS WHICH DOES NOT DAMAGE BOARD CIRCUITRY AND WHICH WOULD REPLACE CHEMICAL AND MECHANICAL PROCESSES. THIS WORK WILL BE BASED UPON PROVEN DEGRADATION APPROACHES FOUND IN PREVIOUS TRA WORK INVOLVING THE BIODEGRADATION OF POLYURETHANES, EPOXIES, POLYSULFIDES AND FLUOROCARBONS.

ANALATOM INC

1183 BORDEAUX DR - #1

SUNNYVALE, CA 94089

Program Manager: DR B LASKOWSKI

Contract #:

Title: THEORETICAL CHEMISTRY STUDIES OF CONDUCTING POLYMER SYSTEMS

Topic #: AF90-111

Office: WRDC/ML

ID #: 39866

THEORETICAL CHEMISTRY TECHNIQUES ARE USED TO PROVIDE FUNDAMENTAL UNDERSTANDING OF THE MOLECULAR REQUIREMENTS FOR ACHIEVING CONDUCTIVE PROPERTIES IN POLYMER SYSTEMS AND IN A LATER STAGE TO ADDRESS THE REQUIREMENTS FOR ACHIEVING NONLINEAR OPTICAL PROPERTIES. IT IS PROPOSED TO DEDUCE THE CONDUCTION MECHANISM BY CALCULATING THE CONDUCTIVITY TENSOR DIRECTLY AND ANALYZING THE DIFFERENT CONTRIBUTIONS TO THIS QUANTITY. NOVEL APPROACHES TO THE CALCULATION OF THE NECESSARY PROPAGATORS MAKE POSSIBLE A DIRECT CONSIDERATION OF THE CONDUCTIVITY TENSOR. THE KEY DIFFERENCE WITH PREVIOUS TREATMENTS IS THAT WE CONSIDER THE FULL ELECTRON-NUCLEAR DYNAMICS WITHOUT AD HOC USE OF BORON-OPPENHEIMER APPROXIMATION. INITIALLY, DURING PHASE I, A WORK CODE WILL BE DEVELOPED FOR THE CALCULATION OF THE ELECTRIC CONDUCTIVITY TENSOR USING A SINGLE DETERMINENTAL STATE FOR THE ELECTRONS AND CLASSICAL NUCLEI. ALSO DURING PHASE I AS A VALIDATION OF THE CODE WE WILL INVESTIGATE THE SOLUTION MECHANISM IN POLACETYLENE FROM THE AB INITIO TIME-DEPENDENT VIEWPOINT AND STUDY THE EVOLUTION OF THE SOLITON EXCITATION TO VERIFY WHETHER IT RETAINS ITS SOLITON SHAPE. THE CODE WILL BE WRITTEN SUCH THAT DURING LATER PHASES OF THIS WORK IT CAN BE USED FOR GENERAL POLYMERIC SYSTEMS.

TEXAS RESEARCH INSTITUTE AUSTIN INC

415A CRYSTAL CREEK DR

AUSTIN, TX 78746

Program Manager: DR GEORGE P HANSEN

Contract #:

Title: SILICON- AND FLUORINE-CONTAINING POLYOXADIAZOLES FOR APPLICATION IN EXTREME CONDITIONS

Topic #: AF90-111

Office: WRDC/ML

ID #: 39867

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TO COMBINE THE CHARACTERISTICS OF THERMAL STABILITY, DIELECTRIC STRENGTH, CLARITY, TRACTABILITY, AND RESISTANCE TO THE AEROSPACE ENVIRONMENT, THREE MOIETIES WILL BE INCORPORATED INTO A POLYMER BACKBONE: TETRAPHENYLSILANE, HEXAFLUOROISOPROPYLIDENE, AND OXADIAZOLE. FACILE REACTIONS ARE PROPOSED TO RESULT IN AN HOMOLOGOUS SERIES OF POLYMERS WHICH WOULD ALLOW THE CAREFUL DETERMINATION OF THE RELATIONSHIP OF PROPERTIES TO STRUCTURE AND THEN THE SYNTHESIS OF THE MOST USEFUL MATERIAL.

UNIVERSAL ENERGY SYSTEMS INC

4401 DAYTON-XENIA RD

DAYTON, OH 45432

Program Manager: TAI-IL MAH

Contract #:

Title: FEASIBILITY STUDY OF REFRACTORY OXIDE EUTECTIC FIBER PRODUCTION

Topic #: AF90-112

Office: WRDC/ML

ID #: 39868

THE UTILIZATION OF EDGE-DEFINED, FILM-FED GROWTH (EFG) TECHNIQUE IS PROPOSED TO PRODUCE $\text{Al}_2\text{O}_3\text{-Y}_3\text{Al}_5\text{O}_{12}$ (YAG) EUTECTIC FIBERS. THE SEED CRYSTAL TO BE USED IS C-ORIENTATION SAPPHIRE. THE RAW MATERIALS REQUIRED FOR THIS PROPOSED RESEARCH WILL BE SYNTHESIZED THROUGH THE HYDROLYTIC DECOMPOSITION OF MIXED METAL ALKOXIDES. FOR FIBER GROWING, THE PROCESSING PARAMETERS TO BE CONTROLLED ARE: DEGREE OF SUPERHEATING, GROWTH RATES, THERMAL GRADIENTS AND CAPILLARY SIZES. THROUGH VARYING THE ABOVE PROCESSING PARAMETERS, VARIOUS FIBER DIAMETERS, AS WELL AS DIFFERENT EUTECTIC MICROSTRUCTURES WOULD BE OBTAINED. EXTENSIVE TRANSMISSION ELECTRON MICROSCOPY (TEM) AND X-RAY DIFFRACTION (XRD) ANALYSES WILL BE CARRIED OUT TO DETERMINE THE GROWTH DIRECTION AND CRYSTALLOGRAPHIC RELATIONS OF ALUMINA AND YAG EUTECTIC. ROOM TEMPERATURE STRENGTH OF THE EUTECTIC FIBERS WILL BE MEASURED IN TENSION. AN EXTENSIVE SEM FRACTOGRAPHIC ANALYSIS WILL BE CARRIED OUT TO STUDY THE CRACK/MICROSTRUCTURE INTERACTIONS OF THE EUTECTIC FIBERS.

L&W RESEARCH INC

SCIENCE PARK - BLDG 5/STE 1157

NEW HAVEN, CT 06511

Program Manager: DR PAUL H LEEK

Contract #:

Title: USE OF FIELD EMISSION SOURCES FOR MICROFOCUS X-RAY GENERATORS

Topic #: AF90-113

Office: WRDC/ML

ID #: 39869

MICROFOCUS X-RAY GENERATORS PRESENTLY USE A TUNGSTEN FILAMENT AS THE SOURCE OF ELECTRONS. THIS HAS A LARGE SIZE AND LIMITED LIFE. A FIELD EMISSION SOURCE HAS A VERY SMALL SIZE AND A LONG LIFE. THIS PROJECT INVESTIGATES THE FEASIBILITY OF USING A FIELD EMISSION SOURCE IN A MICROFOCUS X-RAY GENERATOR.

MARKO MATERIALS INC

19-1 STERLING RD

NORTH BILLERICA, MA 01862

Program Manager: RANJAN RAY

Contract #:

Title: IN-SITU DEVELOPMENT OF HIGH ASPECT RATIO BORIDE REINFORCEMENTS IN FINE GRAINED TiAl ALLOYS TO ENHANCE ELEVATED AND ROOM TEMPERATURE...

Topic #: AF90-114

Office: WRDC/ML

ID #: 39870

GAMMA-TiAl BASED INTERMETALLIC ALLOYS HAVE POTENTIAL AIR FORCE APPLICATIONS FOR TEMPERATURES UP TO 1800 DEG F. ALLOY DEVELOPMENT RESEARCH HAS SHOWN THAT COMPOSITIONS (IN

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ATOM %) SUCH AS Ti-48Al-2Mn-2Nb EXHIBIT SOME ROOM TEMPERATURE DUCTILITY AND GOOD HIGH TEMPERATURE OXIDATION RESISTANCE. HOWEVER, RESEARCH IS NECESSARY TO OPTIMIZE THE ROOM TEMPERATURE MECHANICAL PROPERTIES SUCH AS DUCTIVITY, TOUGHNESS AND IMPACT RESISTANCE, AS WELL AS THE HIGH TEMPERATURE MECHANICAL PROPERTIES SUCH AS TENSILE STRENGTH, FATIGUE AND CREEP GROWTH RATES. THE PROPOSED RESEARCH AIMS TO ACHIEVE OPTIMUM ROOM AND ELEVATED TEMPERATURE MECHANICAL PROPERTIES BY IN-SITU DEVELOPMENT OF A CRITICAL VOLUME FRACTION OF HIGH ASPECT RATIO BORIDE REINFORCEMENTS OF SIZE >10 MICROMETERS IN A FINE GRAINED (<10 MICROMETERS) GAMMA-TiAl MATRIX BY RAPID SOLIDIFICATION AND POWDER METALLURGICAL PROCESSING. BASED ON CONTINUUM MECHANICS CONSIDERATIONS, IMPROVE CREEP RESISTANCE IS EXPECTED FROM BORIDE REINFORCEMENTS. IMPROVED DUCTILITY IS EXPECTED FROM THE FINE GRAIN SIZE OF THE GAMMA-TiAl MATRIX BECAUSE OF THE REDUCED SLIP LENGTH AND THE LOWER STRESS CONCENTRATION AT THE GRAIN BOUNDARIES. PHASE I RESEARCH WILL INVESTIGATE THE EFFECT OF COOLING RATE 10(4)-10(6) K/s AND THE BORON CONTENT 0-10 AT % IN ORDER TO OBTAIN THE OPTIMUM MICROSTRUCTURE FOR THE DESIRED MECHANICAL PROPERTIES.

EMCORE CORP

35 ELIZABETH AVE

SOMERSET, NJ 08873

Program Manager: DR JING ZHAO

Contract #:

Title: LOW TEMPERATURE FABRICATION OF HIGH T_c SUPERCONDUCTING THIN FILMS BY PLASMA ENHANCED MOCVD PROCESS

Topic #: AF90-115

Office: WRDC/ML

ID #: 39871

THE TECHNIQUE OF LOW TEMPERATURE IN SITU FORMATION OF HIGH T_c SUPERCONDUCTING THIN FILMS IS CRUCIAL FOR EARLY APPLICATIONS OF COPPER OXIDE-BASED CERAMIC WITH SUPERCONDUCTIVITY ABOVE LIQUID NITROGEN TEMPERATURE. SUCH PROCESS WILL PERMIT DEPOSITION OF HIGH QUALITY, SMOOTH SURFACE AND HIGH DENSITY, HIGH T_c SUPERCONDUCTING FILMS ON A VARIETY OF SUBSTRATES. THE PROPOSED NOVEL PROCESS SUBSTITUTES ELECTRON KINETIC ENERGY FOR CONVENTIONAL THERMAL ENERGY AND ENHANCES COMPOUND FORMATION WITH THE PRESENCE OF ACTIVATED OXYGEN GENERATED FROM DISSOCIATION OF N₂O, THUS OFFERS LOW TEMPERATURE DEPOSITION, NON-EQUILIBRIUM FILM COMPOSITIONS, AND HIGH PRODUCT PURITY. IN ADDITION CVD PROCESS OFFERS THE ADVANTAGES OF APPLICABLE TO INEXPENSIVE AND LARGE SCALE FABRICATION. OUR PRELIMINARY RESULTS DEMONSTRATED THAT TEXTURED, HIGH DENSITY, MIRROR SMOOTH SURFACE, AND LOW CARBON YBCO FILMS HAVE BEEN IN SITU FORMED AT A REDUCED TEMPERATURE AS LOW AS 570 DEG C. FURTHER REDUCING DEPOSITION TEMPERATURE BY INCREASING MICROWAVE PLASMA POWER IS PROPOSED. OUR RESULTS INDICATES THIS METHOD IS A PROMISING PROCESS FOR SUPERCONDUCTING DEVICE TECHNOLOGY.

HYPRES INC

500 EXECUTIVE BLVD

ELMSFORD, NY 10523

Program Manager: ELIE TRACK

Contract #:

Title: HTSC FILMS AS FAST-RESPONSE IR DETECTORS

Topic #: AF90-115

Office: WRDC/ML

ID #: 39872

HYPRES PROPOSES A PROGRAM TO RESEARCH, DEVELOP, AND DEMONSTRATE HIGH TEMPERATURE SUPERCONDUCTING (HTSC) THIN FILMS AS FAST-RESPONSE IR DETECTORS. HTSC FILMS HAVE POTENTIAL FOR IR DETECTION OFFERING SEVERAL ADVANTAGES OVER EXISTING IR SENSING TECHNOLOGIES: (1) DETECTION TO LONGER WAVELENGTHS, UP TO 50 MICROMETERS; (2) REDUCED CRYOGENIC CONSTRAINTS SIGNIFICANTLY SIMPLIFYING SYSTEM DESIGN AND IMPLEMENTATION; (3) A NON-EQUILIBRIUM DETECTION MECHANISM IMPLYING EXTREMELY FAST RESPONSE TIMES - BELOW A NANOSECOND - POTENTIALLY

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CRITICAL IN HIGH SPEED MULTIPLE-TARGET DETECTION AND TRACKING. HTSC FILM RESPONSE TO IR RADIATION OCCURS THROUGH TWO MECHANISMS: BOLOMETRIC (HEATING), AND NON-EQUILIBRIUM. RECENT EXTENSIVE RESEARCH BY NUMEROUS LABORATORIES HAS FAILED TO LEAD TO A CONSENSUS ON THE PREDOMINANT MECHANISMS AND POTENTIAL OF THE TECHNOLOGY. THIS LACK OF CONCLUSIVE RESULTS IS DUE LARGELY TO THE EXTREMELY WIDE VARIATION IN MATERIAL CHARACTERISTICS OF THE SAMPLES TESTED. THIS PROPOSAL FOCUSES ON THE NON-EQUILIBRIUM MECHANISM WITH ITS SIGNIFICANT ADVANTAGES IN VERY FAST RESPONSE TIMES AND RELAXED CRYOGENIC REQUIREMENTS. IN PHASE I HYPRES WILL CONDUCT THEORETICAL AND EXPERIMENTAL STUDIES TO ESTABLISH THE EXISTENCE AND VIABILITY OF A NON-EQUILIBRIUM MECHANISM. IN PHASE II, EXTENSIVE MATERIALS ENGINEERING AND OPTIMIZATION WILL BE CARRIED OUT TO MAXIMIZE THE RESPONSIVITY, AND PROVIDE A SYSTEM DEMONSTRATION FOR IR HTSC DETECTOR ARRAYS.

ADVANCED TECHNOLOGY MATERIALS INC (ATM)

520-B DANBURY RD

NEW MILFORD, CT 06776

Program Manager: DR PETER S KIRLIN

Contract #:

Title: CW LASER MODULATOR

Topic #: AF90-116

Office: WRDC/ML

ID #: 39873

RECENT DEVELOPMENTS IN OPTICAL COMMUNICATION TECHNOLOGY ARE VERY ENCOURAGING FOR THE POTENTIAL OPERATION OF OPTICAL SATELLITE CROSS- LINKS. MOST NOTABLE IS THE DEVELOPMENT OF HIGH EFFICIENCY ND:YAG RING LASERS WHICH WOULD BE ATTRACTIVE TRANSMITTERS IF WIDE BANDWIDTH EXTERNAL PHASE MODULATORS COULD BE DEVELOPED. A TRAVELING-WAVE CONFIGURATION GIVES THE MAXIMUM BANDWIDTH FOR ELECTRO-OPTIC MODULATORS. THE MAXIMUM BANDWIDTH-LENGTH PRODUCT IS FIXED BY THE VELOCITY DIFFERENCE BETWEEN THE CO-PROPAGATING MICRO/MILLIMETER WAVE AND OPTICAL SIGNAL AND CAN BE DRAMATICALLY IMPROVED BY PROPAGATING THE MICROWAVE IN A LOW INDEX DIELECTRIC MATERIAL. FOR A GIVEN APPLIED VOLTAGE A FURTHER IMPROVEMENT CAN BE OBTAINED THROUGH THE USE OF BaTiO₃ WHICH HAS AN ELECTRO-OPTIC COEFFICIENT 35 TIMES LARGER THAN LiNbO₃. THIS COMBINATION OF MATERIALS CAN BE REALIZED BY FABRICATING A RIDGE WAVE GUIDE FROM A SINGLE CRYSTAL BaTiO₃ THIN FILM GROWN ON A LATTICED MATCHED DIELECTRIC SUBSTRATE. THE OBJECTIVE OF THE PHASE I WORK IS TO DEMONSTRATE LOW LOSS OPTICAL TRANSMISSION IN RIDGE WAVEGUIDES FABRICATED FROM BaTiO₃ THIN FILMS DEPOSITED ON LaGaO₃ BY MOCVD. THESE RESULTS WILL ESTABLISH THE BASIC MATERIALS TECHNOLOGY REQUIRED FOR THE FABRICATION OF PROTOTYPE BaTiO₃ TRAVELING-WAVE PHASE MODULATOR IN PHASE II.

PDA ENGINEERING

2975 REDHILL AVE

COSTA MESA, CA 92626

Program Manager: DR LARRY HARRAH

Contract #:

Title: A LIGHT CURING FUEL TANK REPAIR SEALANT

Topic #: AF90-118

Office: WRDC/ML

ID #: 39874

INTEGRAL FUEL TANKS ARE COMMON TO AIRCRAFT SYSTEMS. FUEL TANK REPAIRS ARE SIGNIFICANT COST ITEM BECAUSE OF MAINTENANCE FREQUENCY AND TIME TO AFFECT REPAIR. CONVENTIONAL FUEL TANK SEALANTS, SUCH AS POLYSULFIDES, REQUIRE HOURS TO CURE. THIS IS A MAJOR CONTRIBUTOR TO REPAIR TIME. A REACTIVE ADHESIVE HAS BEEN DEVELOPED WHICH CAN BE THERMALLY OR PHOTOEXITATION INITIATED. THE REACTIVE SPECIES IS CAPABLE OF COVALENT BOND FORMATION WITH A VARIETY OF STRUCTURES. INCORPORATED INTO A SEALANT MATERIAL, IT PROVIDES A MEANS BY WHICH UV LIGHT CAN AFFECT CURE WHILE IMPROVING THE BOND STRENGTH BETWEEN SEALANT AND FUEL TANK. A FLUOROSILICON WILL BE USED AS A MODEL SEALANT COMPOUND IN PHASE I. UV CURING

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AGENTS TERMINATED WITH PDA'S PROPRIETARY REACTIVE FUNCTIONALITY WILL BE SYNTHESIZED. PHOTO- CHEMICAL ACTIVATION OF THESE AGENTS WILL BE STUDIED. PHOTOCHEMICALLY CURED FLUOROSILICON ADHESIVES WILL BE FORMULATED. MECHANICAL PROPERTIES OF THE CURED ADHESIVE WILL BE MEASURED AS WILL ITS ADHESION STRENGTH WITH ALUMINUM AND NEOPRENE.

INTELLIGENT AUTOMATION INC

1370 PICCARD DR - STE 210

ROCKVILLE, MD 20850

Program Manager: LEONARD S HAYNES

Contract #:

Title: OPEN ARCHITECTURE FOR ELECTRONIC DESIGN AND SUPPORT TOOLS

Topic #: AF90-119

Office: WRDC/ML

ID #: 39875

WE PROPOSE TO DEVELOP A SET OF FORMAL ABSTRACT DATA MODEL WHICH WILL CREATE AN OPEN ARCHITECTURE FOR ELECTRONICS COMPUTER-AIDED DESIGN, EVALUATION, TEST, AND DIAGNOSIS TOOLS. OUR ARCHITECTURE IS MODELED AFTER THE HIGHLY SUCCESSFUL OPEN SYSTEM INTERCONNECTION REFERENCE MODEL WHICH HAS BECOME THE INTERNATIONAL STANDARD FOR COMMUNICATION SYSTEMS. THE OSI MODEL SPECIFIES DATA AND OPERATIONS ONLY AT THE INTERFACES BETWEEN SEVEN HIERARCHICALLY ORGANIZED LEVELS. SYSTEMS ADHERING TO THOSE INTERFACES CAN INTERCOMMUNICATE EVEN THOUGH, INTERNALLY, THEY ARE ENTIRELY DIFFERENT. FOR OUR OPEN ARCHITECTURE WE PROPOSE A COMPONENT LEVEL, DEPENDENCY LEVEL, AMBIGUITY GROUP LEVEL, TEST VECTOR LEVEL, FAULT TREE LEVEL, FAULT DICTIONARY LEVEL, AND DIAGNOSTIC RULES LEVEL. MANY NEW TOOLS ARE BEING DEVELOPED TO AID IN THE DESIGN IMPLEMENTATION, AND SUPPORT OF ELECTRONIC SYSTEMS. IF SUCCESSFUL, THE PROPOSED OPEN ARCHITECTURE WOULD ENABLE SUCH TOOLS TO BE USED TO VALIDATE THE RESULTS OF OTHER TOOLS BY ENABLING BOTH TOOL SYSTEMS TO USE THE SAME INPUT AND PRODUCE OUTPUTS IN THE SAME FORMAT. THIS VERIFICATION AND VALIDATION CAPABILITY WOULD HELP INCREASE THE RELIABILITY OF TODAY'S INCREASINGLY COMPLEX ELECTRONIC SYSTEMS. THE PROPOSED PHASE I EFFORT WILL FOCUS ON THE DEPENDENCY, AMBIGUITY GROUP, AND TEST VECTOR LAYERS OF THE ARCHITECTURE.

APEIRON INC

230 TENTH AVE S

MINNEAPOLIS, MN 55415

Program Manager: DR GLEN M CASTORE

Contract #:

Title: MULTIPLE LASER MEASUREMENT SYSTEM

Topic #: AF90-120

Office: WRDC/ML

ID #: 39877

THE KEY PROBLEM TO BE ADDRESSED IN PHASE I OF THIS PROJECT WILL BE TO DETERMINE THE FEASIBILITY OF A NOVEL POSITION MEASURING SYSTEM FOR A FAMILY OF COMPUTER CONTROLLED MACHINE TOOLS. THE MULTIPLE LASER MEASUREMENT SYSTEM (MLMS), WHICH FORMS THE BASIS OF THIS PROPOSAL, WILL MEASURE THE (x, y, z) POSITION OF THE CUTTING HEAD DIRECTLY AT RATES AND ACCURACIES SUFFICIENT FOR CLOSED LOOP POSITION CONTROL. QUESTIONS ABOUT THE ABILITY OF MLMS TO OPERATE ON A FACTORY FLOOR CAN ONLY BE ANSWERED BY DEVELOPING THE CONCEPT AS PART OF A MACHINE TOOL WHICH WILL BE SOLD AND SUPPORTED. IN THIS CONTEXT, THE SYSTEM MUST SATISFY CRITERIA OF RELIABILITY, COST, EASE OF OPERATION, AND REPAIRABILITY. APEIRON'S PARTNERSHIP WITH KOMO MACHINE, INC. ASSURES THAT THESE CRITERIA WILL BE ADDRESSED.

SOUTH BEND LATHE INC

400 W SAMPLE ST

SOUTH BEND, IN 46625

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AIR FORCE Solicitation 90.1

Program Manager: SOREN B BACKE

Contract #:

Title: MACHINE TOOL PRODUCTS AND PROCESSES

Topic #: AF90-120

Office: WRDC/ML

ID #: 39876

SINGLE SPINDLE SCREW MACHINES HAVE REMAINED ESSENTIALLY UNCHANGED IN DESIGN AND OPERATION SINCE EARLY IN THE CENTURY. CAMS AND LEVERS ARE STILL THE PRINCIPAL MEANS OF OPERATING THE SLIDES. ALTHOUGH VERY PRODUCTIVE ONCE SET UP, THE TREND TOWARD SMALLER LOT SIZES, SETUP TIME REQUIREMENTS, AND SUPPORT SKILLS REQUIREMENTS HAVE COMBINED TO SUPPLANT THE USE OF THESE MACHINES WITH GENERAL PURPOSE CNC MACHINES OF MUCH LONGER PART CYCLE TIMES. VARIOUS ATTEMPTS HAVE BEEN MADE TO IMPROVE THE DESIGN: HYBRIDIZATION OF CNC FOR CERTAIN FUNCTIONS WITH CAMS STILL REQUIRED, OR SERVO MOTOR CONTROL OF THE CAM ROTATION. NONE OF THESE SOLUTIONS HAVE PROVEN SATISFACTORY. IT IS OUR OBJECTIVE TO DESIGN A SCREW MACHINE EMPLOYING NEW COMPUTER TECHNOLOGY TO CONTROL SPECIAL HYDRAULIC SYSTEMS FOR SLIDE, SPINDLE, AND TURRET FUNCTIONS. THIS DEVELOPMENT WILL NOT ONLY RESULT IN AN EXTREMELY PRODUCTIVE MACHINE, BUT THE TECHNOLOGY MAY BE APPLIED TO ALL TYPES OF METAL CUTTING MACHINES, ENHANCING THE ABILITY OF AMERICAN MANUFACTURERS TO COMPETE WITH LOW COST FOREIGN PRODUCERS.

THERMACORE INC

700 EDEN RD

LANCASTER, PA 18701

Program Manager: JOHN R HARTENSTINE

Contract #:

Title: INTERCHANGEABLE VARIABLE CONDUCTANCE HEAT PIPES FOR SODIUM-SULFUR BATTERIES

Topic #: AF90-122

Office: WRDC/PO

ID #: 39878

THE SODIUM-SULFUR BATTERY IS A CANDIDATE ENERGY STORAGE MECHANISM FOR SATELLITES. THERMAL MANAGEMENT OF THE BATTERY CELLS IS REQUIRED DURING CHARGING AND DISCHARGING. PROPER THERMAL MANAGEMENT WILL ISOTHERMALIZE THE BATTERY CELLS BY PROVIDING THERMAL INSULATION DURING RECHARGE OR SUNLIGHT OPERATION AND PROVIDING A MEANS TO RADIATE EXCESS HEAT GENERATED DURING DISCHARGE OR ECLIPSE OPERATION. VARIABLE CONDUCTANCE HEAT PIPES (VCHP) WILL PROVIDE PASSIVE LIGHT-WEIGHT TEMPERATURE CONTROL FOR THE SODIUM-SULFIDE CELLS FOR GEOSYNCHRONOUS-EARTH-ORBIT (GEO) AND LOW-EARTH-ORBIT (LEO). THE GOAL OF THIS PHASE I PROGRAM IS TO ESTABLISH INTERCHANGEABLE THERMAL MANAGEMENT DESIGNS USING VCHPS FOR A COMMON SODIUM-SULFUR BATTERY CELL CONFIGURATION. ONLY ONE BATTERY CELL CONFIGURATION IS REQUIRED AND CAN BE USED FOR GEO OR LEO APPLICATIONS. THE VCHP COOLING SCHEME WOULD SIMPLY MEET THE THERMAL REQUIREMENTS OF THE ORBIT MISSION AND AVOID THE NEED TO CONFIGURE THE BATTERY CELLS TO MEET THE THERMAL MANAGEMENT DESIGN FOR DIFFERENT ORBITS. THIS PHASE I EFFORT WILL FABRICATE AND TEST A PROOF-OF-CONCEPT VCHP TO DEMONSTRATE THERMAL MANAGEMENT FOR SODIUM-SULFUR BATTERY TO BE USED IN LEO.

EIC LABS INC

111 DOWNEY ST

NORWOOD, MA 02062

Program Manager: DR GERHARD L HOLLECK

Contract #:

Title: DEVELOPMENT OF A BIPOLAR LEAD/FLUOROBORIC ACID BATTERY FOR PULSE POWER

Topic #: AF90-123

Office: WRDC/PO

ID #: 39879

THE U.S. AIR FORCE REQUIRES STANDARD PULSE POWER SOURCES FOR AIRBORNE/SPACEBORNE APPLICATIONS WITH POWER DENSITIES GREATER THAN 50 kW/kg. TO MEET THESE REQUIREMENTS, WE PROPOSE TO DEVELOP A RECHARGEABLE HIGH POWER BIPOLAR BATTERY BASED ON THE $Pb/HBF_4(4)PbO(2)$

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SYSTEM. THIS BATTERY IS UNIQUE IN THAT THE DISCHARGE PRODUCT OF BOTH ELECTRODES IS A HIGHLY SOLUBLE SALT, $Pb(BF_4)_2$. THE ACTIVE MATERIALS, Pb AND PbO_2 , ARE REGENERATED FROM THE SALT ON CHARGE. SPECIFIC ADVANTAGES OF THE BATTERY INCLUDE HIGH RATE CAPABILITY, COMPLETE USE OF ACTIVE MATERIALS, INVARIANT ELECTRODES, AND SIMPLE AND INEXPENSIVE BATTERY CONSTRUCTION AND ASSEMBLY. IN PHASE I WE WILL DEMONSTRATE PULSED POWER DENSITIES OF $2 W/cm^2$ IN BIPOLAR PROTOTYPE BATTERIES. AFTER FURTHER DEVELOPMENT MULTILAYER BIPOLAR BATTERIES WILL BE CAPABLE OF $100 kW/kg$ AND $20 Wh/kg$.

ELECTRO-CHEM INC
400 W CUMMINGS PK
WOBBURN, MA 01801

Program Manager: DR VINOD JALAN

Contract #:

Title: HYDROGEN FLUORINE FUEL CELL FOR STRATEGIC AND TACTICAL APPLICATIONS

Topic #: AF90-124

Office: WRDC/PO

ID #: 39880

THE OBJECTIVE OF THE PROPOSED PROGRAM IS TO DEVELOP A BATTERY THAT CAN MEET THE SPECIFIC REQUIREMENTS FOR STRATEGIC AND TACTICAL ONBOARD POWER FOR MISSILE APPLICATIONS. THESE REQUIREMENTS INCLUDE A SHELF LIFE OF UP TO 25 YEARS, OPERATION FROM -54 TO $+74$ DEG C, ATTAINING FULL POWER IN LESS THAN ONE SECOND, AND EXHIBITING MODERATELY HIGH POWER DENSITIES. ELECTRO-CHEM PROPOSES THE UNIQUE AND HIGH PAYOFF CONCEPT OF A HYDROGEN/FLUORINE BATTERY. BY DESIGN, THIS SYSTEM WILL BE CAPABLE OF INDEFINITE STORAGE YET ALSO CAPABLE OF QUICK STARTUP UNDER ANY CONDITION. IN PHASE I, THE PROPOSED CONCEPT WILL BE DEMONSTRATED THROUGH THE DESIGN, CONSTRUCTION AND OPERATION OF A LABORATORY TEST CELL.

ADVANCED TECHNOLOGY MATERIALS INC (ATM)
520-B DANBURY RD
NEW MILFORD, CT 06776

Program Manager: SOO HEE TAN

Contract #:

Title: SCHOTTKY AND OHMIC CONTACTS FOR B-SILICON CARBIDE

Topic #: AF90-125

Office: WRDC/PO

ID #: 39881

HIGH POWER SEMICONDUCTORS USING SILICON AND GaAs ARE LIMITED TO ENVIRONMENTS THAT ARE LESS THAN 300 DEG C IN TEMPERATURE DUE TO LOW BANDGAPS, LOW BREAKDOWN FIELDS AND LOW THERMAL CONDUCTIVITIES. $3C-SiC(B-SiC)$ HAS BEEN IDENTIFIED AS A MATERIAL WITH EXCELLENT POTENTIAL TO FULFILL THE REQUIREMENTS OF A HIGH POWER, HIGH TEMPERATURE SEMICONDUCTOR WITH HIGH RADIATION HARDNESS. THE KEY TO DEVELOPING DEVICES FOR B-SiC IS TO BE ABLE TO CONSISTENTLY PRODUCE INTRINSIC FILMS WITH VERY LOW DEFECTS AND TO DEVELOP SCHOTTKY AND OHMIC CONTACT MATERIALS THAT WILL WITHSTAND HARSH ENVIRONMENTS MUST BE IDENTIFIED. THESE DEVELOPMENTS WILL PERMIT COMPATIBILITY WITH SILICON TECHNOLOGIES AS WELL AS THE INTEGRATION OF B-SiC DEVICES INTO SILICON BASED DEVICES. ATM HAS DEVELOPED UNIQUE SINGLE SOURCE B-SiC DEPOSITION TECHNOLOGY THAT ADDRESSES THE THIN FILM PROBLEM, HOWEVER, CONTACTS REMAIN A MAJOR IMPEDIMENT TO DEVICE FABRICATION. IN PHASE I OF THIS PROGRAM DIFFERENT SCHOTTKY AND OHMIC MATERIALS WILL BE DEVELOPED AND CHARACTERISED. THE RESULTS WILL BE APPLIED TO THE FABRICATION OF A p-n JUNCTION WHICH FORMS THE BASIC BUILDING BLOCK OF EVERY SEMICONDUCTOR DEVICES. PHASE II WILL THEN FOCUS ON OPTIMIZING THE PROCESSES AND ACTUAL DEVELOPMENT OF A DEVICE SUCH AS A FET, JFET, MESFET OR MOSFET.

STRESS TECHNOLOGY INC
1800 BRIGHTON HENRIETTA TOWN LINE RD

SMALL BUSINESS INNOVATION RESEARCH PROGRAM - PHASE I
AIR FORCE Solicitation 90.1

ROCHESTER, NY 14623

Program Manager: TONY LAM

Contract #:

Title: COMPUTER AIDED STRUCTURAL AND LIFE ANALYSIS OF TURBINE ENGINE COMPONENTS

Topic #: AF90-126

Office: WRDC/PO

ID #: 39882

A COMPUTER BASED PROGRAM FOR STRUCTURAL ANALYSIS AND LIFE PREDICTION OF HIGH TEMPERATURE TURBINE ENGINE COMPONENTS IS PROPOSED, USING EXISTING COMPUTER ROUTINES WHICH HAVE BEEN DEMONSTRATED BY STI TO SUCCESSFULLY PREDICT SERVICE LIFE OF LOW TEMPERATURE TURBINE AND COMPRESSOR COMPONENT. THE OBJECTIVE OF PHASE I WILL BE TO INITIATE DEVELOPMENT OF A STAND-ALONE COMPUTER CODE FOR PREDICTION OF OPERATING STRESSES AND SERVICE LIFE OF HIGH TEMPERATURE TURBINE ENGINE COMPONENTS, COMPLETE WITH SUPPORTING GRAPHIC ROUTINES. IN PHASE I STI WILL EXAMINE THE CURRENT CAPABILITIES OF ITS BLADE PROGRAM, AND PRESENT A MEANS FOR EXTENDING THE FINITE ELEMENT FORMULATION AND SOLUTION ROUTINES TO COMPUTE STEADY STATE, THERMAL AND DYNAMIC STRESSES OF GAS TURBINE COMPONENTS USING SELECTED ADVANCED COMPONENT MATERIALS. SUITABLE STATE-OF-THE-ART TECHNIQUES FOR LIFE PREDICTION IN HIGH TEMPERATURE ENVIRONMENTS SUCH AS STRAIN RANGE PARTITIONING, AND THE DOUBLE LINEAR DAMAGE RULE WILL BE REVIEWED AS EXTENSIONS TO THE LOCAL STRAIN AND FRACTURE MECHANICS ROUTINES CURRENTLY AVAILABLE IN THE BLADE CODE FOR ESTIMATING CRACK INITIATION AND CRACK PROPAGATION OF LOW TEMPERATURE ENGINE COMPONENTS. PHASE I WILL DEMONSTRATE THE FEASIBILITY OF ANALYZING A SELECTED GAS TURBINE BLADE WITH BLADE BY PREPARING A CUSTOMIZED PRE-PROCESSING ROUTINE FOR FORMULATING A SELECTED HIGH TEMPERATURE BLADE MODEL, AND CALCULATING STRESSES AND NATURAL FREQUENCIES USING THE BLADE SOLUTION AND POST PROCESSING ROUTINES. FREQUENCY RESULTS WILL BE CORRELATED WITH AVAILABLE AIR FORCE TEST RESULTS FOR THE SELECTED COMPONENT.

WILLIS & KAPLAN INC

720 ARMSTRONG DR

BUFFALO GROVE, IL 60089

Program Manager: MITCHELL P KAPLAN

Contract #:

Title: TURBINE ENGINE COMPONENT DESIGN OPTIMIZATION BY DAMAGE TOLERANCE ASSESSMENT

Topic #: AF90-126

Office: WRDC/POMX

ID #: 40946

DAMAGE TOLERANCE ASSESSMENT (DTA) IS USED TO VALIDATE A STRUCTURE FOR REQUIRED LIFE. ITS USE AS A DESIGN TOOL, HERETOFORE UNTRIED, IS THE PRINCIPAL SUBJECT OF THIS PROPOSAL. ADVANCES IN FINITE ELEMENT ANALYSIS (FEA) AND DTA IN RECENT YEARS OFFER THE POTENTIAL TO PERFORM ANALYSIS SUFFICIENTLY RAPIDLY AND EASILY FOR THEIR INTEGRATION INTO THE DESIGN PROCESS. DTA NEEDS DESCRIPTIONS OF THE STRESS FIELDS IN THE NEIGHBORHOOD OF HYPOTHECATED FLAWS; A GRAPHIC INTERFACE FROM THE FEA CAN PROVIDE THIS INFORMATION; FEA NEEDS A DESCRIPTION OF THE GEOMETRY; DESCRIPTION OF GEOMETRY IS AN INITIAL STAGE OF DESIGN. BY CYCLING THROUGH THIS PROCESS, A DESIGN CAN BE OPTIMIZED FOR ITS LIFE. GEOMETRY TRANSITION ZONES ARE WHERE STRESSES ARE HIGH, WHERE CRACKS TYPICALLY ORIGINATED. FROM TRADITION AND FOR CONVENIENCE, THESE ZONES, OR "FILLET," INVARIABLY HAVE SECTIONS DESCRIBED BY CIRCLES. CONSIDERING THE SHAPE OF A FILLET AND NOT JUST ITS SIZE AS A DESIGN VARIABLE OFFERS A POTENTIAL MEANS TO OPTIMIZE HIGHLY LOCALIZED PARTS OF A DESIGN FOR ITS LIFE CYCLE WITHOUT AFFECTING THE OVERALL DESIGN AND FUNCTION. THE SPEED AND PRECISION REQUIRED FOR THIS PROCEDURE TO BE A PRACTICAL DESIGN TOOL ALSO ENHANCE ITS APPLICABILITY TO ITS TRADITIONAL FUNCTION OF DESIGN VALIDATION.

ITAC

15542 TOWAY LN

HUNTINGTON BEACH, CA 92647

SMALL BUSINESS INNOVATION RESEARCH PROGRAM - PHASE I
AIR FORCE Solicitation 90.1

Program Manager: KONRAD L KRAULAND

Contract #:

Title: UNIVERSAL WEAVING FOR TURBINE ENGINE COMPOSITE PREFORMS

Topic #: AF90-127

Office: WRDC/PO

ID #: 39883

HIGH TEMPERATURE COMPOSITE MATERIALS CAN REDUCE THE WEIGHT OF TURBINE ENGINE COMPONENTS SUCH AS TURBINE BLADES AND ROTORS. MULTI- AXIALLY REINFORCED FIBROUS STRUCTURES (MARFS), COMMONLY CALLED 3-D PREFORMS, ARE NECESSARY TO MEET THE MECHANICAL REQUIREMENTS OF THESE HIGH TEMPERATURE COMPONENTS. PHASE I EFFORTS WILL INCLUDE DETAILED DESIGN AND ANALYSIS OF SPECIAL WEAVING ELEMENTS TO DETERMINE THE FEASIBILITY OF A FULLY AUTOMATED 3-D CARTESIAN WEAVER (WEAVING ELEMENTS ARE SET OUT IN AN X-Y GRID). 3-D BRAIDS OR OTHER INTERLACED STRUCTURES MAY BE FORMED BY USING ONLY WARP OR "Z" DIRECTION YARNS WHICH ARE PERPENDICULAR TO THE WEAVING PLANE. BY ADDING FILLING YARNS, ORTHOGONAL, +/-145 DEG, QUASI-ISOTROPIC, AND OTHER FIBER ARCHITECTURES MAY BE FORMED. THIS TECHNOLOGY WILL ALLOW DESIGNERS TO INCORPORATE SEVERAL SHAPES AND FIBER ARCHITECTURES WITHIN A SINGLE FIBROUS PREFORM, OPTIMIZING THE PERFORMANCE OF RESULTANT PARTS. A LOW COST MANUALLY OPERATED LOOM WILL ALSO BE BUILT TO DEMONSTRATE A FULL SCALE TURBINE BLADE WITH A THICK ROOT SECTION WHICH TRANSITIONS TO A THIN AIRFOIL SHAPED BLADE.

PHASEX CORP

360 MERRIMACK ST

LAWRENCE, MA 01843

Program Manager: VAL KRUKONIS

Contract #:

Title: DEVELOPMENT OF JP-8 WITH IMPROVED THERMAL OXIDATIVE STABILITY

Topic #: AF90-128

Office: WRDC/PO

ID #: 39884

THE PROPERTIES OF SUPERCRITICAL FLUIDS ARE EMPLOYED TO SEPARATE HETEROAROMATIC COMPOUNDS FROM JP-8 FOR THE PURPOSE OF IMPARTING INCREASED THERMAL OXIDATIVE RESISTANCE TO THE FUEL. THE SELECTIVITY, I.E., THE ABILITY TO REMOVE ESSENTIALLY ONLY HETEROAROMATICS, CAN BE PRESSURE TUNED, AND PRELIMINARY DATA PRESENTED SHOW THAT MULTIRING AROMATICS AND HETEROCYCLIC COMPOUNDS CAN BE SEPARATED FROM JP-A AND JP-T. AS A MEANS OF ASSESSING THE POTENTIAL FOR SUCCESSFUL COMPLETION OF A PHASE II EFFORT, THE PHASE I WORK INCLUDES A TASK DIRECTED TO THE DEVELOPMENT OF A PROCESS FLOW DIAGRAM AND ECONOMIC VIABILITY ASSESSMENT.

DESILUBE TECHNOLOGY INC

904 BREEZEWOOD LN

LANSDALE, PA 19446

Program Manager: LUKE R Ocone

Contract #:

Title: SOLID LUBRICANTS AND THEIR DISTRIBUTION FOR ADVANCED AIRCRAFT GAS TURBINES

Topic #: AF90-129

Office: WRDC/PO

ID #: 39885

THE OBJECTIVE OF THIS PROJECT IS TO DEMONSTRATE EXPERIMENTALLY A NOVEL APPROACH TO DELIVERING A SOLID POWDER AS AN AEROSOL OF IMPROVED STABILITY. THE PROPOSED SYSTEM WILL BE DESIGNED SPECIFICALLY FOR THE DELIVERY OF MOLYBDENUM DISULFIDE TO THE BEARINGS OF THE DEVELOPMENTAL ADVANCED AIRCRAFT GAS TURBINE, WHICH MAY OPERATE BETWEEN THE EXTREMES OF -60 DEG F AND 1500 DEG F. THE AVAILABLE LIQUID LUBRICANTS ARE NOT STABLE AT THE HIGH END OF THIS RANGE AND THE USE OF SOLID LUBRICANTS IS THE PREFERRED OPTION FOR LUBRICATION OF THE ADVANCED GAS TURBINE. THIS PROPOSAL ADDRESSES THE MAIN OBSTACLE TO TRANSPORT OF POWDER, WHICH IS THE TENDENCY OF POWDERS TO AGGLOMERATE AND CLING TO SURFACES BECAUSE OF ELECTRO-STATIC FORCES. IF GASEOUS DISPERSIONS OF LUBRICANTS ARE STABILIZED, IT WILL BE POSSIBLE

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TO MOVE THEM IN SIMPLE WAYS IN ORDER TO DELIVER THEM TO BEARINGS. OPERATION AT HIGHER TEMPERATURES WILL IMPROVE THE THERMODYNAMIC EFFICIENCIES OF ENGINES, PROVIDING HIGHER POWER-TO-WEIGHT RATIOS, IMPROVING FUEL EFFICIENCIES, AND, THEREBY, ENHANCING MISSION CAPABILITIES. WHILE THE EFFORT IS ORIENTED TOWARD THE LUBRICATION REQUIREMENTS OF THE ADVANCED GAS TURBINE, THE DELIVERY SYSTEM SHOULD BE ADAPTABLE TO THE CERAMIC DIESEL AND OTHER HIGH-TEMPERATURE ENGINES OF MILITARY INTEREST.

WEDEVEN ASSOCS INC
5068A WEST CHESTER PIKE
EDGEMONT, PA 19028
Program Manager: LAVERN D WEDEVEN

Contract #:

Title: LUBRICATION OF HIGH TEMPERATURE BEARING SURFACES BY VAPOR DEPOSITION

Topic #: AF90-130

Office: WRDC/PO

ID #: 39886

ADVANCED GAS TURBINE ENGINES WILL REQUIRE MAIN SHAFT BEARINGS TO OPERATE OVER A CONTINUOUS TEMPERATURE RANGE FROM -50 TO 500 C. THE FEASIBILITY OF A SYNERGISTIC ASSEMBLY OF LUBRICATION TECHNOLOGIES IS INVESTIGATED. THESE INCLUDE: (1) A NEWLY SYNTHESIZED HIGH TEMPERATURE FLUID BASESTOCK TO EXPAND THE ELASTOHYDRODYNAMIC (EHD) LUBRICATION RANGE, (2) THE MANUFACTURE AND MODIFICATION OF A CERAMIC AND HARD FACE COATING TO OBTAIN MICRO-FINE SURFACES FOR "ULTRA THIN EHD" LUBRICATION AND (3) THE EVALUATION OF VAPOR DEPOSIT LUBRICATION AND A "CHEMICAL CARRIER" TO TRANSITION INTO A HIGH TEMPERATURE "THERMAL DEPOSIT" LUBRICATION MODE. FEASIBILITY STUDIES ARE CONDUCTED WITH A HIGH TEMPERATURE (815 C) TRACTION TEST RIG (WA MACHINE).

PHYSICAL SCIENCES INC
20 NEW ENGLAND BUSINESS CTR
ANDOVER, MA 01810
Program Manager: TERENCE E PARKER

Contract #:

Title: FUEL FOULING INSTRUMENTATION SYSTEMS

Topic #: AF90-131

Office: WRDC/PO

ID #: 39887

FUEL FOULING IS A SERIOUS PROBLEM FOR HIGH PERFORMANCE AIRCRAFT PROPULSION SYSTEMS AND INVOLVES COMPLEX PROCESSES THAT ARE POORLY UNDERSTOOD. THIS PROGRAM WILL VERIFY, WITH EXPERIMENTAL DEMONSTRATIONS, MEASUREMENT TECHNIQUES APPROPRIATE FOR QUANTIFYING PROCESSES INHERENT IN THE FUEL FOULING PROBLEM. THESE DIAGNOSTICS WILL BE APPLIED IN BOTH THE BULK FLOW AND AT THE WALL SURFACES. THE PHASE I EFFORT WILL CONSTRUCT A SIMPLE HIGH TEMPERATURE FLOWING FUEL SYSTEM CAPABLE OF PRODUCING HIGH TEMPERATURES (APPROXIMATELY 700 K) IN AN OPTICALLY ACCESSIBLE FUEL. ABSORPTION, SCATTERING AND FLUORESCENCE DIAGNOSTICS WILL BE APPLIED TO THE PARTICULATE AND PARTICULATE PRECURSORS IN THE BULK FLOW AND ABSORPTION AND FLUORESCENCE WILL BE DEMONSTRATED FOR SURFACE DEPOSITS IN THE FLOWING FUEL SYSTEM. THE PHASE I EFFORT WILL QUICKLY DEMONSTRATE THE UTILITY OF THESE DIAGNOSTICS AND RECOMMEND AN APPROPRIATE DIAGNOSTIC SET FOR FURTHER DEVELOPMENT, AND POSSIBLE DELIVERY, IN PHASE II.

DEACON RESEARCH
2440 EMBARCADERO WY
PALO ALTO, CA 94303
Program Manager: ANTHONY O'KEEFE

Contract #:

Title: LASER BASED NON-INTRUSIVE MEASUREMENT OF JET ENGINE FLOWS: FLOW VELOCITY

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Topic #: AF90-133

Office: WRDC/PO

ID #: 39888

LASER BASED NON-INTRUSIVE REMOTE SENSING TECHNIQUES ARE BEING DEVELOPED TO CHARACTERIZE SUPERSONIC FLOWS AND THRUSTS IN HIGH PERFORMANCE JET ENGINE EXHAUSTS. THE MOST PROMISING APPROACH TO MAKING A VELOCITY MEASUREMENT INVOLVES THE PRECISE MEASUREMENT OF A DOPPLER SHIFTED MOLECULAR ABSORPTION OR FLUORESCENCE SIGNAL AND RELATING THE MAGNITUDE OF THE SHIFT TO THE CARRIER FLOW VELOCITY. THE MOST SIGNIFICANT OBSTACLE TO THIS APPROACH IS IN THE DETERMINATION OF THE SMALL SPECTRAL SHIFT TO AN ACCURACY SUFFICIENT TO BE USEFUL. WE PROPOSE TO DEVELOP A RESONANCE FLUORESCENCE - DOPPLER SHIFT APPROACH WHICH CAN PROVIDE TWO DIMENSIONAL VELOCITY AND DENSITY DATA WITH kHz DATA RATES. IN OUR APPROACH THE FREQUENCY PRECISION IS PROVIDED BY A NARROWBAND CONTINUOUS DYE LASER WHICH IS FREQUENCY MODULATED OVER A SMALL RANGE (NEAR A MOLECULAR ABSORPTION). THE FREQUENCY MODULATION TECHNIQUE TO BE USED HAS BEEN DEVELOPED AND DEMONSTRATED AT kHz CYCLE RATES. THE LASER BEAM IS PASSED THROUGH A REFERENCE CELL CONTAINING THE MOLECULAR SPECIES TO BE PROBED AND IS THEN PASSED THROUGH THE EXHAUST FLOW TO BE DETERMINED. SINCE THE DOPPLER SHIFTED MOLECULES IN THE HIGH SPEED FLOW WILL BE EXCITED AND FLUORESCENCE AT A SLIGHTLY DIFFERENT FREQUENCY FROM THOSE IN THE REFERENCE CELL, THE TWO FLUORESCENCE SIGNALS WILL OCCUR AT DIFFERENT TIMES IN THE LASER MODULATION CYCLE. BY MEASURING THE TIME DIFFERENCE BETWEEN THESE SIGNALS THE DOPPLER SHIFT CAN BE DETERMINED WITH GREAT PRECISION. THE MAGNITUDE OF THE RAYLEIGH SCATTER FROM THE OBSERVATION POINT, WHICH IS CONSTANT WITH LASER FREQUENCY, CAN BE MONITORED AND USED TO DETERMINE THE GAS DENSITY AS WELL. THE ABSOLUTE INTENSITY OF THE FLUORESCENCE SIGNAL (OR THE RELATIVE SIGNALS OF TWO TRANSITIONS) MAY ALSO PROVE USEFUL FOR THE SIMULTANEOUS DETERMINATION OF OTHER FLOW FIELD PROPERTIES SUCH AS SPECIES CONCENTRATION AND TEMPERATURE.

PHYSICAL SCIENCES INC
20 NEW ENGLAND BUSINESS CTR
ANDOVER, MA 01810

Program Manager: MARK ALLEN

Contract #:

Title: VELOCITY MEASUREMENTS IN HIGH TEMPERATURE GASES USING NO FLUORESCENCE

Topic #: AF90-133

Office: WRDC/PO

ID #: 39889

THIS PHASE I PROPOSAL DESCRIBES AN INNOVATIVE APPROACH TO NON-INTRUSIVE VELOCITY MEASUREMENT IN SUPERSONIC FLOWFIELDS BASED ON THE DOPPLER-SHIFTED FLUORESCENCE OF THE NO MOLECULE. A SUCCESSFUL DEMONSTRATION OF THIS CONCEPT WOULD REPRESENT A SIGNIFICANT ADVANCE IN BOTH NON-INTRUSIVE DIAGNOSTICS AND GENERAL PROPULSION INSTRUMENTATION. CURRENT VELOCITY MEASUREMENT TECHNIQUES, SUCH AS HOT-WIRE ANEMOMETRY (BASED ON THE CONVECTIVE COOLING OF A SMALL, HEATED WIRE IN THE FLOW) AND LASER-DOPPLER ANEMOMETRY (BASED ON THE DOPPLER-SHIFT OF LASER LIGHT SCATTERED FROM PARTICLES SEEDED INTO THE FLOW) ARE GENERALLY INAPPLICABLE, OR SUBJECT TO LARGE SYSTEMATIC ERRORS IN COMPRESSIBLE, HIGH-TEMPERATURE FLOWFIELDS. THE NO FLUORESCENCE APPROACH DESCRIBED IN THIS PROPOSAL FINDS PARTICULAR APPLICATION IN SUPERSONIC COMBUSTION RESEARCH WHERE MEASUREMENTS AT COMBUSTOR INLET AND EXHAUST ARE REQUIRED. FURTHERMORE, THE TECHNIQUE IS CONCEPTUALLY AMENABLE FOR EXTENSION TO SIMULTANEOUS, MULTI-POINT MEASUREMENTS USING LASER SHEET ILLUMINATION AND FLUORESCENCE DETECTION VIA SENSITIVE, IMAGING DETECTOR ARRAYS.

ANALYSIS CONSULTANTS
21831 ZUNI DR
EL TORO, CA 92630
Program Manager: DR B G MARTIN
Contract #:

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Title: RADIATION-DISCRIMINATING IMPURITY-BAND-CONDUCTION LWIR PHOTODETECTORS

Topic #: AF90-134

Office: HQ/AFSTC

ID #: 39742

THE INNOVATIVE PROPOSED HERE IS THE DEVELOPMENT OF A NEW TYPE OF RADIATION-DISCRIMINATING, LONG-WAVELENGTH INFRARED (LWIR) DETECTOR BASED ON IMPURITY-BAND-CONDUCTION (IBC). THE NEW CONFIGURATION ENABLES ONE TO DISCRIMINATE BETWEEN GAMMA-RAY AND LWIR-INDUCED EVENTS. PAST USE OF IBC PHOTODETECTORS HAS SHOWN THAT INJECTED DARK CURRENT FROM THE CONTACTS IS A MAJOR PROBLEM LIMITING THEIR USE. FOR THE IBC CONFIGURATION OF INTEREST HERE, THE USE OF A BIAS-DEPENDENT SUPERLATTICE (SL) TUNNELING STRUCTURE IS PROPOSED IS THE EXPLOITATION OF THE FACT THAT THERE IS A CRITICAL BIAS BELOW WHICH IBC IS ESSENTIALLY RANDOM AND ABOVE WHICH IBC IS PARALLEL TO THE ELECTRIC FIELD. THIS MAKES POSSIBLE THE STORAGE OF LWIR-GENERATED IONIZED DONORS AND ALSO THE READ-OUT OF GAMMA-RAY GENERATED ELECTRONS AND HOLES. THE IONIZED DONORS ARE PERIODICALLY READ-OUT AND THIS FORMS THE BASIS OF LWIR DETECTION. PHASE I WOULD BE A FEASIBILITY STUDY, INCLUDING THE DETERMINATION OF THE OPTIMUM DEVICE DESIGN, OPERATING PARAMETERS, AND EXPECTED CURRENT VS. BIAS BEHAVIOR IN THE PRESENCE OF GAMMA-RAYS. THIS PHASE II GOAL IS THE SUCCESSFUL FABRICATION AND TESTING OF THIS DEVICE.

SPARTA INC

23041 AVENIDA DE LA CARLOTA - STE 400

LAGUNA HILLS, CA 92653

Program Manager: ROGER R BENNETT

Contract #:

Title: INNOVATIVE CONCEPTS FOR SPACE CONTROL

Topic #: AF90-136

Office: AFSTC/OLAB

ID #: 39743

THE AIR FORCE SATELLITE CONTROL NETWORK (AFSCN) SUPPORTS SATELLITE SYSTEMS FOR C2, MONITORING, AS WELL AS PROVIDING A PATH FOR MISSION DATA. IN THE EVENT THAT AN RTS SHOULD BECOME NONFUNCTIONAL, THEN ALL GEO SATELLITES UTILIZING THAT STATION WILL BE OUT OF CONTACT WITH C2 AND ALSO POSSIBLY WITH USERS. THE RTS IS AT RISK OF ATTACK/SABOTAGE, POLITICAL SHUT-DOWN, JAMMING, NATURAL DISASTER, AND NUCLEAR ENVIRONMENT EFFECTS. IN ADDITION, THE SCN HAS LIMITED CAPACITY, FLEXIBILITY, SURVIVABILITY, RELIABILITY AND REDUNDANCY TO OPERATE IN STRESSED CONDITIONS. THE PROPOSED CONCEPT IS TO FIELD A SATELLITE SEGMENT TO AUGMENT THE SCN, PROVIDE SERVICES TO BOTH "STRANDED" SATELLITES, AS WELL AS NEW SERVICES, SUCH AS REAL-TIME, SURVIVABLE, A-J, LPI OF C2 AND MISSION DATA. THE PROPOSED SYSTEM WOULD BE TRANSPARENT TO THE EXISTING SCN AND USER SATELLITES, AND COULD BE LAUNCHED ON SCHEDULE OR "ON-DEMAND". THE OBJECTIVES OF THE PHASE I EFFORT WILL BE TO DEVELOP AND EVALUATE VARIOUS SATELLITE CONCEPTS. SEVERAL CONCEPTS WILL BE DEVELOPED THAT PROVIDE VARIOUS LEVELS OF CAPABILITIES AND COSTS TO DETERMINE AN OPTIMUM CONCEPT DEFINITION. VARIOUS ORBITS AND CONCEPTUAL DESIGNS WILL BE ANALYZED. SYSTEM, SATELLITE, AND PAYLOAD REQUIREMENTS WILL BE DETERMINED. OPERATIONAL CONCEPTS AND ISSUES WILL BE DEFINED AND EVALUATED.

STRATEGY TECHNOLOGY & SPACE INC

8 GALLERIA DR

SAN ANTONIO, TX 78257

Program Manager: STEWART C MEYER

Contract #:

Title: INNOVATIVE CONCEPTS FOR FORCE SUPPORT FROM SPACE: SPACE AND LOW INTENSITY CONFLICT

Topic #: AF90-137

Office: AFSTC/OLAB

ID #: 39744

THIS PROPOSAL IS BASED ON THE APPLICATION OF AN INNOVATIVE METHODOLOGY DEVELOPED BY STS UNDER SBIR PHASE I TOPIC NO. AF89-179, CONTRACT NO. FO 4701-89-C-0064, INNOVATIVE CONCEPTS FOR

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FORCE SUPPORT FROM SPACE - HIGH INTENSITY CONFLICT IN NATO EUROPE, PERFORMED DURING THE PERIOD 89 JUL 27 TO 90 JAN 08. THE INNOVATIONS TO BE DEVELOPED UNDER THIS PROPOSAL INCLUDE: 1) THE USE OF SPACE SYSTEMS IN LOW-INTENSITY CONFLICT; 2) AN ADAPTATION OF THE CONCEPT OF SATELLITE READOUT OF GROUND-BASED SENSORS; AND 3) THE DESCRIPTION OF A C3/I SYSTEM BASED ON SPACE SYSTEMS. ONE OF THE CONFLICT SITUATIONS FOR WHICH THE USE OF SPACE HAS NOT BEEN EXPLORED IS THAT OF LOW- INTENSITY CONFLICTS. SUCH CONFLICTS OCCUR AROUND THE GLOBE AND PLACE NEW REQUIREMENTS ON U.S. FORCES. THE CONGRESS LEGISLATED THAT A COMMAND (SPECIAL FORCES COMMAND) BE RESPONSIBLE FOR U.S. FORCES INVOLVED IN THESE CONFLICTS. THE TYPES OF CONFLICTS EXTEND FROM COUNTERINSURGENCY, TO SMALL WAR, REVOLUTIONS AND DRUG WARS. THE ARRAY OF SATELLITES WHICH CAN SUPPORT U.S. AND ALLIED FORCES RANGE FROM NAVIGATION, WEATHER, SIGINT, AND COMMUNICATIONS. PHASE I WILL DEFINE A SYSTEM COMPOSED OF GROUND-BASED SENSORS (ACOUSTIC, SEISMIC, MAGNETIC) AND SPACE-BASED RELAYS, TOGETHER WITH A DEDICATED C3/I SYSTEM. THE PROPOSAL ILLUSTRATES HOW TECHNOLOGICAL ADVANCES IN THE SDI PROGRAM CAN BE APPLIED TO THE MISSION-UNIQUE SPACE SYSTEMS FOR LOW INTENSITY CONFLICT.

AB-TECH CORP
700 HARRIS ST
CHARLOTTESVILLE, VA 22901
Program Manager: KEITH C DRAKE
Contract #:
Title: ABDUCTIVE NETWORKS FOR SPACE SURVEILLANCE AND CLASSIFICATION
Topic #: AF90-139 Office: AFSTC/OLAB ID #: 39745

THE REQUIREMENTS OF SPACE WARFARE DICTATE THE NEED FOR INNOVATIVE TECHNOLOGIES TO SOLVE COMPLEX SPACE OBJECT CLASSIFICATION PROBLEMS. ADVANCES IN COMPUTING SPEED AND EXISTING SOFTWARE TECHNOLOGY ALONE ARE UNLIKELY TO RESULT IN A REAL-TIME DISCRIMINATION SYSTEMS CAPABLE OF MEETING THE COMPLEX REQUIREMENTS OF SPACE OBJECT SURVEILLANCE AND CLASSIFICATION. RATHER, AN ALTERNATIVE METHODOLOGY SUCH AS ABDUCTIVE TECHNOLOGY, A NEW TECHNOLOGY PRESENTED IN THIS PROPOSAL, IS ABSOLUTELY NECESSARY. ABDUCTIVE TECHNOLOGY IS AN INNOVATIVE POTENTIAL SOLUTION TO THE SPACE OBJECT CLASSIFICATION CHALLENGE BECAUSE IT ALLOWS COMPUTER SOFTWARE TO REASON EFFECTIVELY UNDER UNCERTAINTY, LEARN, AND RESOLVE COMBINATIONAL EXPLOSIONS OF POSSIBLE SITUATIONS IN A COMPACT AND RAPIDLY EXECUTABLE FORM. THESE CAPABILITIES WILL INCREASE THE PROBABILITY OF SUCCESSFULLY DEVELOPING A PRACTICAL AND DEPENDABLE SYSTEM, REDUCE SOFTWARE DEVELOPMENT AND SUPPORT COSTS SUBSTANTIALLY, AND ENHANCE SYSTEM CAPABILITIES.

FOSTER-MILLER INC
350 SECOND AVE
WALTHAM, MA 02254
Program Manager: DR LAWRENCE H DOMASH
Contract #:
Title: OPTICAL COMPUTER FOR FRACTAL IMAGE ANALYSIS
Topic #: AF90-139 Office: AFSTC/OLAB ID #: 39746

FRACTAL PATTERNS FROM NATURAL OR MANMADE SOURCES APPEAR IN MANY MILITARY IMAGE INTERPRETATION PROBLEMS. THROUGH EXPERIMENTAL TESTS, THEORY AND DESIGN ANALYSIS, PHASE I RESEARCH WILL DEMONSTRATE THE FEASIBILITY OF CONSTRUCTING AN EXTREMELY HIGH SPEED, DEDICATED OPTICAL COMPUTER TO IDENTIFY FRACTAL PATTERNS WITHIN IMAGES AND MEASURE THEIR FRACTAL DIMENSION. THE PROGRAM BUILDS ON A NONLINEAR OPTICAL CELLULAR AUTOMATION COMPUTER NOW UNDER DEVELOPMENT AT FOSTER- MILLER. PHASE II WILL PROCEED TO DEMONSTRATE A COMPLETE ITERATIVE SYSTEM BASED ON PHOTOREFRACTIVE CRYSTALS. A FULLY DEVELOPED SYSTEM MAY HAVE THE CAPABILITY TO LABEL CERTAIN IMAGE AREAS AS "CLOUD," "MOUNTAIN TERRAIN" OR

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"SEA" WITHIN A FEW MICROSECONDS OF COMPUTATION TIME. ADDITIONAL RESEARCH WILL BE DIRECTED AT OPTICAL COMPUTER IMPLEMENTATION OF BAMSLEY FRACTAL MODELING FUNCTIONS. EXTREMELY SIMPLE ALL-OPTICAL DESIGNS APPEAR CAPABLE OF PERFORMING FRACTAL MATHEMATICAL MANIPULATIONS.

APPLIED TECHNOLOGY ASSOCS INC
1900 RANDOLPH RD SE
ALBUQUERQUE, NM 87106

Program Manager: HENRY R SEBESTA

Contract #:

Title: STABILIZED SENSOR PLATFORM FOR MANNED SPACE OBSERVATION

Topic #: AF90-140

Office:

ID #: 44725

FEASIBILITY STUDY FOR DEVELOPING A STABILIZED SENSOR PLATFORM FOR MANNED SPACE OBSERVATIONS.

AURA SYSTEMS INC
2335 ALASKA AVE
EL SEGUNDO, CA 90245

Program Manager: JEFFREY BLUEN

Contract #:

Title: ELECTROMAGNETICALLY LEVITATED STABLE PLATFORM (ESP)

Topic #: AF90-140

Office: AFSTC/OLAB

ID #: 39747

THE OBJECTIVE OF THE ELECTROMAGNETICALLY LEVITATED STABLE PLATFORM (ESP) EFFORT IS THE DEVELOPMENT OF A COMPACT AND FLEXIBLE TWO-AXES STABILIZED SENSOR PLATFORM FOR MANNED OBSERVATIONS OF THE EARTH OR SKY FROM SPACE UTILIZING AURA SYSTEMS' UNIQUE ELECTROMAGNETIC LEVITATION TECHNOLOGY. ESP REPRESENTS THE FIRST APPLICATION OF ELECTROMAGNETIC LEVITATION TECHNOLOGY TO A STABILIZED PLATFORM SPECIFICALLY DESIGNED FOR MANNED OPTICAL OBSERVATIONS. AS A RESULT OF THIS INNOVATIVE APPLICATION OF STATE-OF-ART TECHNOLOGY WHICH AURA SYSTEMS IS PIONEERING, THE STABILITY CHARACTERISTICS OF ESP WOULD SIGNIFICANTLY EXCEED THOSE OF THE BEST STABILIZED PLATFORMS CURRENTLY AVAILABLE. ACTIVE, ELECTROMAGNETICALLY LEVITATED BEARINGS ARE USED TO PROVIDE THE FRICTION-FREE OPERATION NECESSARY TO IMPLEMENT A TWO-AXES STABILIZED PLATFORM WITHOUT VIBRATIONAL COUPLING MECHANISMS (BEARING FRICTION AND STICKTION) WHICH OTHERWISE ALLOW THE HOST VEHICLE'S ANGULAR MOTIONS TO DISTURB THE SENSOR'S LINE-OF-SIGHT (LOS).

PHYSICAL SCIENCES INC
635 SLATERS LN - STE G101
ALEXANDRIA, VA 22314

Program Manager: DR CHARLES T BUTLER

Contract #:

Title: RETRIEVAL OF ATMOSPHERIC TEMPERATURE PROFILES FROM SATELLITE SOUNDING DATA WITH A NEURAL NETWORK

Topic #: AF90-142

Office: AFSTC/OLAB

ID #: 39748

THE PROPOSED STUDY WILL DEMONSTRATE THE FEASIBILITY OF USING A NEURAL NETWORK TO RETRIEVE ENVIRONMENTAL PARAMETERS SUCH AS THOSE DISCUSSED IN THE 1986 JOINT CHIEFS OF STAFF MEMORANDUM MJCS 154-86. BECAUSE NEURAL NETWORKS ARE INHERENTLY PATTERN PROCESSORS, THEY ARE EXCELLENT CANDIDATES TO PROCESS THE OUTPUTS OF SATELLITE-BORNE SOUNDERS. A NETWORK IMPLEMENTED ON A DESKTOP COMPUTER WILL BE TRAINED TO MATCH SOUNDING DATA TO MEASURED TEMPERATURE PROFILES TAKEN OVER LAND AND OCEAN, IN TROPICAL AND MID-LATITUDE REGIONS, AND

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IN DIFFERENT SEASONS. IT WILL, THEREAFTER BE ABLE TO QUICKLY SYNTHESIZE TEMPERATURE PROFILES FROM NEW SOUNDING DATA, EVEN IF THE DATA WERE COLLECTED UNDER CONDITIONS NOT EXACTLY MATCHING THOSE REPRESENTED IN THE TRAINING SET. PHASE I OF THE PROJECT WILL CHOOSE THE BEST NETWORK FOR THE APPLICATION AND ESTABLISH THE FEASIBILITY AND ACCURACY OF THE METHOD. TESTS WILL BE RUN USING PROPRIETARY NETWORK DESIGNS TO DEMONSTRATE THE EFFICACY OF THE METHOD. THE ULTIMATE GOAL OF LATER PHASES OF THE RESEARCH IS TO INCREASE THE ACCURACY AND UTILITY OF ATMOSPHERIC PARAMETER RETRIEVAL USING DESKTOP COMPUTERS AND A PROPRIETARY APPROACH DESCRIBED IN THE PROPOSAL.

SANDIA SYSTEMS INC
13423 DESERT HILLS NE
ALBUQUERQUE, NM 87111
Program Manager: SCOTT R WILSON
Contract #:
Title: ION BEAM PROCESSING ZnSe
Topic #: AF90-143

Office: AFSTC/OLAB

ID #: 39749

ION BEAMS WILL BE APPLIED IN SEVERAL ASPECTS OF PROCESSING ZnSe OPTICAL COMPONENTS. FIRST THE MATERIAL WILL BE MILLED, AND THEN IT WILL BE COATED USING ION ASSISTED DEPOSITION TECHNIQUES. REDUCED SCATTER FROM THE SUBSTRATE AND IMPROVE OPTICAL AND MECHANICAL PROPERTIES OF THE FILM ARE ANTICIPATED.

BREHN CORP
407 HIGH ST
MOUNT HOLLY, NJ 08060
Program Manager: BRUCE F BOGNER
Contract #:
Title: RETRODIRECTIVE FLIGHT TEST ARTICLE INSTRUMENTATION ANTENNA
Topic #: AF90-144

Office: SAMTO/WBMC

ID #: 39750

A FAMILY OF ELECTRONICALLY STEERED CIRCULAR PHASED ARRAY ANTENNAS ARE CONFIGURED FOR USE ON SPINNING RE-ENTRY VEHICLES (RV). THIS TECHNIQUE ALLOWS RVs FROM SIX INCHES TO TEN FEET DIAMETER TO ACHIEVE GREATLY INCREASED PERFORMANCE COMPARED TO PRESENT SYSTEMS: CONTINUOUS RANGE SAFETY ACHIEVED THROUGHOUT RV FLIGHT; SIGNIFICANTLY HIGHER DATA RATES FROM IMPROVED DATA MONITORING; REQUIRED SPATIAL COVERAGE WITH SIMPLE BEAM-POINTING MECHANISMS. A NOVEL RF COMPUTATION CIRCUIT ALLOWS A LOW SIDELOBE RADIATION PATTERN TO BE GENERATED AND DE-SPUN SUCH THAT THE ARRAY HIGH GAIN BEAM IS ALWAYS POINTING AT A DATA COLLECTION STATION. THIS TECHNIQUE, PROVEN ON THE NAVY'S AEGIS IFF SYSTEM, IS ADAPTED FOR ENHANCEMENT OF RV FLIGHT TESTS. ALSO CONSIDERED IS THE UTILIZATION OF TDRS AS THE DATA COLLECTION STATION IN ORDER TO PROVIDE CONTINUOUS LINE-OF-SIGHT COMMUNICATION WITH THE RV. SUITABILITY OF CIRCULAR PHASED ARRAYS TO ENHANCE THE DATA COLLECTION FROM THE PLANNED NATIONAL AEROSPACE PLANE (NASP) AND THE HYPERSONIC GLIDE VEHICLE (HGV) IS ASSESSED.

DEFENSE SYSTEMS INC
5121 WESTBRANCH DR
McLEAN, VA 22102
Program Manager: LEONARD A ATKINSON
Contract #:
Title: HIGH POWER MICROWAVE DETECTOR
Topic #: AF90-146

Office: SAMTO/WBMC

ID #: 39751

GROUND RADARS AND OTHER SPACECRAFT SUPPORT SYSTEMS WHICH TRANSMIT MICROWAVE RADIATION

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MAY PRODUCE ELECTRIC FIELD STRENGTHS IN EXCESS OF THOSE SPECIFIED IN MIL-STD-461. THESE HIGH ELECTRIC FIELD STRENGTHS CAN DAMAGE OR REDUCE THE RELIABILITY OF SPACECRAFT AND ELECTRONIC SYSTEMS BEFORE AND DURING LAUNCH. A HIGH POWER MICROWAVE DETECTOR (HPMD) WILL BE DEVELOPED TO DETECT ELECTRIC FIELDS OVER THE 1 TO 10 GHz FREQUENCY RANGE WITH STRENGTHS FROM 1 V/m TO 50 V/m, USING AN INNOVATIVE ANTENNA/DETECTOR DESIGN. THE HPMD MEASURES THE AMPLITUDE OF INCIDENT MICROWAVE PULSE OR CW RADIATION, AND STORES THE FIELD INTENSITY AND TIME OF OCCURRENCE. THIS HPMD HAS HEMISPHERICAL (-3 dB) COVERAGE. THE HPMD IS BUILT INTO A SMALL ENCLOSURE THAT CAN BE LOCATED CLOSE TO THE SPACECRAFT AND IS SIMPLY PROGRAMMED THROUGH A "DIGITAL WATCH" TYPE INTERFACE. THE HPMD DISPLAYS THE GREATEST ELECTRIC FIELD STRENGTH MEASURED AND HAS AN ALARM MODE WITH FLASHING LIGHT AND AUDIBLE ALARM IF A PRESET ELECTRIC FIELD THRESHOLD IS EXCEEDED. IT OPERATES ON BATTERIES, OR MAY USE AN EXTERNAL CALCULATOR TYPE POWER SUPPLY RUN FROM LINE VOLTAGE. IT RECORDS DATA FOR SEVERAL HOURS ON A SET OF BATTERIES. A MICROWAVE DETECTOR CALIBRATED IN VOLTS/METER TO ± 3 dB ACCURACY, WITH HEMISPHERICAL COVERAGE OVER THE 1 TO 10 GHz FREQUENCY RANGE, ALL IN A COMPACT BATTERY OPERATED UNIT, WILL ADVANCE THE STATE OF THE ART.

STAR TECH
PO BOX 867
GREAT FALLS, VA 22066
Program Manager: ROBERT R STRUNCE JR
Contract #:
Title: CONTROL-STRUCTURES INTERACTION SATELLITE (CSI-SAT)
Topic #: AF90-147 Office: AL/TSTR ID #: 39752

THIS PROPOSAL WILL DESCRIBE AN INNOVATIVE APPROACH FOR SPACE FLIGHT EXPERIMENTS TO DEMONSTRATE AND VALIDATE CONTROL-STRUCTURES INTER- ACTION (CSI) TECHNOLOGIES AND METHODOLOGIES BASED ON EMERGING SMALL SATELLITE INITIATIVE. THIS PHASE I PROPOSAL ADDRESSES THE CONCEPT DESIGN FOR A CONTROL-STRUCTURES INTERACTION SATELLITE (CSI-SAT), LAUNCHING PLATFORM AND GROUND MISSION OPERATIONS CENTER NECESSARY FOR PERFORMING AFFORDABLE ON-ORBIT TESTING OF SELECTED CSI TECHNOLOGIES WHICH CAN NOT BE ACCOMMODATED IN GROUND TESTS. THE ADVANTAGES OF THIS CSI-SAT FLIGHT EXPERIMENT APPROACH ARE THAT (1) IT WOULD BE A DEDICATED CSI FLIGHT EXPERIMENT WITH APPROXIMATELY A ONE YEAR LIFE TIME; (2) WITH THE APPROPRIATE CONCEPT DESIGN, NUMEROUS GUEST INVESTIGATORS COULD FLIGHT TEST INNOVATIVE MATERIALS OR COMPONENTS AS WELL AS UPLINK EXPERIMENTAL SYSTEM IDENTIFICATION AND CONTROL ALGORITHMS FOR EVALUATION; (3) IT WILL PROVIDE A RECONFIGURABLE PLATFORM FOR FLIGHT TESTING NEW CSI TECHNOLOGIES/METHODOLOGIES BEFORE APPLYING THEM TO OPERATIONAL SYSTEMS; (4) THIS APPROACH IS POTENTIALLY 5 TO 10 TIMES LOWER IN COST THAN PREVIOUSLY PROPOSED METHODS.

SOFTWARE & ENGINEERING ASSOCS INC
1000 E WILLIAM ST - STE 200
CARSON CITY, NV 89701
Program Manager: GARY R NICKERSON
Contract #:
Title: COMBUSTION PROCESSES IN SPACE STORABLE LIQUID ROCKET ENGINES
Topic #: AF90-148 Office: AL/TSTR ID #: 39753

THE EXHAUST FROM NTO/MMH FUEL RICH GAS GENERATORS (GG) ARE KNOWN TO CONTAIN A LARGE FRACTION OF AMMONIA. THIS PHENOMENON MAKES IT POSSIBLE TO ACTIVELY COOL A ROCKET NOZZLE WALL USING THE ENDOTHERMIC DECOMPOSITION OF AMMONIA. A REALISTIC ANALYSIS OF THIS COMBUSTION PROCESS IS TO BE DEVELOPED WHICH INCLUDES ROCKET NOZZLE FLOW WITH FINITE RATE CHEMICAL KINETICS AND THE TANGENTIAL SLOT INJECTION OF GG EXHAUST. THE ANALYSIS IS TO BE APPLIED TO PUMP FED LIQUID ROCKET SPACE ENGINES OPERATING WITH STORABLE PROPELLANTS. THE

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EFFECT ON WALL HEAT TRANSFER AND ENGINE PERFORMANCE ARE TO BE STUDIED. EFFECTS TO BE INVESTIGATED INCLUDE THOSE OBTAINED BY VARYING THE GAS GENERATOR MIXTURE RATIO AND MASS FLOW RATE. A PRIMARY OBJECTIVE OF THE PROJECT IS TO OBTAIN A BETTER UNDERSTANDING OF THE ROLE PLAYED BY AMMONIA DECOMPOSITION IN THE BOUNDARY LAYER DOWNSTREAM OF THE INJECTION POSITION. RECOMMENDATIONS ARE TO BE MADE FOR IMPROVED ENGINE DESIGN.

ALABAMA CRYOGENIC ENGINEERING, INC
PO BOX 2470

HUNTSVILLE, AL 35804

Program Manager: JOHN B HENDRICKS

Contract #:

Title: A REGENERATOR FOR INCREASING THE EFFICIENCY OF LOW TEMPERATURE CRYOCOOLERS

Topic #: AF90-149

Office: AL/TSTR

ID #: 39754

MANY MATERIALS, SUCH AS DOPED Si AND Ge, REQUIRE LOW OPERATING TEMPERATURES FOR OPERATION. ELEMENTAL SUPERCONDUCTORS, SUCH AS Nb, MUST BE OPERATED BELOW THEIR TRANSITION TEMPERATURES, WHICH DO NOT EXCEED 9 KELVIN. THE EXISTING CRYOCOOLER CYCLES, EVEN IF THEY CAN REACH THESE TEMPERATURES, ARE VERY INEFFICIENT BECAUSE OF POOR REGENERATOR PERFORMANCE. THE PROPOSED EFFORT COVERS THE DEVELOPMENT, USING AN INNOVATIVE CONCEPT, OF IMPROVED LOW TEMPERATURE REGENERATORS. THIS COULD, IF SUCCESSFUL, MAKE HIGH EFFICIENCY, LOW TEMPERATURE REGENERATIVE CRYOCOOLERS POSSIBLE.

INTEGRATED ACCELERATOR TECHNOLOGIES

2431 AL OMA AVE - STE 244

WINTER PARK, FL 32792

Program Manager: DR DELBERT LARSON

Contract #:

Title: A PORTABLE ELECTRON COOLED ANTIPROTON STORAGE RING

Topic #: AF90-150

Office: AL/TSTR

ID #: 39755

ANTIMATTER CONTAINS THE HIGHEST RATIO OF ENERGY STORAGE PER UNIT MASS OF ANY SUBSTANCE KNOWN TO MAN. WHEN ANTIMATTER COMES INTO CONTACT WITH NORMAL MATTER IT COMPLETELY ANNIHILATES, WITH ITS MASS CONVERTED INTO ENERGY ACCORDING TO THE FORMULA $E=mc^2$. THE ENERGY RELEASED IN THE ANNIHILATION MAY PROVE USEFUL AS A FUTURE SOURCE OF POWER FOR APPLICATIONS REQUIRING HIGH POWER DENSITY FUEL SOURCES, SUCH AS SPACE PROPULSION. NEAR TERM APPLICATIONS OF ANTIMATTER INCLUDE MATERIAL DIAGNOSIS AND TESTS OF FUNDAMENTAL PHYSICS. AT PRESENT THE HADRONIC FORM OF ANTIMATTER ONLY EXISTS AT MAJOR HIGH ENERGY PHYSICS LABORATORIES. IN ORDER TO MAKE EXPERIMENTATION WITH ANTIMATTER MORE AVAILABLE TO THE GENERAL USER COMMUNITY, A SMALL TRANSPORTABLE SOURCE OF ANTIPROTONS IS REQUIRED. WE WILL INVESTIGATE THE DESIGN OF SUCH A PORTABLE SOURCE. WE WILL DO A COMPLETE BEAM OPTICS STUDY THAT WILL RESULT IN SPECIFICATIONS FOR ALL OF THE COMPONENTS OF THE RING. THE PHASE STUDY WILL DETERMINE WHICH COMPONENTS CAN BE CONSTRUCTED AND TESTED DURING PHASE II, WITH THE AIM OF COMPLETE DEVICE CONSTRUCTION DURING PHASE II.

ENGINEERING MECHANICS ASSOCS INC

3820 DEL AMO BLVD - STE 318

TORRANCE, CA 90503

Program Manager: T K HASSELMAN

Contract #:

Title: GLOBAL CONTROL OF SUSPENSION FORCES FOR MICROGRAVITY SIMULATION

Topic #: AF90-151

Office: AL/TSTR

ID #: 39756

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LARGE PRECISION SPACE STRUCTURES ARE BEING CONCEIVED TO ACCOMPLISH AIR FORCE SPACE OBJECTIVES IN THE 1990'S AND BEYOND. SOME OF THE STRUCTURES ARE HUNDREDS OF METERS IN DIMENSION AND WILL BE REQUIRED TO MAINTAIN SHAPE AND ALIGNMENT TO WITHIN MICRONS. OTHER TYPES OF STRUCTURES WILL BE SMALLER, STIFFER, AND WILL BE REQUIRED TO SLEW RAPIDLY, ACHIEVE POINTING ACCURACIES ON THE ORDER OF MICRORADIANS, AND LIMIT JITTER TO NANORADIANS. IN BOTH CASES, CONTROL SYSTEMS WILL REQUIRE ACCURATE STRUCTURAL MODELS. INITIAL DEVELOPMENT OF THE CONTROLLERS WILL REQUIRE EXTENSIVE GROUND TESTING, BOTH TO VERIFY THE STRUCTURAL MODELS AND TO VERIFY THE PERFORMANCE OF CONTROL SYSTEMS. THESE STRUCTURES MAY BUCKLE IF THEY ARE NOT PROPERLY SUPPORTED, AND THEIR MODAL CHARACTERISTICS CAN BE DISTORTED BY GEOMETRIC STIFFNESS WHICH IS PROPORTIONAL TO GRAVITY. DISTRIBUTED SUSPENSION SYSTEMS WILL BE REQUIRED TO MINIMIZE GRAVITY-INDUCED STIFFNESS WITHOUT CONSTRAINING THE MOTION OF THE STRUCTURE. THIS PROPOSAL CONCERNS THE DEVELOPMENT OF A MULTI-INPUT MULTI-OUTPUT (MIMO) CONTROL SYSTEM FOR THE GLOBAL CONTROL OF A MULTI-CABLE SUSPENSION SYSTEM. PHASE I IS LIMITED TO SMALL AMPLITUDE CONSIDERATIONS; PHASE II WILL CONSIDER LARGE AMPLITUDE APPLICATIONS AS WELL.

ELECTRIC PROPULSION LAB INC
43423 DIVISION ST - STE 205
LANCASTER, CA 93535
Program Manager: DR GRAEME ASTON
Contract #:

Title: ARCJET SELF-GETTER PUMPING

Topic #: AF90-152

Office: AL/TSTR

ID #: 39757

A NOVEL, HIGH THROUGHPUT, TITANIUM GETTER VACUUM PUMPING CONCEPT THAT UTILIZES THE KINETIC ENERGY IN THE PLASMA JET EMANATING FROM AN ARCJET ENGINE AS THE GETTER PUMPING POWER SOURCE IS PROPOSED. CALCULATIONS ARE PRESENTED WHICH SHOW THAT ARCJET ENGINES, WITH EXHAUST PLUME POWERS IN THE RANGE OF 20 - 60 kW, COULD BE OPERATED STEADY STATE FOR SEVERAL TENS OF MINUTES AT A BACKGROUND PRESSURE OF 5×10^{-4} TORR USING THIS CONCEPT. THE ABILITY TO EFFICIENTLY GETTER NITROGEN OR HYDROGEN PERMITS APPLICATION OF THIS PUMPING CONCEPT TO ENGINE PROPELLANTS SUCH AS AMMONIA, HYDRAZINE, AND HYDROGEN. A PROOF OF CONCEPT EXPERIMENT IS PROPOSED TO VERIFY THIS PLASMA JET SELF-GETTER PUMPING TECHNIQUE.

LYNNTECH INC
RTE 5 - BOX 946A
COLLEGE STATION, TX 77840
Program Manager: OLIVER J MURPHY
Contract #:

Title: LIGHTWEIGHT HIGH-POWER ELECTROCHEMICAL ENERGY STORAGE SYSTEMS FOR SATELLITES

Topic #: AF90-153

Office: AL/TSTR

ID #: 39758

ELECTRICAL ENERGY STORAGE FOR SATELLITES IS PROVIDED BY RECHARGEABLE Ni-Cd, OR MORE COMMONLY AT PRESENT, BY RECHARGEABLE Ni-H₂ BATTERY SYSTEMS. WHILE THESE WORK RATHER WELL FOR GEOSYNCHRONOUS ORBIT (GEO) APPLICATIONS, THEIR PREDICTED PERFORMANCE CHARACTERISTICS ARE LESS THAN SATISFACTORY FOR THE MORE DEMANDING LOW EARTH ORBIT (LEO) SATELLITE APPLICATIONS. IN TERMS OF POWER OUTPUT PER UNIT WEIGHT, THERMAL AND FLUID MANAGEMENT AND RELIABILITY, A PROTON EXCHANGE MEMBRANE (PEM)-BASED FUEL CELL-ELECTROLYZER COMBINATION IS THE MOST ATTRACTIVE OPTION FOR THE LATTER SATELLITE APPLICATIONS. THE PRESENT PROPOSAL FOCUSES ON A COMPLETE SYSTEM FEASIBILITY ANALYSIS, A PREDICTION OF PERFORMANCE CHARACTERISTICS AND A PROOF-OF-PRINCIPLE DESIGN FOR A PEM-BASED COUPLED SYSTEM. IN THE DESIGN PROPOSED IN THIS PROPOSAL FOR A PEM FUEL CELL, INCORPORATING A BIPOLAR PLATE OF KUREKA. KE-1 TYPE WITH A 100 MICROMETER PEM MEMBRANE, A PLATINUM-BASED CATALYST LOADING OF 10 mg/cm² AND EVAPORATIVE COOLING VIA WATER INJECTED INTO THE ANODE

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COMPARTMENT, A CELL WITH A STACK POWER DENSITY CORRESPONDING TO 0.23 LB/kW IS OBTAINABLE BASED ON EXISTING CELL POTENTIAL-CURRENT DENSITY DATA. IN THE WORK PROPOSED METHODS ARE OUTLINED TO FURTHER INCREASE THE POWER DENSITIES IN PEM-BASED FUEL CELLS (AND ELECTROLYZERS) WHICH ARE NECESSARY TO REDUCE WEIGHT AND VOLUME OF OVERALL SYSTEMS.

LIGHTWAVE ELECTRONICS

1161 SAN ANTONIO RD

MOUNTAIN VIEW, CA 94043

Program Manager: DR THOMAS J KANE

Contract #:

Title: EYE-SAFE SOLID-STATE DOPPLER LIDAR

Topic #: AF90-154

Office: GL/XOP

ID #: 39759

THE GOAL OF PHASE I AND PHASE II TOGETHER WOULD BE TO BUILD AND DELIVER TO AFGL AN EYE-SAFE DOPPLER WIND-SENSING LIDAR AT 2 OR 2.1 MICRONS. THIS LIDAR WOULD BE INTEGRATED INTO THE AFGL MOBILE LIDAR LABORATORY. DURING PHASE I, WE PROPOSE TO BUILD AND TEST A KEY COMPONENT OF THE LIDAR SYSTEM, THE HETERODYNE DETECTOR. WE WOULD FIRST DEMONSTRATE OFFSET FREQUENCY LOCKING OF A PAIR OF DOPPLER SHIFTS DUE TO PLATFORM VELOCITY. THEN WE WOULD BUILD TWO HETERODYNE-DETECTION SYSTEMS, ONE USING SINGLE-MODE FIBER AND ONE USING FREE-SPACE BEAMS. WE WOULD COMPARE THE EFFICIENCY AND WORKABILITY OF THESE TWO SYSTEMS. THE FINAL EXPERIMENTS OF PHASE I WOULD BE TO COMPARE RETURN SIGNAL OBTAINED WITH A CW LABORATORY LASER RADAR TO THE SIGNAL EXPECTED FROM THEORY. ALSO DURING PHASE I, WE WOULD PLAN A PULSED DOPPLER LIDAR SUITABLE FOR FIELD TESTING IN PHASE II, AND OBTAIN THE SPECIFICATIONS REQUIRED OF LASERS USED IN THE AFGL MOBILE LIDAR LAB.

ENSCO INC

5400 PORT ROYAL RD

SPRINGFIELD, VA 22151

Program Manager: DR DAVID W A TAYLOR

Contract #:

Title: KNOWLEDGE BASED SEISMIC EVENT AUTOMATIC ASSOCIATION AND LOCATION ESTIMATION

Topic #: AF90-155

Office: GL/XOP

ID #: 39760

THE FEASIBILITY OF USING PROCESSING AND CONTROL KNOWLEDGE TO IMPROVE THE SPEED AND ACCURACY OF AUTOMATIC SEISMIC EVENT ASSOCIATION AND LOCATION IS EXAMINED. A PROTOTYPE SYSTEM WILL BE DEVELOPED TO EVALUATE THE UTILITY OF KNOWLEDGE BASED STRUCTURES FOR SEISMIC EVENT ASSOCIATION AND LOCATION. ALL WORK WILL BE DONE AT ENSCO, INC. OBJECTIVES OF THIS PROGRAM ARE: (1) EVALUATE THE ABILITY OF KNOWLEDGE-BASED SYSTEMS TO ASSOCIATE SEISMIC SIGNALS IN THE PRESENCE OF MANY FALSE DETECTIONS. (2) EXPLOITATION OF AVAILABLE KNOWLEDGE ABOUT OBSERVED DETECTIONS IN THE ASSOCIATION/LOCATION PROCESS. (3) DETERMINE THE EFFICIENCY OF KNOWLEDGE-BASED PROCESSING FOR SEISMIC ASSOCIATION.

LIU & ASSOCS

4480 ADONIS DR

SALT LAKE CITY, UT 84124

Program Manager: DR S C OU

Contract #:

Title: REMOTE SENSING OF GLOBAL CIRRUS CLOUDS USING SATELLITE DATA

Topic #: AF90-156

Office: GL/XOP

ID #: 39761

THE OBJECTIVE OF THE PROPOSED STUDY IN PHASE I IS TO DEVELOP A NOVEL AND COMPREHENSIVE

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ALGORITHM FOR THE RETRIEVAL OF THE COMPOSITIONS AND STRUCTURE OF CIRRUS CLOUDS USING DATA GATHERED FROM ORBITING METEOROLOGICAL SATELLITES. IN THE PROPOSED PROGRAM, THE TEMPERATURE, EMISSIVITY AND FRACTIONAL COVER OF CIRRUS CLOUDS ARE FIRST DETERMINED FROM NOAA-AVHRR AND DMSP-OLS RADIANCE DATA. ONCE THE CIRRUS CLOUD TEMPERATURE IS KNOWN, THE MEAN ICE CRYSTAL SIZE DISTRIBUTION AND ICE WATER CONTENT MAY BE DETERMINED THROUGH PARAMETERIZED EQUATIONS DERIVED FROM AIRCRAFT CLOUD MICROPHYSICAL DATA. SUBSEQUENTLY, THE SCATTERING AND ABSORPTION PROPERTIES OF ICE CRYSTALS FOR THE WAVELENGTHS OF SCIENTIFIC AND TECHNOLOGICAL INTEREST CAN BE COMPUTED FROM LIGHT SCATTERING PROGRAMS. FINALLY, USING THE SCATTERING AND ABSORPTION PROPERTIES OF ICE CRYSTALS, SIMULATION OF THE RADIATION ATTENUATION FOR A TARGET-SENSOR SYSTEM ASSOCIATED WITH THE MILITARY ELECTRO-OPTICS REQUIREMENT MAY BE CARRIED OUT.

NORTHWEST RESEARCH ASSOCS INC
PO BOX 3027
BELLEVUE, WA 98009
Program Manager: EDWARD J FREMOUW
Contract #:

Title: A PROPOSAL TO DEVELOP AN IONOSPHERIC TOMOGRAPHY SYSTEM
Topic #: AF90-157 Office: GL/XOP ID #: 39762

TRANSIONOSPHERIC C3I RADIO SYSTEMS AND OTH RADARS BENEFIT FROM KNOWLEDGE OF PLASMA DENSITY (RADIO REFRACTIVE INDEX) IN THE IONOSPHERE AND GRADIENTS HEREIN. WE PROPOSE TO ASSESS FEASIBILITY OF AN IONOSPHERIC TOMOGRAPHY SYSTEM (ITS) FOR PROVIDING SUCH INFORMATION IN THE FORM OF NEAR-REAL-TIME IMAGES, USING MUTUALLY COHERENT VHF-UHF SIGNALS PRESENTLY TRANSMITTED FROM THE NNSS ("TRANSIT") SATELLITES. WE PROPOSE ALSO, IN PHASE I, TO PREPARE PAPER DESIGNS FOR (1) A DIGITAL RECEIVING SUBSYSTEM TO RECORD THE PATH FROM SUCH A SATELLITE AND (2) A DATA COMMUNICATION SUBSYSTEM FOR TRANSFERRING THE TEC RECORDS FROM SEVERAL SUCH REMOTE RECEIVERS TO A CENTRAL PROCESSING FACILITY, HOPEFULLY IN CON-US REGARDLESS OF RECEIVER LOCATION. IN ADDITION, WE PROPOSE TO ASSESS AND ADAPT IMAGE-FORMATION SOFTWARE PRESENTLY EMPLOYED IN OCEAN ACOUSTIC TOMOGRAPHY FOR USE IN THE ITS. WE BELIEVE OUR RECEIVER DESIGN CONCEPT TO BE INNOVATIVE IN ITS SIMPLICITY, WHICH SHOULD LEAD TO LOW COST AND READY TRANSPORTABILITY. WE ENVISION DEVELOPMENT AND DEPLOYMENT OF A PROTOTYPE ITS IN A PHASE II EFFORT.

SPIRE CORP
PATRIOTS PK
BEDFORD, MA 01730
Program Manager: DR YI-KANG PU
Contract #:

Title: ELECTRON DENSITY MEASUREMENT SYSTEM FOR PARTIALLY IONIZED GASES
Topic #: AF90-158 Office: GL/XOP ID #: 39763

A RADIO FREQUENCY MULTI-CHANNEL PROBE ARRAY METHOD IS PROPOSED TO DETERMINE THE DENSITIES OF PLASMAS PRODUCED IN LABORATORY CHAMBERS BY HIGH POWER MICROWAVE BREAKDOWN. IN ADDITION TO MAKING TIME-RESOLVED MEASUREMENTS OF ELECTRON DENSITY, THE ARRAY WILL ALSO PROVIDE SPATIAL INFORMATION ON THE PLASMA DENSITY PROFILE. THE PROBE ARRAY METHOD IS BASED ON THE DIRECT RELATIONSHIP BETWEEN THE ELECTRICAL RESISTIVITY OF THE PLASMA AND THE ELECTRON DENSITY, TAKING ADVANTAGE OF THE HIGH COLLISIONALITY OF THE CHARGE CARRIERS WITH THE NEUTRAL GAS PARTICLES. THIS METHOD IS EXPECTED TO MEASURE ELECTRON DENSITIES RANGING FROM $10(4)$ TO $10(10)\text{cm}^{-3}$ IN PLASMAS WITH NEUTRAL GAS PRESSURE OF 0.01 TO 3 TORR. WITH SUFFICIENTLY HIGH FREQUENCY (3 MHz OR MORE), A TIME RESOLUTION OF 10 MICROSECONDS CAN BE EASILY OBTAINED IN DENSE PLASMAS; DC PROBE DRIVE IS PROPOSED FOR TIME-RESOLVED MEASUREMENTS OF VERY LOW PLASMA DENSITIES. THE TWO-DIMENSIONAL PROBE ARRAY IS CAPABLE

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OF DETERMINING A LINE-AVERAGED PLASMA DENSITY PROFILE. THE PROBE TECHNIQUE WILL BE ESPECIALLY IMPORTANT IF THE SPATIAL UNIFORMITY OF THE PLASMA MUST BE MONITORED AND CONTROLLED.

VISIDYNE INC
10 CORPORATE PL - S BEDFORD ST
BURLINGTON, MA 01803
Program Manager: ORR SHEPHERD
Contract #:
Title: VARIABLE POLARIZATION LIDAR OPTICS SYSTEM
Topic #: AF90-159

Office: GL/XOP

ID #: 39764

IT IS PROPOSED TO ADD AN INNOVATIVE VARIABLE POLARIZATION OPTICAL SYSTEM TO THE AIR FORCE ABLE (ATMOSPHERIC BACKSCATTER EXPERIMENT) LIDAR SYSTEM. THIS CAPABILITY FOR REAL-TIME, RANGE-RESOLVED POLARIZATION ANALYSIS OF ATMOSPHERIC BACKSCATTER WOULD BE UNIQUE TO THE ABLE LIDAR SYSTEM. IT WOULD ENABLE THE AIR FORCE TO ACQUIRE BOTH GROUND BASED AND BALLOONBORNE POLARIZATION DATA OF GREATER ACCURACY THAN IS CURRENTLY ATTAINABLE. DATA OBTAINED BY EXISTING LIDAR SYSTEMS ARE BASED ON THE ASSUMPTION THAT THE POLARIZATION OF THE BACKSCATTER RADIATION IS UNCHANGED FROM THAT TRANSMITTED. THE PROPOSED SYSTEM WILL TEST THAT ASSUMPTION. IT IS PROPOSED TO STUDY THE FEASIBILITY OF IMPLEMENTING A VARIABLE POLARIZATION SYSTEM WHICH WOULD INCLUDE STATE-OF-THE-ART VARIABLE LIQUID CRYSTAL RETARDERS HAVING HIGH LASER DAMAGE THRESHOLDS. THESE RETARDERS WOULD ALTERNATELY SWITCH THE POLARIZATION OF THE THREE TRANSMITTED LIDAR WAVELENGTHS, 1064, 532, AND 355 nm. SIMILARLY AN ALTERNATELY SWITCHED POLARIZATION ANALYZER WOULD BE INCORPORATED INTO THE LIDAR RECEIVER. AN ADDITIONAL INNOVATIVE FEATURE OF THE SYSTEM WOULD BE THE USE OF A PHOTON-COUNTING AVALANCHE PHOTODIODE DETECTOR AT 1064 nm TO PROVIDE POLARIZATION DATA AT THAT ADDITIONAL WAVELENGTH.

APPLIED TECHNOLOGY ASSOCS INC
1900 RANDOLPH RD SE
ALBUQUERQUE, NM 87117
Program Manager: DR AHMED ERTEZA
Contract #:
Title: PHASED ARRAY TELESCOPE IMAGE PROCESSING
Topic #: AF90-160

Office: WL/PRC

ID #: 39765

AN ANALYTIC MODEL OF A WIDE FIELD, PHASED ARRAY IMAGING SYSTEM WILL BE DEVELOPED. THE MODEL IS BASED ON A MEASUREMENT SYSTEM CAPABLE OF ERROR MEASUREMENT DIRECTLY WITH RESPECT TO THE FINAL IMAGE PLANE. THE BEAMS FROM INDIVIDUAL SUBAPERTURES WILL BE COMPACTED AND CONFORMALLY MAPPED TO A DEMAGNIFIED PUPIL. WE WILL DEVELOP NON-REDUNDANT, CODED APERTURE MASKS TO BE INSERTED AT THIS COMPACT PUPIL WHICH WILL SAMPLE SPECIFIC SPATIAL FREQUENCIES WHEN IMAGED. THE RESULTING VISIBILITY FRINGE WOULD BE SAMPLED BY A CHARGE-COUPLED DEVICE (CCD) AREA-ARRAY IN THE FINAL IMAGE PLANE AND FOURIER TRANSFORMED BY A DIGITAL SIGNAL PROCESSOR. THE TRANSFORM WILL CONTAIN "SUFFICIENT" INFORMATION FOR THE INDIVIDUAL BEAM PHASE ERROR IN THE SYSTEM IMAGE PLANE. ABSOLUTE GEOMETRY ERRORS CAN BE DETERMINED FROM VISIBILITY FRINGE OBTAINED FROM AN INTERMEDIATE IMAGE-FIELD IMAGED ON THE SAME CCD ARRAY. IF NECESSARY, AN IMAGE SHARPENING ALGORITHM WILL BE DEVELOPED FOR FINAL IMAGE REFINEMENT AND FOR ELIMINATING ANY RESIDUAL ERRORS. EXCEPT ABSOLUTE PISTON, THE NONREDUNDANT VISIBILITY DATA ALLOW IMAGE PLANE MEASUREMENT OF ALL THE PHASE ERRORS ABSOLUTELY. THIS HOLDS TRUE FOR BOTH THE EXTERNAL AND INTERNAL REFERENCE SOURCES. A SOFTWARE MODEL OF THE MEASUREMENT SYSTEMS WILL BE DEVELOPED FOR TESTING THE VALIDITY OF THE ALGORITHMS.

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DEVANEY A J ASSOCS

26 EDMUNDS RD

WELLESLEY, MA 02181

Program Manager: A J DEVANEY

Contract #:

Title: PHASED ARRAY TELESCOPE IMAGE PROCESSING

Topic #: AF90-160

Office: WL/PRC

ID #: 39766

THE METHOD OF PHASE DIVERSITY CONSISTS OF MAKING TWO MEASUREMENTS OF THE IMAGE OF AN UNKNOWN EXTENDED OBJECT AT TWO SETTINGS OF FOCUS AND USING THESE IMAGES IN A CERTAIN LEAST SQUARES ERROR METRIC TO ESTIMATE THE WAVE ABERRATION FUNCTION OF AN INCOHERENT OPTICAL IMAGING SYSTEM. IN THIS PROPOSAL THIS CONCEPT IS GENERALIZED TO INCLUDE OTHER METHODS OF INTRODUCING "DIVERSITY" THROUGH THE INTRODUCTION OF KNOWN PERTURBATIONS IN THE SYSTEMS COHERENT TRANSFER FUNCTION (CTF). THE RESULTING METHOD, WHICH INCLUDES THE USUAL METHOD OF PHASE DIVERSITY AS A SPECIAL CASE, IS CALLED THE METHOD OF GENERALIZED PHASE DIVERSITY. IT IS PROPOSED TO USE THE METHOD OF GENERALIZED PHASE DIVERSITY TO ESTIMATE THE "STATE" OF A PHASED ARRAY TELESCOPE FOR THE PURPOSE OF EITHER CORRECTING (REALIGNING) THE ELEMENTS OF THE TELESCOPE OR POST PROCESSING IMAGERY GENERATED BY THF (MISALIGNED) SYSTEM TO YIELD IMPROVED IMAGE QUALITY. THE RESEARCH CALLS FOR AN INVESTIGATION INTO VARIOUS SCHEMES FOR INTRODUCING GENERALIZED PHASE DIVERSITY, THE DEVELOPMENT OF ALGORITHMS FOR ESTIMATING THE STATE OF AN OPTICAL SYSTEM USING THIS METHOD, AND THE TEST AND EVALUATION OF THE DEVELOPED ALGORITHMS IN A COMPUTER SIMULATION STUDY.

PHYSICAL OPTICS CORP

2545 W 237TH ST - STE B

TORRANCE, CA 90505

Program Manager: FREDDIE LIN

Contract #:

Title: OPTICAL HOLOGRAPHIC NEURAL NETWORK FOR TARGET RECOGNITION APPLICATIONS

Topic #: AF90-161

Office: WL/PRC

ID #: 39767

IN ORDER TO MAKE HIGHLY-PARALLEL LARGE-SCALE OPTICAL NEURAL NETWORKS OR ASSOCIATIVE MEMORY FOR TARGET RECOGNITION APPLICATIONS, PHYSICAL OPTICS CORPORATION (POC) PROPOSES A PRACTICAL HIGHLY-PARALLEL FULLY-INTERCONNECTED OPTICAL HOLOGRAPHIC NEURAL NETWORK ARCHITECTURE BASED ON POC'S PROPRIETARY MATERIALS. THE PROPOSED ARCHITECTURE PROMISES A PRACTICAL ENGINEERING REALIZATION WITH POTENTIAL TO STORE UP TO 10(12) WEIGHTED CONNECTIONS FOR 10(6) NEURONS. THE MATERIALS ARE BASED ON POC'S DICHROMATED GELATIN POLYMER GRAFT (DCGPG), A STATIC MATERIAL AND REAL-TIME PHOTOPOLYMER, A DYNAMIC MATERIAL. THESE HAVE THE FOLLOWING UNIQUE CHARACTERISTICS, NOT ACHIEVABLE SIMULTANEOUSLY BY ANY OTHER STATE-OF-THE-ART TECHNOLOGIES (I.E., REFRACTIVE CRYSTAL AND BINARY SPATIAL LIGHT MODULATORS): 1) LARGE SIZE (> 10x10 QUARE INCHES) AND LOW COST, 2) HIGH SENSITIVITY AND HIGH RESOLUTION, 3) HIGH STORAGE CAPACITY, 4) REAL-TIME READ/WRITE/ERASE CAPABILITY (FOR REAL-TIME PHOTOPOLYMER). A PHOTOTYPE NEURAL NETWORK WITH A MODERATE NUMBER OF NEURONS (~1000) FOR TARGET RECOGNITION APPLICATIONS WILL BE BUILT AND DEMONSTRATED IN PHASE I OF THIS PROGRAM. A DETAILED ENGINEERING DESIGN OF A ROBUST ADAPTABLE NONLINEAR IMAGING NEURAL NETWORK WILL BE PRESENTED BASED ON THE EXPERIENCE OF FABRICATING THE PROTOTYPE NEURAL NETWORK.

MIDWEST RESEARCH TECHNOLOGIES INC

5510 W FLORIST AVE

MILWAUKEE, WI 53218

Program Manager: DR NORMAN A DRAEGER

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Contract #:

Title: RUGGED AMTEC POWER SYSTEM UTILIZING A THIN FILM SOLID ELECTROLYTE

Topic #: AF90-162

Office: WL/PRC

ID #: 39768

ALKALI METAL THERMAL TO ELECTRIC CONVERTER (AMTEC) TECHNOLOGY HOLDS PROMISE AS AN ADVANCED POWER CONVERSION SYSTEM FOR AEROSPACE AND TERRESTRIAL APPLICATIONS. IT OFFERS HIGH EFFICIENCY AND HIGH TEMPERATURE IN A MODULAR CONFIGURATION, AND CAN BE MADE VERY RUGGED AND COMPACT BY EMPLOYING THIN FILM SOLID ELECTROLYTES ON POROUS METAL SUBSTRATES. THIS PROPOSAL DEVELOPS AND DEMONSTRATES THE THIN FILM ELECTROLYTE, AND DESIGNS A SYSTEM BASED UPON IT. IN PHASE I, THIN FILMS OF BETA-ALUMINA SOLID ELECTROLYTE WILL BE DEPOSITED BY SPUTTERING. THE IONIC CONDUCTIVITY OF THE THIN FILM WILL BE STUDIED AS A FUNCTION OF SPUTTERING POWER, APPLIED BIAS, BACKFILL GAS COMPOSITION AND PRESSURE, AND SYSTEM GEOMETRY. SUBSTRATES WILL BE PREPARED WHICH WILL MIMIC THE SURFACE STRUCTURE AND CHEMISTRY USED IN AN ACTUAL AMTEC DESIGN. THE COATED SUBSTRATES WILL BE CHARACTERIZED FOR IONIC CONDUCTIVITY, FILM STRUCTURE AND FILM CHEMISTRY. A DEPOSITION PROCEDURE TO MAXIMIZE IONIC CONDUCTIVITY WILL BE DEVELOPED. SCOPING DESIGN STUDIED WILL BE PERFORMED. IN PHASE II, THE COATING COMPOSITION IDENTIFIED IN PHASE I WILL BE DEVELOPED AND A PROTOTYPE PROOF OF PRINCIPLE TEST WILL BE PERFORMED. A DESIGN WILL BE DEVELOPED THAT MAKES OPTIMUM USE OF THE THIN FILM ADVANTAGES.

VOSS SCIENTIFIC

416 WASHINGTON ST SE

ALBUQUERQUE, NM 87108

Program Manager: DR ROBERT A KOSLOVER

Contract #:

Title: PC-BASED SYSTEM FOR THE RAPID DETERMINATION OF HPM TESTING FIDELITY IN ANECHOIC CHAMBER ENVIRONMENTS

Topic #: AF90-163

Office: WL/PRC

ID #: 39769

NEXT GENERATION HPM SUSCEPTIBILITY TESTS WILL INVOLVE SIGNIFICANTLY LARGER TEST OBJECTS AND ANECHOIC CHAMBERS THAN THOSE PRESENTLY USED. WHILE ACCEPTABLE TEST FIDELITY REQUIRES ACCURATE SIMULATION OF BATTLEFIELD-LIKE IRRADIATION CONDITIONS, ITS ACHIEVEMENT, PARTICULARLY UNIFORM PLANE-WAVE ILLUMINATION, BECOMES SUBSTANTIALLY MORE DIFFICULT FOR LARGE, COMPLEX TARGETS, I.E., THOSE WITH EXTENDED CROSS-SECTIONS AND MULTIPLE POEs, SUCH AS AIRCRAFT. THESE PROBLEMS, EXACERBATED BY LIMITED ANTENNA-TARGET SEPARATION AND POOR LOW FREQUENCY ABSORBER PERFORMANCE, MUST BE ADDRESSED DAILY BY TEST PERSONNEL. WE PROPOSE TO DEVELOP AN INNOVATIVE, PC-BASED PROGRAM WHICH WILL INCORPORATE COMPARTMENTALIZED, SELF-CONTAINED ROUTINES FOR NEAR-FIELD ANTENNA RADIATION, TEST OBJECT SCATTERING, ABSORBER SCATTERING, AND SITUATION ANALYSIS. BY USING A NOVEL TECHNIQUE INVOLVING FAST LOOK-UP IN A PRE-COMPUTED LIBRARY/DATABASE, THE PROBLEM'S MOST TIME-INTENSIVE PART, TEST-OBJECT SCATTERING, IS GREATLY SIMPLIFIED, THEREBY ALLOWING EXTRAORDINARILY RAPID DETERMINATION OF THE FIDELITY OF A BROAD CLASS OF TESTS. TEST FIDELITY WILL BE EVALUATED AS A FUNCTION OF: (1) RELEVANT HPM SOURCE AND ANTENNA PARAMETERS; (2) PLACEMENT, ORIENTATION, AND NATURE OF THE TEST OBJECT; AND (3) CHARACTERISTICS OF ABSORBING MATERIAL LINING CHAMBER WALLS. USING CODE-PRODUCED FIGURES-OF-MERIT, TEST CONDUCT PERSONNEL WILL, FOR THE FIRST TIME, MONITOR AND QUANTIFY ACCEPTABILITY OF IN-PROCESS TESTS IN REAL TIME.

CSA ENGINEERING INC

560 SAN ANTONIO RD - STE 101

PALO ALTO, CA 94306

Program Manager: DR DAVID A KIENHOLZ

Contract #:

SMALL BUSINESS INNOVATION RESEARCH PROGRAM - PHASE I
AIR FORCE Solicitation 90.1

Title: ADVANCED SUSPENSION SYSTEM FOR SIMULATING ON-ORBIT CONDITIONS
Topic #: AF90-164 Office: WL/PRC ID #: 39770

SIMULATING THE WEIGHTLESS CONDITION OF ORBIT IN GROUND-BASED BEAM POINTING AND TRACKING EXPERIMENTS REQUIRES A MEANS FOR OFFLOADING THE WEIGHT OF THE BEAM DIRECTOR FROM THE SERVO SYSTEM THAT CONTROLS ITS POSITION AND ORIENTATION. A SUSPENSION SYSTEM MUST SUPPORT THE BEAM DIRECTOR WITH ONLY MODEST STATIC DEFLECTION UNDER ITS WEIGHT AND WITH MINIMAL CONSTRAINT FORCES DUE TO SUSPENSION STIFFNESS, MASS, FRICTION, OR VIBRATION MODES. THE PROPOSED PHASE I DEVELOPMENT WILL INVESTIGATE THE APPLICATION TO THE OFFLOAD PROBLEM OF RECENT DEVELOPMENTS IN SUSPENSION SYSTEMS FOR GROUND VIBRATION TESTING OF LARGE, FLEXIBLE SPACE STRUCTURES. A SUBSCALE, FLOOR-STANDING (SUPPORT FROM BELOW) SUSPENSION DEVICE WILL BE BUILT BASED ON THE PNEUMATIC/ELECTRIC CONCEPT PREVIOUSLY DEVELOPED BY CSA ENGINEERING. IT WILL SERVE AS A TESTBED FOR DEVELOPING A LARGE (6000-12000-LB PAYLOAD) SYSTEM USING MULTIPLE DEVICES.

ADVANCED LASER SYSTEMS TECHNOLOGY INC
6860 EDGEWATER COMMERCE PKY - STE 400
ORLANDO, IL 32810
Program Manager: ROBERT E MCKINNEY
Contract #:

Title: DIODE-PUMPED OPTICAL PARAMETRIC OSCILLATION IN NONLINEAR FIBERS OF LITHIUM TRIBORATE (LBO) AND DAN
Topic #: AF90-165 Office: WL/PRC ID #: 39771

THE OBJECTIVES OF THIS PHASE I PROGRAM ARE (1) TRADE-OFF STUDIED OF VARIOUS OPO CRYSTALS AND IDENTIFICATION OF THE OPTIMAL PERFORMANCE OF THE CRYSTAL; (2) IDENTIFICATION OF THE CRYSTAL FIBER ORIENTATIONS SUITABLE FOR HIGH EFFICIENCY OPO DEVICES USING DIODE LASERS (0.7-0.9 MICRONMETERS, 1.2-1.6 MICROMETERS) AS THE PUMPS AND (3) PREDICTION OF THE FIGURE OF MERIT FOR OPO (THRESHOLD POWER, GAIN) AND CONVERSION EFFICIENCIES. IN THIS PROGRAM, WE PROPOSE NONLINEAR FIBERS OF LITHIUM TRIBORATE (LBO) AND THE ORGANIC CRYSTALS OF DAN. THESE CRYSTALS FEATURE VERY HIGH DAMAGE THRESHOLD (IN LBO) AND VERY HIGH NONLINEARITY (IN DAN). THE LBO-FIBER WILL BE PROVIDED BY TSING-HUS UNIVERSITY IN CHINA (THE SOLE SOURCE, CRYSTAL WAS GROWN BY THE LASER-HEATED PEDESTAL METHOD) AND THE DAN-FIBER WILL BE GROWN AT CREOL (AT THE UNIVERSITY OF CENTRAL FLORIDA), WHERE CORED-FIBER WILL BE GROWN BY THE BRIDGMAN METHOD. THIS PROGRAM WILL BE CONDUCTED JOINTLY BY ADVANCED LASER SYSTEMS TECHNOLOGY AND CREOL (CENTER FOR RESEARCH IN ELECTROOPTICS AND LASERS) AT UCF. DATA ANTICIPATED FROM PHASE I STUDIES WILL BE USED FOR OPTIMAL PERFORMANCE IN PHASE II PROGRAM.

KACHINA TECHNOLOGIES INC
2120 FATHER SKY NE
ALBUQUERQUE, NM 87112
Program Manager: DR GEORGE LUGER
Contract #:

Title: OBJECT ORIENTED PROGRAMMING IN C++ ON THE CRAY FOR SCIENTIFIC CODES
Topic #: AF90-166 Office: WL/PRC ID #: 39772

OBJECT ORIENTED PROGRAMMING (OOP) HAS BEEN SUCCESSFULLY APPLIED RECENTLY TO A VARIETY OF SOFTWARE MODELS. IT HAS BEEN USED IN SIMULATION, IN OBJECT-ORIENTED DATA BASES, AND IN SOFTWARE ENGINEERING. THE C LANGUAGE IS BECOMING A DOMINANT PROGRAMMING LANGUAGE. THE FACT THAT C++ IS AN EXTENSION OF THE C LANGUAGE IS ESPECIALLY NOTABLE. IT HAS MACHINE LEVEL EFFICIENCY AND IT IS PORTABLE ON ANYTHING FROM A CRAY TO A PC. IT HAS GENERALLY BEEN REGARDED AS A LANGUAGE THAT IS NOT EFFECTIVE FOR NUMERICAL CALCULATIONS, BUT NEWER

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COMPILERS ARE ERASING THIS DISADVANTAGE. THEREFORE, IT SHOULD BE NATURAL TO APPLY OOP TO THE DESIGN OF MODULES FOR SCIENTIFIC COMPUTATIONS. IN ORDER TO DO THIS IN SUPERCOMPUTER ENVIRONMENTS IT WILL BE NECESSARY TO BUILD AN OOP ENVIRONMENT WITH EXISTING SOFTWARE AND OPERATING SYSTEMS ON THE AFWL CRAY. TO THAT END WE WILL DESIGN A C++ INTERPRETER IN PHASE I AND A C++ COMPILER IN PHASE II USING THE PRESENT CRAY C ENVIRONMENT TO DEMONSTRATE THE FEASIBILITY OF AN OOP ENVIRONMENT ON A SUPERCOMPUTER ARCHITECTURE. FURTHER, WE WILL BUILD AN OOP NUMERICAL APPLICATION ENVIRONMENT AND WILL DEMONSTRATE THIS ENVIRONMENT WITH A C++ SCIENTIFIC APPLICATION ON THE CRAY SUPERCOMPUTER.

ANRO ENGINEERING INC
5 MILITIA DR - STE 104
LEXINGTON, MA 02173
Program Manager: DR GERALD F ROSS
Contract #:

Title: ULTRA-WIDEBAND (IMPULSE) RADAR FOR BASE SECURITY APPLICATION
Topic #: AF90-167 Office: BSD/MYST ID #: 39773

IMPULSE RADAR WHICH DERIVES ITS "MAIN BANG", A TRANSIENT, BY EXCITING AN ANTENNA CAVITY WITH A SUBNANOSECOND PULSE HAS BEEN SHOWN TO BE VERY EFFECTIVE FOR INTRUSION DETECTION. A RECENT SBIR PROGRAM COMPLETED FOR DNA RESULTED IN THE DEVELOPMENT OF A NEW LOW COST, LIGHT WEIGHT, RADAR SENSOR FOR THE PROTECTION OF NUCLEAR SITES NOW BEING MARKETED COMMERCIALY. DURING THE DNA FIELD EXPERIMENTS ON ANIMAL AND HUMAN SUBJECTS, A TARGET SCINTILLATION PHENOMENA WAS DISCOVERED WHICH, IF EXPLOITED, SHOULD SIGNIFICANTLY REDUCE FALSE ALARMS NOW PREVALENT IN RADAR INTRUSION SENSORS. THIS PHENOMENA RELATES TO THE APPARENT VARIATION TO THE LEADING EDGE OF THE TARGET DUE TO THE CONSTRUCTIVE AND DESTRUCTIVE INTERFERENCE OF THE SCATTERING CENTERS AND GROUND BOUNCE SIGNALS. IT IS PROPOSED UNDER PHASE I TO DESIGN AND DEVELOP A DISTRIBUTED NETWORK FILTER FOR MEASURING THE RATE OF CHANGE OF TARGET DISTANCE; IMPULSE RADAR SENSORS PERMIT RANGE RESOLUTION OF ABOUT 3 INCHES. THE OUTPUT OF THE FILTER IS DESIGNED TO FEED A BANDPASS FILTER AND ALARM CIRCUIT FOR PROCESSING AND DISCRIMINATION. ONCE BENCH TESTED, THE FILTER- PROCESSOR WILL BE INTEGRATED INTO AN EXISTING IMPULSE RADAR SENSOR AND FIELD TESTED BY SMI, A SUBCONTRACTOR. BASED ON THE SUCCESS OF THE PHASE I TESTS AND NEW EQUIPMENT NOW UNDER CONSIDERATION ON OTHER PROGRAMS FOR RANGE EXTENSION, A SUGGESTED SENSOR DEVELOPMENT FOR PHASE II IS PROPOSED.

DEFENSE GROUP INC
606 WILSHIRE BLVD - STE 706
SANTA MONICA, CA 90401
Program Manager: RICHARD F MESIC
Contract #:

Title: INNOVATIVE MISSILES AND BASING
Topic #: AF90-167 Office: BSD/MYST ID #: 39774

DGI PROPOSES TO APPLY A TOP-DOWN APPROACH TO DEVELOP AND TEST INNOVATIVE, REVOLUTIONARY FAR TERM MISSILE AND BASING CONCEPTS AND SUPPORTING TECHNOLOGIES AIMED AT PROVIDING OPTIONS FOR A VIABLE CONUS BASED MISSILE FORCE IN THE YEARS 2010 AND BEYOND. EVEN IF CONGRESS APPROVES DEPLOYMENT OF THE PRG AND HML SYSTEMS, IT IS CERTAIN THAT THERE WILL BE CONTINUING DEVELOPMENTS IN THREAT TECHNOLOGY AND ARMS CONTROL THAT WILL EVENTUALLY PUT THE EFFECTIVENESS OF THESE MODERNIZED SYSTEMS IN DOUBT. IN THIS PROPOSAL WE WILL SUGGEST AN APPROACH TO DEVELOPING OPTIONS FOR THE FAR TERM THAT COULD, IN PARTICULAR, INCORPORATE TECHNOLOGIES SUCH AS SCRAMJET PROPULSION NOT TYPICALLY CONSIDERED FOR BALLISTIC MISSILE APPLICATIONS.

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SPARTA INC

23041 AVENIDA DE LA CARLOTA - STE 400

LAGUNA HILLS, CA 92653

Program Manager: DR KEITH W LANE

Contract #:

Title: FAR TERM BASING APPROACHES

Topic #: AF90-167

Office: BSD/MYST

ID #: 39775

IF THE UNITED STATES ENTERS INTO A STRATEGIC ARMS CONTROL AGREEMENT WHICH SIGNIFICANTLY CUTS BACK THE NUMBER OF STRATEGIC WARHEADS, NEW CONSIDERATIONS ARE INTRODUCED INTO ICBM BASING CONSIDERATIONS. WHILE A PEACEKEEPER RAIL GARRISON COMBINED WITH SMALL ICBMs IN HMLs MAY BE SUFFICIENT IN THE NEAR OR INTERMEDIATE TERM, THERE ARE REASONS TO CONSIDER A NEW BASING APPROACH FOR THE FAR TERM. THIS PROPOSAL IS TO UPDATE A CONCEPT WHICH STARTED A "HARD TEL, SOFT TUNNEL" APPROACH IN A PREVIOUS STUDY. THIS CONCEPT WILL BE TECHNICALLY UPDATED FOR FAR TERM APPLICATIONS AND EVALUATED FOR SURVIVABILITY AND COST EFFECTIVENESS.

ELECTRO MAGNETIC APPLICATIONS INC

PO BOX 260263

DENVER, CO 80226

Program Manager: CALVIN C EASTERBROOK

Contract #:

Title: DEVELOPMENT OF A STANDARD PROPELLANT TO LINER PEEL TEST METHOD

Topic #: AF90-169

Office: BSD/MYST

ID #: 39776

THE PROPOSED EFFORT IS AIMED AT IMPROVING THE QUANTITATIVE RESULTS OF THE PROPELLANT-LINER PEEL TEST THAT IS CURRENTLY BEING USED. THE APPROACH TO BE UTILIZED INVOLVES STANDARDIZING THE MECHANICAL TEST PROCEDURE AND IDENTIFYING OTHER PARAMETERS THAT ARE ASSOCIATED WITH THE PEEL THAT CAN BE CONSISTENTLY AND ACCURATELY MEASURED.

QUEST INTEGRATED INC (OLD: FLOW RSCH)

21414 - 68TH AVE S

KENT, WA 98032

Program Manager: DR MOHAMED HASHISH

Contract #:

Title: NOVEL ABRASIVE-WATERJET TECHNIQUES FOR THE MACHINING OF ISOGRID STRUCTURES

Topic #: AF90-170

Office: BSD/MYST

ID #: 39777

ISOGRID STRUCTURES ARE USED IN MANY MISSILE BECAUSE OF THEIR LIGHTWEIGHT AND STIFFNESS CHARACTERISTICS. THESE STRUCTURES ARE COMPLEX AND REQUIRE EXTENSIVE MANUFACTURING PROCESSES THAT, IN MANY SITUATIONS, ARE COST PROHIBITIVE, AS IN THE CASE OF SMALL ICBMs. THIS PROPOSAL ADDRESSES NOVEL CONCEPTS USING THE ABRASIVE-WATERJET (AWJ) TECHNIQUE. THE TECHNICAL AND ECONOMICAL FEASIBILITY OF THIS TECHNIQUE WILL BE DETERMINED IN PHASE I, WHILE IN PHASE II, THE FULL MACHINING PROCESS WILL BE DEMONSTRATED. THE AWJ TECHNIQUE WILL ALLOW THE MACHINING OF PARTS IN THE CYLINDRICAL SHAPE, AS OPPOSED TO THE METHOD USED NOW OF MILLING FLAT PATTERNS, ROLLING THEM, AND THEN WELDING. AN AWJ MOUNTED ON A ROBOT ARM WILL BE USED TO MILL THE PATTERNS OF THE ISOGRID FROM THE INSIDE OF THE PART. TWO MILLING STRATEGIES WILL BE INVESTIGATED: IN THE FIRST, LINEARLY TRAVERSING JETS WILL BE USED, WHILE IN THE OTHER, ROTARY JETS WILL BE USED. A SMALL PATTERN TEMPLATE (OR TEMPLATES) OF HARD MATERIAL (MACHINED WITH THE AWJ) WILL BE USED IN THE MILLING PROCESS AS A MASK(S) SO THAT MILLING OF DIFFERENT "POCKET" SHAPES CAN BE OBTAINED WITH SIMPLE JET TRAVERSAL OVER THE MASK. SIMPLE EXPERIMENTS WILL BE CONDUCTED IN PHASE I TO DETERMINE THE QUANTITATIVE AND QUALITATIVE RESULTS OF AWJ ISOGRID MACHINING. A BRIEF ANALYSIS WILL BE CONDUCTED TO

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DETERMINE IF THE STATE OF THE ART IN DIFFUSION BONDING WILL OFFER AN ALTERNATIVE METHOD. RESEARCH ON OPTIMAL AWJ PARAMETERS AND CONCEPTS WILL BE ADDRESSED TO DEFINE PROMISING DIRECTIONS FOR FUTURE DEVELOPMENT EFFORTS. A DATA MATRIX WILL BE GENERATED TO ANALYZE THE TECHNICAL AND ECONOMIC FEASIBILITIES OF THE AWJ MILLING TOOL CONCEPT.

QUEST INTEGRATED INC (OLD: FLOW RSCH)

21414 - 68TH AVE S

KENT, WA 98032

Program Manager: DR MICHAEL LIND

Contract #:

Title: NONCONTACT SMALL DIAMETER BORE GAUGE

Topic #: AF90-171

Office: BSD/MYST

ID #: 39778

CURRENT PEACEKEEPER AND SMALL ICBM GUIDANCE SYSTEMS REQUIRE TOLERANCES ON SFIR (SPECIFIC FORCE INTEGRATING RECEIVER) AND TGG (THIRD GENERATION GYRO) BORES OF 5×10^{-6} INCH (125nm). CURRENTLY, THESE BORES ARE INSPECTED USING A MANUALLY LOADED AIR GAUGE. IT IS POSSIBLE FOR THE OPERATOR TO DAMAGE THESE PYROCERAM BORES WHILE ATTEMPTING TO MEASURE THEM. THE PART MUST THEN BE WORKED OR SCRAPPED. THE DEVELOPMENT OF A MECHANICAL LOADED, HIGHLY ACCURATE NONCONTACT SMALL DIAMETER BORE MEASURING SYSTEM IS DESIRED SINCE IT COULD SAVE MANY MANHOURS AND REDUCE THE SCRAP RATE ON VERY EXPENSIVE PARTS. FLOW RESEARCH INC., PROPOSES TO CONDUCT A PHASE I FEASIBILITY STUDY TO INVESTIGATE POSSIBILITY OF DEVELOPING A NONCONTACT MEASURING SYSTEM BASED ON THE PRINCIPLE OF OPTICAL TRIANGULATION. IF SUCCESSFUL, A PHASE II PROGRAM WILL BE DEVOTED TO FINALIZING THE DESIGN AND THEN MANUFACTURING, TESTING AND VALIDATING A FULL-SCALE PROTOTYPE MEASURING SYSTEM.

AIREX CORP

RTE 16

DOVER, NH 03820

Program Manager: JAMES C SEDGEWICK

Contract #:

Title: AUTO MANUFACTURE OF VERY SMALL ELECTRIC MOTORS

Topic #: AF90-172

Office: BSD/MYST

ID #: 39779

THE PROJECT OBJECTIVE IS TO DETERMINE FEASIBILITY OF MACHINE WINDING CERTAIN MULTI-PHASE, MULTI-POLE DEVICES IDENTIFIED AS CURRENTLY BEING HAND WOUND AND THE FOCUS OF THIS SOLICITATION. THE EFFORT INCLUDES A STUDY OF THE DEVICES TO IDENTIFY THE PROBLEMS ASSOCIATED WITH THE MECHANIZATION OF THE WINDING PROCESS, AS WELL AS A REVIEW OF EXISTING WINDING EQUIPMENT THAT MIGHT BE APPLICABLE IN EXISTING OR MODIFIED FORM. MACHINE WINDING SUCH DEVICES HAS THE BENEFIT OF LOWER COST AND A MORE IMPORTANT ADVANTAGE OF UNIFORM PERFORMANCE WHEN APPLIED TO HIGH RELIABILITY COMPONENTS. WE ANTICIPATE THAT AIREX TYPE WINDING MACHINES, ENHANCED WITH EXPANDED CAPACITY FOR NEW MOTIONS AND CONTROLS, CAN SUCCESSFULLY WIND THE COMPONENTS SELETED AS MACHINE WINDABLE.

APTEK INC

1257 LAKE PLAZA DR

COLORADO SPRINGS, CO 80906

Program Manager: DR LEONARD E SCHWER

Contract #:

Title: NONDESTRUCTIVE TESTS AND EVALUATION TECHNIQUES FOR SOLID ROCKET MOTORS

Topic #: AF90-173

Office: BSD/MYST

ID #: 39780

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AIR FORCE Solicitation 90.1

THE PROPOSED RESEARCH PROGRAM WILL PROVIDE AN EVALUATION TOOL FOR ASSESSING THE EFFECTS OF MANUFACTURING AND IN-SERVICE MATERIAL ANOMALIES ON SUBSEQUENT SOLID ROCKET MOTOR PERFORMANCE. THE EVALUATION TOOL CONSISTS OF A NONLINEAR FINITE ELEMENT PROGRAM WITH A COMPOSITE DAMAGE AND FAILURE CONSTITUTIVE MODEL. THE EVALUATION TOOL WILL BE VERIFIED BY CORRELATION WITH LABORATORY TESTS OF DESIGNATED COMPOSITE MATERIALS AND SIMPLE SMALL SCALE STRUCTURES. LABORATORY TESTING TECHNIQUES WILL INCLUDE MONITORING OF TEST SPECIMEN MECHANICAL RESPONSE WITH STANDARD TRANSDUCERS AND MONITORING OF TEST SPECIMEN DAMAGE PROGRESSION THROUGH TO FAILURE WITH NONDESTRUCTIVE EVALUATION (NDE) TECHNIQUES, INCLUDING X-RAY COMPUTED TOMOGRAPHY, ULTRASONICS, AND EDDY CURRENT. THE NDE DATA WILL BE USED TO VERIFY THE MATERIAL DAMAGE AND FAILURE MODES INCORPORATED IN THE COMPOSITE MATERIAL MODEL. THE MEASURED MECHANICAL RESPONSE WILL BE USED TO VERIFY THE INTERACTION OF THE DAMAGE MODEL WITH THE STRUCTURAL RESPONSE. THE OUTLINED APPROACH IS EQUALLY APPLICABLE TO EVALUATING CANDIDATE COMPOSITE MATERIALS AND THE EFFECTIVENESS OF INNOVATIVE DESIGNS THAT UTILIZE COMPOSITES.

ARACOR (ADV RSCH & APPLICATIONS CORP)

425 LAKESIDE DR

SUNNYVALE, CA 94086

Program Manager: HARVEY E PECK

Contract #:

Title: KISSING DEBOND DETECTION IN SOLID ROCKET MOTORS USING CT

Topic #: AF90-173

Office: BSD/MYST

ID #: 39781

THE OBJECTIVE OF THE PROPOSED WORK IS TO DEVELOP TECHNIQUES FOR DETECTING AND QUANTIFYING WEAK OR "KISSING" DEBONDS IN SOLID ROCKET MOTORS. THE PROPOSED TECHNIQUE IS BASED ON X-RAY COMPUTED TOMOGRAPHY. IT IS INNOVATIVE BECAUSE IT DOES NOT REQUIRE THAT ANY GAPS IN THE DEBOND AREA BE RESOLVED. INSTEAD, IT RELIES ON MEASUREMENTS OF THE PROPELLANT DILATATION NEAR THE BONDED INTERFACE TO SHOW WHETHER LOAD TRANSFER IS OCCURRING ACROSS THE BOND. THE DILATION IS MEASURED USING STATISTICAL MEASURES OF THE TEXTURE OF THE PROPELLANT IN THE CT IMAGE. SIMPLE METHODS BASED ON FIRST ORDER STATISTICS (HISTOGRAMS) HAVE ALREADY SHOWN THAT STRAIN CAN BE MEASURED TO WITHIN 40% USING STATISTICAL TECHNIQUES. WE PROPOSE TO MEASURE MORE DETAILED STATISTICS OF THE RELATIONSHIPS BETWEEN DATA AT DIFFERENT IMAGE POINTS TO INCREASE THE ACCURACY OF THE TECHNIQUE. THE EFFORT WILL BE THE DEVELOPMENT OF PROTOTYPE SOFTWARE TO EXTRACT THE STATISTICAL INFORMATION, ACQUISITION OF CT IMAGE DATA ON ANALOG SPECIMENS FABRICATED WITH KNOWN DEBONDS, AND QUANTIFICATION OF THE PERFORMANCE OF THE SOFTWARE TOOLS.

SRS TECHNOLOGIES

1500 QUAIL ST - STE 350

NEWPORT BEACH, CA 92660

Program Manager: JEFFREY COOPER

Contract #:

Title: CONCEPTS FOR ENHANCING ICBM FORCE EFFECTIVENESS BASED ON IMPROVED INFORMATION

Topic #: AF90-174

Office: BSD/MYST

ID #: 39782

FUTURE PERFORMANCE REQUIREMENTS FOR THE U.S. ICBM FORCE WILL BE EVEN MORE DEMANDING THAN TODAY'S GIVEN SUBSTANTIALLY UNCHANGED STRATEGIC FORCE MISSION REQUIREMENTS. CONTINUING CHANGES IN THE SOVIET TARGET BASE WILL ACCOUNT IN LARGE MEASURE FOR THE DIFFICULTIES FACED BY THE ICBM FORCE IN MAINTAINING ITS MISSION EFFECTIVENESS. DEEP BURIAL, SUPERHARDENING, AND MOBILITY OF SOVIET TARGETS ALL INCREASE THE NEED FOR HIGHLY EFFECTIVE WEAPONS. LIKELY ARMS CONTROL LIMITS ASSOCIATED WITH THE FUTURE ENVIRONMENT WILL PLACE AN ADDITIONAL PREMIUM ON ICBM EFFICIENCY. THE ENHANCEMENT OF EXISTING SOVIET ABM DEFENSE WOULD FURTHER COMPLICATE ICBM REQUIREMENTS. INFORMATION COLLECTED BY THE STRATEGIC DEFENSE SYSTEM (SDS)

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SENSOR AND BM/C3 ELEMENTS, AS WELL AS BY OTHER MILITARY SPACE ASSETS, HAS THE POTENTIAL TO PROVIDE NEW AND ENHANCED DATA IN REAL-TIME TO ICBM FORCES. ICBM ENHANCEMENT CONCEPTS UTILIZING SUCH INFORMATION ARE SYNTHESIZED IN THIS PROJECT AND ARE ELABORATED WITHIN A CONSTRUCT OF INFORMATION STATES THAT ARE RELEVANT FOR TESTING THE UTILITY OF ODI CONCEPTS FOR ICBM ENHANCEMENT. FROM THAT ANALYSIS, SRS IDENTIFIES THE SUPPORTING TECHNOLOGIES REQUIRED TO EXPLOIT NEW INFORMATION DURING AN ICBM'S PRE-LAUNCH, BOOST, AND RE-ENTRY PHASES. POTENTIAL IMPACTS ON TW/AA, RAPID RETARGETING, SIOP-FOLLOWING, AND ICBM LETHALITY ARE THE FOCUS OF THIS PROJECT.

AKM ASSOCS INC
635 MARINERS ISLAND BLVD - STE 205
SAN MATEO, CA 94404
Program Manager: DR ADOLPH SMITH

Contract #:

Title: MODELING AND SIMULATION OF DIAMOND FILM GROWTH ON ADVANCED SUBSTRATES

Topic #: AF90-175

Office: BSD/MYST

ID #: 39785

THE GOAL OF THE PROPOSED RESEARCH IS TO DEVELOP A THEORETICAL MODEL OF DIAMOND FILM DEPOSITION SO THAT THERE WILL BE A SIMULATION GUIDE FOR EXPERIMENTAL WORK. THERE IS A CONCEPTUAL SIMILARITY BETWEEN THE ISING MODEL AND CELLULAR AUTOMATA (CA), BOTH OF WHICH USE ARRAYS OF CELLS WHOSE STATES DEPEND ON THE STATES OF THE NEIGHBORING CELLS. THE CELLULAR AUTOMAT (CA) MODEL USES "TRANSITION RULES" TO DETERMINE THE STATE CHANGES. THESE RULES CAN OPERATE AT A MUCH HIGHER LEVEL (I.E. DESCRIBE MUCH MORE COMPLEX PHENOMENA) THAN THE MATHEMATICAL DESCRIPTIONS OF THE ISING MODEL. THIS SUGGESTS THAT THE CA MODEL COULD BE USED IN COMPLEX PROCESSES SUCH AS VAPOR DEPOSITION OF DIAMONDS. WE WILL INVESTIGATE THE USE OF THE CA MODEL AND EXAMINE ITS UTILITY IN MODELING THIN FILM DIAMOND DEPOSITION FROM THE VAPOR PHASE. THE TECHNIQUE IS INDEPENDENT OF THE ACTUAL CHEMICAL BONDING WHETHER IT IS BASED ON TSUDA'S CARBON DEPOSITION FROM A METHANE ATMOSPHERE OR THE FRENKLACH-SPEAR CARBON DEPOSITION FROM AN ACETYLENE ATMOSPHERE. IN PHASE I, WE WILL DEVELOP A CA MODEL BASED ON THE MODEL OF TSUDA. CA SIMULATION OF THIS SITUATION WILL BE ILLUSTRATED. THE INITIAL GOAL OF THIS WORK IS TO PRODUCE SIMULATED DIAMOND GROWTH USING THIS MODEL.

DIAMOND MATERIALS INC
2820 E COLLEGE AVE
STATE COLLEGE, PA 16801
Program Manager: RICHARD KOBAYASHI

Contract #:

Title: A DIAMOND TRANSMIT/RECEIVE SWITCH FOR RADAR

Topic #: AF90-175

Office: BSD/MYST

ID #: 39784

THE PURPOSE OF THIS PROPOSED PROGRAM IS TO DEVELOP A DIAMOND TRANSMIT/RECEIVE (T/R) SWITCH FOR HIGH POWER, HIGH FREQUENCY RADAR SYSTEMS. THE DIAMOND ELECTRONIC DEVICE MOST LIKELY TO ACHIEVE THE DESIRED T/R SWITCH SPECIFICATIONS IS AN INSULATED GATE FIELD EFFECT TRANSISTOR (IGFET) OPERATED AS A SWITCHING POWER TRANSISTOR. DIAMOND MATERIALS, INC. (DMI) PLANS TO DEVELOP A DIAMOND IGFET T/R SWITCH IN TWO PHASES. IN PHASE I, DMI WILL EVALUATE CUBIC BORON NITRIDE (c-BN) THIN FILMS AS A SUITABLE GATE DIELECTRIC FOR DIAMOND IGFETs. THE PROPERTIES OF THE GATE DIELECTRIC ARE CRITICAL TO THE SUCCESS OF THE DIAMOND IGFET, AND DMI BELIEVES THAT c-BN SHOULD BE THE BEST GATE DIELECTRIC MATERIAL. DMI WILL DEPOSIT c-BN FILMS ON p-TYPE, EPITAXIAL DIAMOND MONOCRYSTALS, AND WILL EVALUATE THE ELECTRICAL PROPERTIES OF THE c-BN/DIAMOND INTERFACE. THE c-BN FILMS WILL BE DEPOSITED USING A PROPRIETARY PROCESS UNDER DEVELOPMENT AT DMI. IF THE ELECTRICAL PROPERTIES OF c-BN ON DIAMOND ARE ACCEPTABLE, THEN DMI WILL PROPOSE A PHASE II PROGRAM TO DEVELOP DIAMOND IGFETs (WITH c-BN GATE DIELECTRICS).

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AS T/R SWITCHES. PHASE II WILL STRIVE TO DEVELOP DIAMOND T/R SWITCHES WHICH MEET THE POWER, FREQUENCY, VOLTAGE, AND SWITCHING TIME SPECIFICATIONS DESIRED BY THE AIR FORCE. THE p-CHANNEL IGFET HAS BEEN IDENTIFIED AS THE MOST PRACTICAL TRANSISTOR ARCHITECTURE FOR DIAMOND BECAUSE ITS PERFORMANCE CHARACTERISTICS SHOULD BE REASONABLY CONSTANT OVER A WIDE TEMPERATURE RANGE, AND BECAUSE IT SHOULD HAVE THE ABILITY TO TRANSMIT HIGH FREQUENCY SIGNALS.

PHYSICAL SCIENCES INC
20 NEW ENGLAND BUSINESS CTR
ANDOVER, MA 01810
Program Manager: GEORGE E CALEDONIA
Contract #:

Title: DIAMOND TECHNOLOGY FOR INTERCONTINENTAL MISSILES (ICM) APPLICATIONS
Topic #: AF90-175 Office: BSD/MYST ID #: 39783

MANY SUBSTRATES ARE NOT AMENABLE TO DIAMOND COATING BECAUSE THE CORRECT PROCESSING TECHNOLOGIES REQUIRE OPERATION AT ELEVATED PRESSURES AND TEMPERATURES WHICH CAN BE DELETERIOUS TO THE SUBSTRATE. WE PROPOSE TO UTILIZE OUR UNIQUE PULSED FAST ATOM SOURCE TO DEVELOP DIAMOND COATINGS ON SUBSTRATES HELD AT LOW TEMPERATURES. OUR FAST BEAM CAN PROVIDE HIGH CONCENTRATIONS OF C AND H ATOMS IN THE SAME RATIO AS UTILIZED IN PCVD PROCESSES BUT AT VERY HIGH VELOCITIES. UPON IMPACT THE HIGH VELOCITY, SHORT DURATION (~30 MICROMETER) BEAM WILL ACCOMMODATE WITH THE SURFACE, HEATING A MICRO LAYER TO ELEVATE TEMPERATURES. THIS APPROACH AVOIDS THE REQUIREMENTS OF BULK SUBSTRATE HEATING. THE PHASE I EFFORT WILL BE DIRECTED TOWARDS A LABORATORY DEMONSTRATION FOR THE POTENTIAL OF USING OUR FAST BEAM TECHNOLOGY FOR DIAMOND COATING OF LOW TEMPERATURE SUBSTRATES. THE SUCCESSFUL COMPLETION OF THE PHASE I EFFORT WILL ALLOW THE UTILIZATION OF DIAMOND FILMS ON ADVANCED SUBSTRATES WHICH WOULD BE AFFECTED ADVERSELY BY THE ENVIRONMENTAL CONDITIONS REQUIRED IN EXISTANT DIAMOND COATING PROCESSES.

INNOVATIVE SOLUTIONS FROM ADV TECH INC
7375 BOSTON BLVD - 110
SPRINGFIELD, VA 22153
Program Manager: ERNEST BLASE
Contract #:

Title: A NOVEL HIGH SPECIFIC POWER HIGH SPECIFIC ENERGY RECHARGEABLE BATTERY CONCEPT
Topic #: AF90-178 Office: BSD/MYST ID #: 39786

A NEW APPROACH TO ALKALI BATTERY DEVELOPMENT, WHICH CAN SATISFY THE DEMANDING HIGH RATE, HIGH SPECIFIC ENERGY SPACE MISSION REQUIREMENTS, IS PROPOSED. THE PROPOSED APPROACH OFFERS SPECIFIC ENERGY PERFORMANCE COMPARABLE TO THE BEST RECHARGEABLE LITHIUM BATTERY CHEMISTRIES CURRENTLY UNDER DEVELOPMENT, WITH SUBSTANTIAL INCREASES IN SPECIFIC POWER. THIS PROPOSAL DESCRIBES A PHASE I BATTERY CONCEPT FEASIBILITY ANALYSIS AND CELL PROOF OF CONCEPT LABORATORY DEMONSTRATION. PHASE II WILL DEMONSTRATE THE FEASIBILITY AND PAYOFFS OF A PROTOTYPE BATTERY.

AERODYNE RESEARCH INC
45 MANNING RD
BILLERICA, MA 01821
Program Manager: STEPHEN Y YUN
Contract #:

Title: REENTRY VEHICLE BODY SIGNATURE SIMULATION IN THE ULTRAVIOLET TO INFRARED SPECTRUM
Topic #: AF90-179 Office: BSD/MYST ID #: 39787

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AIR FORCE Solicitation 90.1

THE PROPOSED PROGRAM WOULD PROVIDE THE AIR FORCE BALLISTIC SYSTEMS DIVISION (BSD) WITH AN ENGINEERING LEVEL SIGNATURE MODELING CAPABILITY FOR VARIOUS TYPES OF REENTRY VEHICLES (RVs) DURING THE MIDCOURSE PHASE. THE PRESENT AERODYNE RESEARCH, INC. (ARI) SPIRITS SIGNATURE MODEL OFFERS THE BASIS FOR THE MODELING CAPABILITY IN THE ULTRAVIOLET (UV) THROUGH THE INFRARED (IR) SPECTRUM. THE SPIRITS MODEL WILL PROVIDE THE HARDBODY SIGNATURES FOR VARIOUS RVs, E.G., TETHERED RVs, AS WELL AS DECOYS, E.G., BALLOONS, REPLICAS. THE SPIRITS MODEL IS CONSTRUCTED TO INCLUDE SPECTRAL RADIATION EFFECTS FROM AND THROUGH EXHAUST PLUMES AND CAN THEREFORE BE CONFIGURED TO INCLUDE THE MODIFIED SPF/SIRRM INFRARED PLUME RADIATION MODEL CURRENTLY UTILIZED AT BSD AND THE EXTENDED UV/VISIBLE/NEAR IR PLUME RADIATION MODEL TO BE DEVELOPED AT ARI UNDER AN ADDITIONAL PROPOSED EFFORT. THIS WORK WOULD COMPLEMENT A JUST COMPLETED BSD SPONSORED PHASE I SBIR PROJECT AT ARI TO PROVIDE PLUME VISIBLE AND ULTRAVIOLET SIGNATURES FOR THRUSTED, MANEUVERING REENTRY VEHICLES AND DECOYS, SINCE PLUME SIGNATURES CAN BE COMPLETELY INTEGRATED INTO SPIRITS HARDBODY IMAGES.

PHYSICAL SCIENCES INC
20 NEW ENGLAND BUSINESS CTR
ANDOVER, MA 01810
Program Manager: DR DAVID RESENDES

Contract #:

Title: ELECTROMAGNETIC WAVE SCATTERING OFF TURBULENT WAKES

Topic #: AF90-179

Office: BSD/MYST

ID #: 39789

WE PROPOSE TO DEVELOP AN IMPROVED, MORE ACCURATE TECHNIQUES FOR PREDICTING THE RADAR SCATTERING RETURN FROM TURBULENT HYPERSONIC FLOWS. THE WELL-KNOWN SELF-CONSISTENT FIELD APPROACH TO MULTIPLE SCATTERING WILL BE EXTENDED TO VECTOR ELECTROMAGNETIC WAVES AND APPLIED TO THE PREDICTION OF TURBULENT WAKE RADAR SIGNATURES. PROJECT OBJECTIVES INCLUDE A DETERMINATION OF THE COHERENT AS WELL AS INCOHERENT FIELDS AT THE RADAR DETECTOR SCATTERED OFF A WAKE WITH AN ASSUMED SET OF STATISTICAL PROPERTIES AND A SIMPLE GEOMETRY. THIS APPROACH WILL PROVIDE A GENERAL AND SYSTEMATIC TREATMENT TO ALL ORDERS IN TURBULENCE OF THE SCATTERING OF ELECTROMAGNETIC WAVES IN TERMS OF THE PROPERTIES OF THE TURBULENT STRUCTURE OF THE SCATTERING SYSTEM, AND IS APPLICABLE TO BOTH UNDERDENSE AND OVERDENSE PLASMAS. THIS APPROACH THUS OVERCOMES THE WELL KNOWN INTRODUCTION OF SINGULARITIES IN FINITE ORDER BORN EXPANSIONS, AND SHOULD REPRESENT A SUBSTANTIAL IMPROVEMENT OVER EXISTING APPROXIMATE METHODS.

SSDD RESEARCH CORP
315 S ALLEN ST - STE 421
STATE COLLEGE, PA 16801
Program Manager: TED GROSCH

Contract #:

Title: RCS PREDICTION USING FREQUENCY DEPENDENT FINITE DIFFERENCE TIME DOMAIN (FDFDTD) METHOD

Topic #: AF90-179

Office: BSD/MYST

ID #: 39788

RECENT ADVANCES INDICATE THAT TIME DOMAIN CALCULATIONS BASED ON FINITE DIFFERENCE (FDTD) HAVE THE CAPABILITY TO ACCURATELY COMPUTE RCS FROM GEOMETRICALLY GENERAL VEHICLES COMPOSED OF NONHOMOGENEOUS MATERIALS. THE FDTD METHOD INVOLVES DIVIDING THE VEHICLE INTO SMALL CELLS. THE MATERIAL IN EACH CELL MAY BE SPECIFIED INDEPENDENTLY, THUS ALLOWING THE GREAT FLEXIBILITY. AN INCIDENT PLANE WAVE IS SPECIFIED ANALYTICALLY, AND THE PROGRESS OF THE INCIDENT WAVE AND ITS INTERACTIONS WITH THE VEHICLE ARE COMPUTED AT SMALL TIME STEPS. SEVERAL FOUNDAMENTAL EXTENSIONS TO THE FDTD METHOD HAVE GREATLY EXTENDED ITS APPLICABILITY. THESE EXTENSIONS INCLUDE THE CAPABILITY TO MODEL FREQUENCY DEPENDENT

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DISPERSIVE MATERIALS, AND TO TRANSFORM THE NEAR ZONE FIELDS TO THE FAR ZONE IN THE TIME DOMAIN IN ORDER TO ALLOW WIDEBAND COMPUTATION OF RCS. THE PROPOSED DEVELOPMENT SHOULD ALLOW COMPUTATION OF RCS WITH VIRTUALLY ANY MATERIAL AND GEOMETRY, SUBJECT ONLY TO COMPUTER RESOURCE LIMITATIONS.

AEROMET INC
PO BOX 701767
TULSA, OK 74170
Program Manager: R LYNN ROSE
Contract #:
Title: LIGHT-WEATHER DATABASE FOR REENTRY TECHNOLOGIES
Topic #: AF90-180 Office: BSD/MYST ID #: 39792

DEVELOPMENT OF A PLAN AND ITS DEMONSTRATION IN PRODUCING MODERN DATABASE FOR RV TECHNOLOGIES IS PROPOSED BY USING CLOUD MICROPHYSICAL DATA SETS COLLECTED SINCE 1985 OVER THE NORTH AMERICAN CONTINENT AND U.S. ARMY KWAJALEIN ATOLL. THE PLAN INCLUDES THE USE OF AIRBORNE RADAR, MODELING, AND SATELLITE ADDITIONS TO THE PARTICLE SIZE DATA TO CORRELATE PARTICLE SIZE AND LIQUID WATER CONTENT OVER AN EXTENDED AREA, LEADING TO PREDICTIVE SKILLS IN REENTRY TEST AND TARGETING. SPECIAL ATTENTION WILL BE GIVEN TO THE HIGH ALTITUDE CIRRUS AND DIFFERENCES BETWEEN CONTINENTAL AND OCEAN REGIONS. CLUSTER ANALYSES WILL BE USED ON THE ELEVEN CITY STUDY TO DEMONSTRATE THE ABILITY TO PARTITION SITUATIONS THAT CAN BE ASSOCIATED WITH CURRENT OPERATIONAL DATA PRODUCTS SUCH AS THE 3-DNEPH AND SATELLITE DATA.

HYPERSONICS INC
164 FERNE CT
PALO ALTO, CA 94306
Program Manager: RAUL J CONTI
Contract #:
Title: ADVANCED AEROTHERMOCHEMISTRY ALGORITHM
Topic #: AF90-180 Office: BSD/MYST ID #: 39793

A COMPUTER BASED ALGORITHM IS PROPOSED THAT INTEGRATES AN ADVANCED NAVIER-STOKES HYPERSONIC FLOW SOLVER WITH STATE-OF-THE-ART MATERIAL RESPONSE COMPUTER CODES TO CREATE A POWERFUL TOOL FOR REENTRY VEHICLE HEATSHIELD DESIGN. COMPLEX GAS PHYSICS ARE MODELED WITH CONSIDERATION OF THERMAL AND CHEMICAL NONEQUILIBRIUM EFFECTS.

VRA INC
PO BOX 50
BLACKSBURG, VA 24063
Program Manager: DR CLARK H LEWIS
Contract #:
Title: LOW-TO-HIGH ALTITUDE NONEQUILIBRIUM VSL/PNS SCHEME FOR BRV/MaRV/DECOY APPLICATIONS
Topic #: AF90-180 Office: BSD/MYST ID #: 39790

BECAUSE OF A LACK OF ADEQUATE FLIGHT OR GROUND TEST DATA FOR HYPERSONIC REENTRY CONDITIONS, THE DESIGN AND ANALYSIS OF EXISTING AND FUTURE BRVs, MaRVs AND DECOYS WILL INCREASINGLY BENEFIT FROM THE DEVELOPMENT OF ACCURATE AND RELIABLE NUMERICAL TOOLS FOR PREDICTING SUCH HYPERSONIC FLOWFIELDS. TO EFFECTIVELY SUPPORT THE DESIGN AND ANALYSIS STUDIES, THE NUMERICAL SCHEMES REQUIRE A UNIQUE COMBINATION OF SPEED AND ACCURACY. THE PURPOSE OF THIS SBIR EFFORT IS TO ADDRESS THIS NEED AND DEVELOP A UNIFIED 3-D COUPLED-CHEMISTRY VSL/PNS CODE CAPABLE OF TREATING DIFFERENT HEATSHIELD MATERIALS AND

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APPLICABLE OVER THE ENTIRE ALTITUDE RANGE OF 0 TO 250 KFT. IN PHASE I WE WILL DEVELOP AXISYMMETRIC COUPLED-CHEMISTRY VSL AND PNS SCHEMES FOR TEFLON ABLATION INTO AIR. TWO TET CASES WILL BE DONE, AND A FINAL REPORT WILL BE PROVIDED AT THE END OF PHASE I. THE FOLLOW-ON PHASE II EFFORT WILL CONSIDER LARGE ANGLE OF ATTACK UP TO 25 DEG, FIVE HEATSHIELD MATERIALS, THERMAL NONEQUILIBRIUM, SLIP EFFECTS, ABLATED NOSETIPS, 3-D LIFTING CONFIGURATIONS AND TURBULENCE EFFECTS. THE FINAL CODE(S) WILL BE DELIVERED AT THE END OF PHASE II TOGETHER WITH TEST CASES, FINAL REPORT AND USER'S MANUAL(S).

DEFENSE GROUP INC
606 WILSHIRE BLVD - STE 706
SANTA MONICA, CA 90401
Program Manager: DR MORGAN GROVER
Contract #:
Title: GROUNDWAVE COMMUNICATIONS FOR MOBILE BASING
Topic #: AF90-181 Office: BSD/MYST ID #: 39795

THIS PROPOSAL DESCRIBES AN INNOVATIVE TECHNICAL APPROACH FOR HML COMMUNICATIONS, USING LF/MF GROUNDWAVE. RELATIVE TO THE CURRENT WCS BASELINE, LF/MF SUPPORTS LARGER DISPERSAL AREAS, AND OFFERS GREATER RESISTANCE TO NUCLEAR EFFECTS AND TO POTENTIAL FUTURE JAMMING AND LOCALIZATION THREATS. THEREFORE, THE LONG-TERM VIABILITY OF HML BASING CAN BE ENHANCED. LF/MF CAN BE IMPLEMENTED AS AN OVERLAY TO THE CURRENT WCS BASELINE. IT ALSO OFFERS BACKWARD COMPATIBILITY WITH BOTH SLFCS AND GWEN. ALTHOUGH THE PRESENT DISCUSSION FOCUSES ON HML BASING, LF/MF GROUNDWAVE MAY ALSO BE APPLICABLE TO OTHER MOBILE ICBM BASING MODES--INCLUDING RGB, AND OTHER BASING CONCEPTS OF THE FUTURE. THE POTENTIAL ADVANTAGES OF LF/MF FOR HML SERVE TO ILLUSTRATE THE BROADER UTILITY OF THIS APPROACH.

GREEN MOUNTAIN RADIO RESEARCH CO
50 VERMONT AVE - FT ETHAN ALLEN
COLCHESTER, VT 05446
Program Manager: DR FREDERICK H RAAB
Contract #:
Title: FEASIBILITY STUDY FOR HIGH-DATA-RATE NONDENIABLE COMMUNICATIONS
Topic #: AF90-181 Office: BSD/MYST ID #: 39794

MAINTAINING COMMAND-AND-CONTROL COMMUNICATIONS CONNECTIVITY CONTINUOUSLY THROUGH PRE-, TRANS-, AND POST-ATTACK PERIODS IS ESSENTIAL. COMMUNICATION LINKS FOR THIS APPLICATION SHOULD BE NONDENIABLE (BY NUCLEAR DETONATION) AND NONINTERRUPTABLE, AND SHOULD ALSO ALLOW COMMUNICATIONS WHILE IN MOTION AND HIGH DATA RATES. HOWEVER, CONVENTIONAL COMMUNICATION TECHNIQUES ARE ILL SUITED FOR USE IN THIS APPLICATION OR OFFER ONLY LOW DATA RATES. THE PROPOSED PROGRAM WILL EXAMINE A SOLUTION BASED UPON A COMBINATION OF A NONDENIABLE COMMUNICATION TECHNIQUE (IONOSPHERIC-SCATTER, METEOR- BURST, AND TROPOSCATTER) AND DATA COMPRESSION. THE ISSUES INCLUDE POWER, ANTENNAS, PATH LOSS, PATH AVAILABILITY, CHANNEL STABILITY, DATA RATES, AND INTERCEPTABILITY.

PHYSICAL RESEARCH INC
25500 HAWTHORNE BLVD - STE 2300
TORRANCE, CA 90505
Program Manager: JAMES E CRAIG
Contract #:
Title: A BALLISTIC RANGE EXPERIMENT TO MEASURE ELECTRON DENSITY PROFILES WITH HOLOGRAPHIC INTERFEROMETRY

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Topic #: AF90-183

Office: BSD/MYST

ID #: 39796

THE INNOVATIVE PROPOSED HEREIN CONCERNS THE DEVELOPMENT OF A HOLOGRAPHIC DIAGNOSTIC TECHNIQUE FOR THE MEASUREMENT OF ELECTRON DENSITY PROFILES IN THE FLOWS OVER A RV BALLISTIC RANGE MODEL. AN EXPERIMENT IS IDENTIFIED IN WHICH HOLOGRAPHIC PLASMA MEASUREMENTS WILL BE USED FOR REFINEMENT AND VALIDATION OF COMPUTATIONAL FLOW/CHEMISTRY ANALYSIS. THE TECHNICAL APPROACH IS BASED ON THE DEVELOPMENT OF A TWO-WAVELENGTH HOLOGRAPHIC INTERFEROMETER COMPRISED OF AN INTEGRATED HARDWARE AND SOFTWARE SYSTEM: INCLUDING A SYSTEM FOR HOLOGRAM RECORDING, FOR INTERFEROMETRY ANALYSIS, AND FOR INVERSION OF THE INTERFEROMETRY DATA INTO SPATIALLY RESOLVED PLASMA PROFILES. AN INTEGRATED METHODOLOGY WILL BE ESTABLISHED FOR ANALYSIS OF THE HOLOGRAPHY DATA AND FOR REFINEMENT AND VALIDATION OF THE COMPUTATIONAL FLOW/CHEMISTRY ANALYSIS. THE DEVELOPMENT OF THIS HOLOGRAPHIC PLASMA DIAGNOSTIC WILL PROVIDE A DRAMATIC INCREASE IN THE FLOW/CHEMISTRY DATA OBTAINED IN BALLISTIC RANGE TESTING.

SAM TECHNOLOGY INC

51 FEDERAL ST - STE 402

SAN FRANCISCO, CA 94107

Program Manager: ALAN S GEVINS

Contract #: FQ8671-9001458

Title: MENTAL WORKLOAD ASSESSMENT WITH NEURAL NETWORKS

Topic #: AF90-184

Office: AFOSR/XOT

ID #: 39807

NEURAL NETWORKS WILL BE USED TO DEVELOP A REAL-TIME, MULTIMODALITY, NONINTRUSIVE PHYSIOLOGICAL METRIC OF MENTAL WORKLOAD. OUR METRIC WILL MEASURE MENTAL WORKLOAD RELATIVE TO TWO OR MORE CALIBRATION POINTS FOR A FAMILY OF CLOSELY RELATED TASKS WHERE MENTAL LOADING IS THE MAIN VARIABLE DIFFERING BETWEEN TASKS. THE METHODS WILL BE BASED ON PHYSIOLOGICAL SIGNALS THAT NEED NOT BE EVOKED BY IRRELEVANT STIMULI AND DO NOT REQUIRE THE USE OF ARTIFICIAL TASK STRUCTURES. DURING PHASE I, WE WILL TEST FEASIBILITY BY IDENTIFYING COMBINATIONS OF EYE BLINK, HEART RATE VARIABILITY AND REGIONAL NEUROELECTRIC SIGNAL FEATURES THAT WILL BEST DISTINGUISH BETWEEN TWO MENTAL WORKLOAD LEVELS OF A VISUOMOTOR JUDGEMENT TASK PREVIOUSLY RECORDED FROM FIVE USAF FIGHTER TEST PILOTS. WE WILL USE FEED-FORWARD NEURAL NETWORKS, RECURRENT UNSUPERVISED NEURAL NETWORKS, AND BAYESIAN CLUSTER ANALYSIS TO ACHIEVE THIS GOAL. DURING PHASE II, WE WILL TEST THE SPECIFICITY AND GENERALIZABILITY OF THE METHOD BY TESTING IT ON DATA RECORDED IN FLIGHT SIMULATORS AND DURING PERFORMANCE OF SEVERAL STANDARDIZED COGNITIVE TASKS. WE WILL ALSO INCORPORATE OTHER PASSIVE PSYCHOPHYSIOLOGICAL MEASUREMENTS SUCH AS ELECTRODERMAL ACTIVITY AND TONIC EMG, REFINE THE METHOD, AND DESIGN A DEVICE THAT CAN BE USED TO CONSTRUCT THE WORKLOAD INDEX FOR ANY OPERATOR AND ANY FAMILY OF TASKS.

VISION SCIENCES RESEARCH CORP

130 RYAN INDUSTRIAL CT - STE 105

SAN RAMON, CA 94583

Program Manager: DR ARTHUR P GINSBURG

Contract #: FQ8671-9001459

Title: QUANTIFYING IMPROVED VISUAL PERFORMANCE THROUGH VISION TRAINING

Topic #: AF90-184

Office: AFOSR/XOT

ID #: 39806

VISUAL PERFORMANCE CAN BE IMPROVED WITH PRACTICE. HOWEVER, VISION TRAINING HAS BEEN LIMITED MAINLY TO ORTHOPTISTS AND CERTAIN OPTOMETRISTS. ALTHOUGH VISION TRAINING HAS PRODUCED IMPROVED VISUAL PERFORMANCE IN CERTAIN CASES, THE SCIENTIFIC UNDERSTANDING OF THE VISUAL MECHANISMS BEING TRAINED LAGS FOR BEHIND. THE EMERGENCE OF CONTRAST SENSITIVITY AS BOTH A TOOL TO BETTER UNDERSTAND VISUAL MECHANISMS AND AS A GENERAL MEASURE OF

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COMPLEX VISUAL TARGET ACQUISITION, OFFERS UNIQUE CAPABILITIES FOR UNDERSTANDING AND QUANTIFYING IMPORTANT ASPECTS OF VISION TRAINING. SPOTTY SCIENTIFIC EVIDENCE EXISTS FOR THE IMPROVEMENT OF CONTRAST SENSITIVITY USING SEVERAL PSYCHOPHYSICAL TECHNIQUES ON NORMAL AND CLINICALLY ABNORMAL OBSERVERS. THE IMPORTANCE OF IMPROVING CONTRAST SENSITIVITY IS EVIDENT FOR ALL VISION INTENSIVE OCCUPATIONS AND SPORTS. THE PROPOSED RESEARCH WILL INITIALLY DEVELOP AND TEST A PSYCHOPHYSICALLY VALID, SCIENTIFICALLY BASED CONTRAST SENSITIVITY TRAINING PROGRAM AND TEST THE RESULTS ON OBSERVERS HAVING LOW TO NORMAL AND CLINICALLY ABNORMAL CONTRAST SENSITIVITY TO DETERMINE THE DEGREE TO WHICH CONTRAST SENSITIVITY AND COMPLEX TARGET PERCEPTION IS IMPROVED. THE FINAL PRODUCT WILL BE A SELF-ADMINISTERED COMPUTER-BASED VISION TRAINING BATTERY FOR THE IMPROVEMENT OF OTHER VISUAL FUNCTIONS RELEVANT TO COMPLEX VISUAL PERFORMANCE.

SCIENTIFIC RESEARCH ASSOCS INC

PO BOX 1058 - 50 NYE RD

GLASTONBURY, CT 06033

Program Manager: HAROLD L GRUBIN

Contract #: FQ8671-9001372

Title: QUANTUM STRUCTURES AND DEVICES

Topic #: AF90-185

Office: AFOSR/XOT

ID #: 39803

THIS PROPOSAL DISCUSSES A PROGRAM FOR UTILIZING AND EXPANDING AN INNOVATIVE QUANTUM BASED MULTI-PARTICLE SELF-CONSISTENT ALGORITHM FOR SOLVING THE EQUATION OF MOTION OF THE DENSITY MATRIX TO EXPLORE NEW DEVICE PHENOMENA. THE ALGORITHM HAS BEEN DEVELOPED AT SRA AND OFFERS FOR THE FIRST TIME THE POSSIBILITY OF NUMERICALLY EXAMINING THE FUNDAMENTAL ISSUES GERMANE TO THE TIME DEPENDENT MIXING OF QUASI-BOUND STATES IN A QUANTUM WELL DIODE, AND THE ANTICIPATED DEVICE APPLICATIONS. THE PROPOSAL ILLUSTRATES THIS TIME DEPENDENT MIXING FOR A SIMPLE POTENTIAL WELL OF FINITE DEPTH. THE INNOVATIVE USE OF THE DENSITY MATRIX FORMULATION INCORPORATES THE NONLOCALITY OF THE BOUNDARY CONDITIONS WHICH IN THIS FORMULATION, WITH THE EXCEPTION OF TWO POINTS, ARE OFF-DIAGONAL ELEMENTS. THE PROPOSED PROGRAM WILL FOCUS ON OBTAINING SELF-CONSISTENT SOLUTIONS FOR QUASI-BOUND STATE MIXING ARISING FROM THE APPLICATION OF A HIGH FREQUENCY SIGNAL, IMPOSED UPON A RECENTLY REPORTED PSEUDOMORPHIC $\text{In}_{.53}\text{Ga}_{.47}\text{As}/\text{AlAs}/\text{InAs}$ DOUBLE BARRIER RESONANT TUNNELING DIODE, WHICH HAS DISPLAYED PEAK-TO VALLEY CURRENT RATIOS OF 30.

UNIVERSAL ENERGY SYSTEMS INC

4401 DAYTON-XENIA RD

DAYTON, OH 45432

Program Manager: BRAHMANAND JOGAI

Contract #: FQ8671-9001379

Title: NUMERICAL MODELING OF AHARANOV-BHOM SEMICONDUCTOR HETEROSTRUCTURES

Topic #: AF90-185

Office: AFOSR/XOT

ID #: 39805

THIS DOCUMENT DISCUSSES A PROPOSAL TO PERFORM NUMERICAL SIMULATIONS OF AHARANOV-BOHM (A-B) DEVICES BUILT OF SEMICONDUCTOR HETEROSTRUCTURES. IN THE CALCULATIONS, WE USE THE SCATTERING MATRIX APPROACH TO PROPERLY TREAT THE PROBLEM AT THE JUNCTION BETWEEN THE CONTACTS AND THE TWO CHANNELS OF THE A-B STRUCTURE. THE SCATTERING MATRIX APPROACH ALSO ALLOW TREATMENT OF THE PROBLEM OF IMPURITY SCATTERING INTO BOTH ARMS OF THE DEVICE. THERE ARE SEVERAL ISSUES ADDRESSED IN THIS PROPOSAL. THE FIRST IS AN IMPLEMENTATION OF THE SCATTERING MATRIX APPROACH TO CALCULATE ACCURATELY THE JUNCTION SCATTER WHEN THERE EXISTS A DIFFERENCE OF POTENTIAL BETWEEN BOTH ARMS OF THE AHARANOV-BOHM DEVICE (THE SO-CALLED ELECTROSTATIC A-B EFFECT). THE EFFECT OF MULTIPLE REFLECTIONS AT THE JUNCTIONS CAN THEN READILY BE INCLUDED IN THE CONDUCTANCE MODULATION OF A-B STRUCTURES BY USING THE TECHNIQUE FOR CASCADING SCATTERING MATRICES. SUCH CALCULATIONS WILL BE PERFORMED TO

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INVESTIGATE THE IMPORTANCE OF MULTIPLE REFLECTIONS ON THE PERFORMANCE OF ELECTROSTATIC A-B SEMICONDUCTOR HETEROSTRUCTURES AND THE INFLUENCE OF IMPURITY SCATTERING ON THE PERFORMANCE OF A-B DEVICES WILL BE INVESTIGATED. ALSO, THE ELECTRON WAVE FUNCTION AS A FUNCTION OF INCIDENT ENERGY WILL BE COMPUTED. THIS LAST STEP IS NEEDED TO CALCULATE THE IMPORTANCE OF SPACE-CHARGE EFFECTS IN A-B DEVICES.

KOZIN BOGDANOFF & ASSOCS INC
PO BOX 2372

WEST LAFAYETTE, IN 47906

Program Manager: FRANK KOZIN

Contract #: FQ8671-9001470

Title: REACTION RATE ENGINEERING MODELS OF FATIGUE CRACK GROWTH

Topic #: AF90-186

Office: AFOSR/XOT

ID #: 39797

EXPLORE TO WHAT EXTENT THE EXISTING MICRO REACTION RATE KINETIC THEORY OF THERMALLY ACTIVATED FRACTURE CAN BE USED TO RELATE THE PARAMETERS OF PROBABILISTIC MACRO ENGINEERING MODELS OF CUMULATIVE DAMAGE (FATIGUE, FATIGUE CRACK GROWTH) TO THE USUAL PARAMETERS OF ENGINEERING SIGNIFICANCE SO THAT ACCURATE PREDICTION OF CRACK GROWTH CAN BE ACHIEVED WITH MINIMUM TESTING FOR A SPECIFIC SET OF ENGINEERING CONDITIONS. FIRST, A DETERMINISTIC MACRO MODEL OF DAMAGE ACCUMULATION FOR FATIGUE CRACK GROWTH (FCG) WILL BE CONSTRUCTED FROM THE MICRO THEORY. SECOND, IDENTIFY THE PARAMETERS IN THE MACRO MODEL WITH PHYSICAL AND MATERIALS PROPERTIES OF ENGINEERING SIGNIFICANCE TO SEE WHICH MUST BE ESTIMATED BY TESTING AND WHICH CAN BE ESTIMATED FROM KNOWN MATERIAL PROPERTIES. THIRD, FOUR SETS OF EXISTING DATA ON FCG WILL BE USED TO EXPLORE THE PARAMETER ESTIMATION PROBLEM IN ORDER TO DETERMINE THE MINIMUM AMOUNT OF TESTING NEEDED TO CHARACTERIZE A COMPONENT FOR PREDICTION PURPOSES. FOURTH, DETERMINE HOW VARIABILITY IS TO BE INCLUDED IN THE DETERMINISTIC ENGINEERING MODEL SO THAT THE INHERENT PROBABILISTITY DISTRIBUTIONS PRESENT IN THE PHENOMENON CAN BE INCLUDED, AND REPEAT THE FIRST, AND THIRD ITEMS ABOVE.

TECHNO-SCIENCES INC

7833 WALKER DR - STE 620

GREENBELT, MD 20770

Program Manager: CHARLES FLETCHER

Contract #: FQ8671-9001467

Title: CAD OF STRUCTURES USING COMPOSITE MATERIALS

Topic #: AF90-186

Office: AFOSR/XOT

ID #: 39798

THE OBJECTIVE OF THE PROPOSED WORK IS THE DEVELOPMENT OF A CAD SYSTEM FOR THE DESIGN AND ANALYSIS OF STRUCTURES FOR HIGH PERFORMANCE APPLICATIONS USING ADVANCED COMPOSITE MATERIALS. WE PROPOSE TO ADAPT EXISTING THEORIES OF OPTIMAL STRUCTURAL DESIGN, E., OPTIMAL SHAPE DESIGN, TO TREAT THE DESIGN OF STRUCTURES USING ADVANCED COMPOSITE MATERIALS, E.G., FIBER REINFORCED, RESIN MATRIX MATERIALS, AND METAL MATRIX COMPOSITES. AN EXTENSIVE MATHEMATICAL THEORY FOR OPTIMAL STRUCTURAL DESIGN HAS BEEN DEVELOPED OVER THE PAST THIRTY YEARS. ASPECTS OF THIS THEORY HAVE BEEN USED IN THE DESIGN OF COMPONENTS FOR HYPERSONIC VEHICLES AND THERMAL DIFFUSION SYSTEMS BASED ON HOMOGENEOUS MATERIALS. ENHANCEMENT OF THE DESIGN METHODS TO INCLUDE OPTIMIZATION OF THE MICROSTRUCTURE OF THE COMPONENT IS A SIGNIFICANT INNOVATION WHICH CAN LEAD TO MAJOR ENHANCEMENTS IN COMPONENT PERFORMANCE.

TERRA TEK INC
420 WAKARA WY

SMALL BUSINESS INNOVATION RESEARCH PROGRAM - PHASE I
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SALT LAKE CITY, UT 84108

Program Manager: DR ZIQIONG ZHENG

Contract #: FQ8671-9001461

Title: STATISTICAL STUDY OF STRESS-INDUCED MICROSTRUCTURES IN SELECTED ROCK AND CONCRETE

Topic #: AF90-186

Office: AFOST/XOT

ID #: 39799

PROPERTIES OF ELASTIC-BRITTLE MATERIALS CHANGE UNDER STRESSES WHICH ARE HIGH ENOUGH TO INDUCE MICROSTRUCTURAL ALTERNATIONS. THESE MICROSTRUCTURAL CHANGES ULTIMATELY ARE THE CAUSES FOR MACROSCALE FAILURE OF MATERIALS. OBSERVATIONS AND STATISTICAL STUDIES OF THE STRESS-INDUCED MICROSTRUCTURAL CHANGES (DAMAGE TO THE MATERIAL) IN RELATION TO THE STRESS CONDITIONS, AND THEORETICAL ANALYSIS OF EFFECTIVE MECHANICAL PROPERTIES AS FUNCTIONS OF THE DAMAGE, WILL PROVIDE A BASIS FOR EVENTUAL INCORPORATION IN CONSTITUTIVE MODELS. A DETAILED EVALUATION OF STRESS-INDUCED MICROSTRUCTURES IN ROCK AND CONCRETE TO REVEAL THE STATISTICAL RELATIONSHIP BETWEEN THE MICRO-STRUCTURES AND APPLIED STRESSES IS PROPOSED. THE STATISTICAL RESULT OF THE STUDY WILL SERVE AS A DATA BASE FOR THE LINKAGE BETWEEN THE MACROSCALE AND MICROSCALE BEHAVIOR OF ELASTIC-BRITTLE MATERIALS. USING ENERGY CONSERVATION PRINCIPLES, THE MACROSCOPIC BEHAVIOR OF A DAMAGE MATERIAL CAN BE REPRESENTED BY A SERIES OF "EFFECTIVE" MECHANICAL PROPERTIES, AS FUNCTIONS OF STRESS CONDITIONS, TO WHICH THE MATERIAL IS SUBJECTED. THE EXPLICIT SOLUTIONS OF EFFECTIVE MECHANICAL PROPERTIES WILL BE THE END PRODUCT OF THE THEORETICAL PORTION OF THIS PROPOSED STUDY.

MESO INC - (MESOSCALE ENV SIMU & OPER)

28 RESEARCH DR

HAMPTON, VA 23666

Program Manager: KENNETH T WAIGHT III

Contract #: FQ8671-9001428

Title: THE DEVELOPMENT OF AN IMPROVED CONVECTIVE INITIATION SCHEME FOR MESOSCALE NUMERICAL WEATHER PREDICTION MODELS

Topic #: AF90-188

Office: AFOSR/XOT

ID #: 39800

A THREE-DIMENSIONAL, NONHYDROSTATIC CLOUD MODEL IS USED AS A TOOL TO INVESTIGATE THE PROBLEM OF THUNDERSTORM INITIATION. OPERATIONAL NUMERICAL MODELS DO A POOR JOB OF PREDICTING THE GEOGRAPHIC DISTRIBUTION OF CONVECTIVE ACTIVITY, ESPECIALLY DURING THE WARM SEASON, WHEN THE LARGE SCALE CIRCULATION IS RELATIVELY WEAK. THE CUMULUS PARAMETERIZATION SCHEMES USED IN CURRENT MESO-BETA-SCALE RESEARCH MODELS DISAGREE ON THE NECESSARY MESOSCALE CRITERIA FOR DEEP CONVECTION. CLOUD MODEL RESULTS WILL BE USED AS A SURROGATE ATMOSPHERE IN WHICH A BETTER UNDERSTANDING OF THE PHYSICAL FACTORS NECESSARY FOR THE INITIATION OF CONVECTION WILL LEAD TO AN IMPROVED SET OF CRITERIA SUITABLE FOR MESO-BETA-SCALE MODELS. IN THE PHASE I EFFORT, A CLOUD MODEL SIMULATION COVERING A LARGE DOMAIN WILL BE MADE WITH A COMPLEX PATTERN OF LOW-LEVEL SENSIBLE HEATING. THE HEATING OF THE LOWEST MODEL LAYER WILL LEAD TO THE INITIATION OF CONVECTION IN SEVERAL AREAS AT DIFFERENT TIMES. DYNAMIC AND THERMODYNAMIC VARIABLES WILL BE AVERAGED TO MESOSCALE GRID SIZES, THEN THE MESOSCALE DATASET WILL BE ANALYZED. A SUCCESSFUL RESULT WOULD BE THE IDENTIFICATION OF A RELATIONSHIP BETWEEN MESOSCALE VARIABLES WHICH IS ABLE TO ACCURATELY PREDICT THE INITIATION OF SUBGRID-SCALE DEEP CONVECTION.

NIELSEN ENGINEERING & RESEARCH INC

510 CLYDE AVE

MOUNTAIN VIEW, CA 94043

Program Manager: LAURA C RODMAN

Contract #: FQ8671-9001453

SMALL BUSINESS INNOVATION RESEARCH PROGRAM - PHASE I
AIR FORCE Solicitation 90.1

Title: ADVANCED METHODS FOR ATMOSPHERIC MODELING

Topic #: AF90-188

Office: AFOSR/XOT

ID #: 39801

ATMOSPHERIC SCIENCE INVOLVES STUDIES OF VERY COMPLEX PHYSICAL PROCESSES. OFTEN, SIMPLIFIED VERSIONS OF THESE PROCESSES ARE SIMULATED IN A LABORATORY OR ON A COMPUTER. COMPUTATIONAL FLUID DYNAMICS (CFD) METHODS PROVIDE A GOOD WAY TO PERFORM THESE SIMULATIONS OF ATMOSPHERIC PHENOMENA, SINCE THEY ALLOW FOR THE EASY VARIATION OF INDEPENDENT VARIABLES. HOWEVER, AS THE NUMBER OF POSSIBLE COMBINATIONS OF VARIABLES INCREASES, THE AMOUNT OF GENERATED DATA GROWS TO THE POINT THAT IT IS DIFFICULT TO DISTILL SPECIFIC RESULTS FROM THE SOLUTIONS. AN INNOVATIVE METHOD IS PROPOSED HERE WHICH WILL APPLY AN "INTELLIGENT" POSTPROCESSOR TO THE RESULTS OF A SERIES OF RELATED COMPUTATIONS TO GIVE INSIGHT INTO THE CAUSE-AND-EFFECT RELATIONSHIPS FOR VARIOUS FLOW QUANTITIES. THE POSTPROCESSOR DETERMINES HOW CERTAIN FLOW RESULTS, FOR EXAMPLE, THE TIME HISTORY OF A TURBULENT VELOCITY FIELD, ARE DEPENDENT UPON THE VARIABLES OF THE CALCULATION, SUCH AS THE DEGREE OF STRATIFICATION. THE CODE ALSO DETERMINES IF A FLOW RESULT IS DEPENDENT UPON MORE THAN ONE VARIABLE. IN ADDITION, THE POSTPROCESSOR CHECKS FOR CORRELATIONS AMONG SEVERAL FLOW QUANTITIES OF INTEREST OVER THE COURSE OF A CALCULATION. THE RESULT OF THE POSTPROCESSING IS THE DETERMINATION OF FUNCTIONAL RELATIONSHIPS BETWEEN THE COMPUTED FLOW QUANTITIES AND THE INPUT VARIABLES, IN ADDITION TO THE RELATIONSHIPS AMONG THE FLOW QUANTITIES THEMSELVES.

EHRlich ASSOCS

11 GRANT PL

LEXINGTON, MA 02173

Program Manager: DANIEL J EHRlich

Contract #: FQ8671-900

Title: LASER MICROCHEMICAL PROCESSING INSTRUMENT

Topic #: AF90-189

Office: AFOSR/XOT

ID #: 39810

THE OBJECT IS TO DEVELOP A DETAILED DESIGN FOR A LASER INSTRUMENT TO CONTROL AND MONITOR MICROCHEMICAL PROCESSING OF SEMICONDUCTOR DEVICES.

OPTRON SYSTEMS INC

3 PRESTON CT

BEDFORD, MA 01730

Program Manager: DANIEL O/MARA

Contract #: FQ8671-9001462

Title: OPTICAL ANALOG TO DIGITAL COMPUTING

Topic #: AF90-189

Office: AFOSR/XOT

ID #: 39804

OPTICAL METHODS FOR ANALOG TO DIGITAL CONVERSION OFFER PROMISE FOR HIGHER SPEED AND HIGHER RESOLUTION THAN THAT ATTAINABLE BY ELECTRONIC MEANS. PARALLEL SAMPLING CONVERTERS, ALTHOUGH CONCEPTUALLY SIMPLE AND ELEGANT, HAVE SHOWN LITTLE PROGRESS BEYOND THE 1-2 GHz, 2-4 BIT LEVEL ACHIEVED EARLY IN THE LAST DECADE. GREATER PERFORMANCE MAY BE AVAILABLE BY ADAPTING DELTA AND DELTA-SIGMA CONVERSION TECHNIQUES DEVELOPED FOR AUDIO AND VOICEBAND APPLICATIONS. THE DEVELOPMENT OF FIRST AND HIGHER ORDER OPTICAL DELTA MODULATORS, THEIR INCORPORATION INTO A/D AND D/A CONVERSION SYSTEMS, AND THE NECESSARY PROCESSING AND ENCODING OF OUTPUT DATA TO ACHIEVE AN OPTICAL ANALOG TO BINARY CONVERTER IS PROPOSED.

COMPUTER AIDED PLANNING & SCHEDULING INC

2900 PACES FERRY RD - BLDG D

SMALL BUSINESS INNOVATION RESEARCH PROGRAM - PHASE I
AIR FORCE Solicitation 90.1

ATLANTA, GA 30339

Program Manager: WILLIAM G NULTY

Contract #: FQ8671-9001442

Title: INTERACTIVE DISTRIBUTED LOGISTICS MANAGEMENT

Topic #: AF90-190

Office: AFOSR/XOT

ID #: 39809

THIS PROJECT WILL DEMONSTRATE THE PRACTICALITY OF AN INTERACTIVE, HIERARCHICAL, DISTRIBUTED PLANNING SYSTEM FOR LOGISTICS MANAGEMENT. WE WILL DESIGN A SYSTEM THAT WILL SUPPORT PARALLEL, ASYNCHRONOUS, INTERACTIVE LOGISTICS PLANNING AT MULTIPLE LEVELS OF THE MANAGEMENT HIERARCHY AND AT MULTIPLE SITES SO THAT MANY PEOPLE COOPERATIVELY BUILD AND ADMINISTER A LOGISTICS PLAN. FOR EXAMPLE, A HIGHER-LEVEL MANAGER CAN OUTLINE AN AGGREGATE PLAN AT HIS HEADQUARTERS WORK-STATION; THE PLANNING SYSTEM WILL SUITABLY PARTITION AND DISTRIBUTE THE RESULTING GOALS AND CONSTRAINTS TO SUCCESSIVELY LOWER-LEVEL MANAGERS, WHO WILL INTERACTIVELY ADD DETAIL TO REALIZE THE PLAN AND MONITOR ITS EXECUTION. WE WILL DETERMINE THE INFORMATION REQUIREMENTS AND OPTIMIZATION CAPABILITIES APPROPRIATE TO EACH LEVEL OF THE HIERARCHY AND COMMUNICATION PROTOCOLS AMONG LEVELS TO ENSURE THAT THE SYSTEM IS RESPONSIVE, ROBUST, AND ACCURATE.

NETROLOGIC INC

5080 SHOREHAM PL - STE 201

SAN DIEGO, CA 92122

Program Manager: JAMES R JOHNSON

Contract #: FQ8671-9001443

Title: MICROCOMPUTER-BASED VEHICLE ROUTING AND SCHEDULING

Topic #: AF90-190

Office: AFOSR/XOT

ID #: 39808

THE INVESTIGATION HAS THE FOLLOWING OBJECTIVES: 1) ESTABLISH THAT MICROCOMPUTERS CAN QUICKLY PROVIDE HIGH QUALITY SOLUTIONS TO LARGE-SCALE VEHICLE ROUTING AND SCHEDULING PROBLEMS, 2) DEMONSTRATE THAT NEURAL NETWORKS AND GENETIC SEARCH CAN WORK SYNERGISTICALLY WITH HEURISTIC MATHEMATICAL ALGORITHMS TO PROVIDE SUPERIOR SOLUTIONS TO VEHICLE ROUTING PROBLEMS. THE METHODS BUILD UPON THE PROVEN STRENGTHS OF GENERALIZED ASSIGNMENT ALGORITHMS FOR VEHICLE ROUTING, AS WELL AS THE NEURAL NETWORK AND GENETIC SEARCH PARADIGMS THAT ARE NEW TO THE VEHICLE ROUTING AND SCHEDULING PROBLEM SOLVING DOMAIN. IN ESSENCE, THE NEURAL NETWORKS ACT AS A KNOWLEDGE SOURCE THAT ASSISTS IN MODEL AND ALGORITHM SELECTION AND IN SPECIFYING PARAMETERS FOR THE MATHEMATICAL METHODS. THE GENETIC SEARCH PROVIDES A DYNAMIC CAPABILITY, ALLOWING THE HEURISTIC SOLUTION PROCEDURE OF THE MATHEMATICAL MODEL TO BE ADAPTIVELY STEERED IN RESPONSE TO PARTIAL SOLUTIONS THAT ARE COMPUTED. PRELIMINARY TESTING SUGGESTS THAT SOLUTION QUALITY IS SIGNIFICANTLY BETTER THAN WHAT ANY OF THE UNDERLYING MATHEMATICAL METHODS WORKING INDIVIDUALLY CAN ACHIEVE. THE PRIMARY ISSUES TO BE RESOLVED INCLUDE THE TOPOLOGY OF THE NEURAL NETWORKS, THE PARAMETERS AND DEGREES OF FREEDOM OF THE GENETIC ALGORITHMS, AND SOME DETAILS OF THE UNDERLYING HEURISTIC BEING CONTROLLED.

AMERICAN RESEARCH CORP OF VA

PO BOX 3406

RADFORD, VA 24143

Program Manager: DR M G NIIMURA

Contract #: FQ8671-9001446

Title: POTENTIAL-WELL CONSERVED HELICITY INJECTED ELECTRON-BEAM-DRIVEN MILLIMETER WAVE SOURCE MODIFIED ORBITRON

Topic #: AF90-191

Office: AFOSR/XOT

ID #: 39811

THE OBJECTIVE OF THIS PROPOSAL IS TO DEVELOP A MORE EFFICIENT, HIGH POWER MILLIMETER WAVE

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SOURCE BY MODIFYING THE ORIGINAL ORBITRON MASER. THE ORIGINAL ORBITRON IS DRIVEN BY A SINGLE POWER SUPPLY (I.E. A SMALL CAPACITOR) WHICH GENERATES AN AXISYMMETRIC LOGARITHMIC POTENTIAL-WELL AS RADIALLY DIRECTING (AT FIRST) ELECTRON BEAMS IN THE TUBE OF COAXIAL GEOMETRY. HOWEVER, THE POSITIVE POTENTIAL ($V(o)$) INITIALLY APPLIED ON THE CENTER CONDUCTOR DECAYS CONTINUALLY AS THE DISCHARGE CURRENT INCREASES DUE TO THE INDUCTIVE LOAD OF THE ORBITRON TUBE, THEREBY PREMATURELY TERMINATING THE EMISSION OF HIGH FREQUENCY COMPONENTS ($f(o) \sim \sqrt{V(o)}$). SIMPLE REPLACEMENT OF THE CAPACITOR WITH A BATTERY IS NOT ECONOMICAL, BUT ALSO FLATTENS THE POTENTIAL- WELL AS THE DISCHARGE CURRENT INCREASES BEYOND THE TRANSITION FROM GLOW TO ARC. FOR SINGLY POWERED ORBITRONS, MORE THAN HALF THE RADIALLY INJECTED ELECTRONS IS LOST DIRECTLY TO THE ANODE, BEFORE PARTICIPATING IN THE MILLIMETERWAVE OSCILLATION BECAUSE OF THE LACK OF ACCELERATION BEFORE COLLISIONS. THE MAJOR EFFORT OF THIS PROPOSAL IS TO OVERCOME THE PROBLEM OF LOW EFFICIENCY THROUGH A MINIMUM MODIFICATION OF THE ORIGINAL ORBITRON MASER. TWO SEPARATE POWER SUPPLIES, ONE FOR THE POTENTIAL-WELL AND ANOTHER FOR THE ELECTRON BEAM, WILL BE EMPLOYED. A NOVEL SCHEME WOULD CONSERVE THE POTENTIAL-WELL UP TO VERY HIGH VOLTAGES, IMPORTANT FOR HIGH FREQUENCY GENERATION. THE ELECTRON BEAM WILL BE INJECTED EXTERNALLY BY MINIATURE GUNS IN THE TANGENTIAL DIRECTION SO THAT A MAJORITY OF ELECTRONS UNDERGOES A HELICAL ORBIT BEFORE REACHING THE CENTER CONDUCTOR (ANODE). OUR PRELIMINARY EXPERIMENT WITH A COLD-CATHODE ELECTRON GUN WAS ENCOURAGING. THE USEFULNESS OF A NUMBER OF SUCH GUNS AND THE EFFECT OF NON-ORTHOGONAL (WITH RESPECT TO THE TUBE AXIS) INJECTION WILL BE INVESTIGATED IN TERMS OF POWER AND EFFICIENCY ENHANCEMENT DURING THE PHASE I PERIOD. THE PROPOSED WORK WILL INCLUDE EXTENSION OF THEORY, PROOF-OF-THEORY EXPERIMENTATION ASSISTED BY NOVEL DIAGNOSTIC TECHNIQUES, AND FABRICATION AND CHARACTERIZATION OF THE MODIFIED ORBITRON PROTOTYPE.

ACCURATE AUTOMATION CORP
1548 RIVERSIDE DR - STE B
CHATTANOOGA, TN 37406

Program Manager: ROBERT M PAP

Contract #:

Title: EMERGING TECHNOLOGIES RESULTING IN LIGHTER AIRCRAFT WEIGHT INCREASED ENGINE PERFORMANCE (ISP) AND IMPROVED DESIGN TOOLS

Topic #: AF90-192

Office: AFSC/NASP

ID #: 39813

WE WILL STUDY THE FEASIBILITY OF USING NEURAL NETWORKS (NN) IN FAULT DETECTION AND ISOLATION (FDI) SYSTEMS. WE HOPE TO DEMONSTRATE THE APPLICABILITY OF NEURAL NETWORK TECHNOLOGIES AND ALGORITHMS FOR THE DESIGN OF IMPORTANT SUBSYSTEMS TO BE USED ON BOARD THE HIGH VISIBILITY NASP OR X-30. THIS RESEARCH PROJECT WILL CONTRIBUTE TO THE DEVELOPMENT OF THE MOST ADVANCED AVIONICS FOR USE IN THIS 21ST CENTURY AIRCRAFT AND THE DEVELOPMENT OF OTHER COMPUTATIONAL HARDWARE NEEDED. VARIOUS SENSOR TYPES FROM THE 12 DIFFERENT MEASUREMENT CATEGORIES (INERTIAL, AIRFRAME, ETC.) WILL BE CONSIDERED. BY USING NEURAL NETWORKS, WE WILL CONSIDER THE USE OF THIS PROMISING COMPUTATIONAL PARADIGM BASED ON NONLINEAR DYNAMICAL SYSTEMS, WHICH MIMIC THE BEHAVIOR OF NEURONAL SYSTEMS IN THE HUMAN BRAIN TO DESIGN A SYSTEM TO MONITOR THE "HEALTH" OF THE NASP. OUR PROPOSAL NEURAL NETWORK-BASED SYSTEM WILL MONITOR THE STATUS OF VARIABLES DESCRIBING THE CURRENT NASP STATE.

REFRACTORY COMPOSITES INC
12220-A RIVERA RD
WHITTIER, CA 90606

Program Manager: EDWARD L PAQUETTE

Contract #:

Title: HIGH TEMPERATURE COMPOSITE HOT HYDROGEN CONTROL VALVE DEVELOPMENT

Topic #: AF90-192

Office: AFSC/NASP

ID #: 39812

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CERAMIC COMPOSITES PRESENTLY DEMONSTRATE GOOD MECHANICAL PROPERTIES AT TEMPERATURES BELOW 2100 DEG F WITHOUT DEGRADATION AND LOW THERMAL CONDUCTIVITY WITHOUT SACRIFICING THERMAL SHOCK TOLERANCE. THESE FACTORS COMBINED WITH LOW DENSITY AND LOW THERMAL EXPANSION CHARACTERISTICS MAKE THESE MATERIALS AN EXCELLENT CANDIDATE FOR A HIGH RESPONSE RATE VALVE MOVING PARTS WHILE LIMITING HOT VALVE THERMAL LOADS ON ELECTRICALLY POWERED ACTUATORS WITHOUT EXCESSIVE VOLUME OR WEIGHT PENALTIES. HOT HYDROGEN FLOW CONTROL AND SHUT-OFF VALVES WILL BE REQUIRED FOR SCRAMJET ENGINE CONTROL AND HYDROGEN COOLING CONTROL PURPOSES FOR MANNED HYPERSONIC VEHICLES. SUFFICIENT HOT HYDROGEN CORROSION DATA AND COMPOSITE FABRICATION TECHNOLOGIES HAVE BEEN DEVELOPED TO MAKE A QUANTUM LEAP IN HYDROGEN VALVE TECHNOLOGY FEASIBLE.

THERMACORE INC

780 EDEN RD

LANCASTER, PA 17601

Program Manager: JOHN R HARTENSTINE

Contract #:

Title: THE DEVELOPMENT OF CARBON-CARBON VACUUM ENVELOPES FOR HYPERSONIC VEHICLE HEAT PIPE APPLICATIONS

Topic #: AF90-193

Office: AFSC/NASP

ID #: 39814

HYPERSONIC VEHICLE APPLICATIONS REQUIRE COOLING ON THE WING LEADING EDGES AND COWL LEADING EDGES. HEAT PIPES CAN COOL THESE SURFACES EITHER ACTIVELY OR PASSIVELY. COOLING THE LEADING EDGE ACTIVELY REQUIRES AN AUXILIARY HYDROGEN COOLED HEAT EXCHANGER COUPLED TO THE HEAT PIPE CONDENSER. THIS METHOD ADD WEIGHT AND COMPLEXITY TO THE DESIGN. PASSIVELY COOLING THE LEADING EDGE REQUIRES A MATERIAL WITH A HIGH SERVICE TEMPERATURE BECAUSE, AT STEADY STATE, THE HEAT INPUT MUST EQUAL THE RADIATED HEAT LOAD. CARBON-CARBON IS SUCH A MATERIAL. ALTHOUGH CARBON-CARBON HAS EXCELLENT MECHANICAL PROPERTIES AT HIGH TEMPERATURE SUCH AS HIGH SERVICE TEMPERATURE, HIGH STRENGTH AND MODULUS OF ELASTICITY AND LOW DENSITY, IT DOES HAVE SHORTCOMINGS WITH RESPECT TO HEAT PIPES. CARBON-CARBON IS POROUS AND HAS A VERY LOW COEFFICIENT OF THERMAL EXPANSION. THIS PHASE I PROGRAM OUTLINES A WORK EFFORT TO EVALUATE POSSIBLE SEALING TECHNIQUES/MATERIALS TO THE CARBON-CARBON SUBSTRATE. THESE SEALING MATERIALS AND METHODS WILL BE APPLIED TO TEST COUPONS AND TESTED ACCORDING TO THE ENVIRONMENTAL CONDITIONS FOR HYPERSONIC VEHICLES. THE END RESULT OF THE WORK EFFORT WILL BE A VACUUM TIGHT CARBON-CARBON HEAT PIPE ENVELOPE TO BE USED FOR WING LEADING EDGES.

COMPUTATIONAL MECHANICS CO INC

3701 N LAMAR - STE 201

AUSTIN, TX 78705

Program Manager: DR STEPHEN R KENNON

Contract #:

Title: HIGHLY ACCURATE SKIN FRICTION AND HEATING RATE PREDICTIONS USING NOVEL ADAPTIVE TECHNIQUES

Topic #: AF90-194

Office: AFSC/NASP

ID #: 39815

ACCURATE AND EFFICIENT PREDICTION OF SKIN FRICTION AND HEATING RATES FOR SUPER- AND HYPERSONIC VEHICLES HAS LONG BEEN A GOAL OF COMPUTATIONAL FLUID DYNAMICS (CFD). THE USE OF STANDARD CFD METHODS TO RESOLVE THE NEAR-WALL BOUNDARY LAYER (WHICH IS ESSENTIAL FOR GOOD PRECITIONS OF AIRFOIL BEHAVIOR) USING A LARGE NUMBER OF GRID POINTS IS SELDOM FEASIBLE, OFTEN INACCURATE, AND IF DONE, ALWAYS REQUIRES EXCESSIVE COMPUTATIONAL POWER AND EXPENSE. CONSEQUENTLY, THE OBJECTIVE OF THIS SBIR PROJECT IS THE DEVELOPMENT OF INNOVATIVE COMPUTATIONAL PROCEDURES WHICH DO NOT SUFFER FROM THE PROBLEMS OF CONVENTIONAL FINITE DIFFERENCE CODES AND YET STILL PROVIDE HIGHLY ACCURATE PREDICTION OF SKIN FRICTION AND

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HEATING RATES FOR HYPERSONIC FLOWS. THIS WILL BE ACHIEVED USING HIGHER-ORDER POLYNOMIALS TO MODEL THE BOUNDARY-LAYER IN CONJUNCTION WITH LOCAL GRID REFINEMENT. AUTOMATIC ADAPTIVE STRATEGIES THAT WILL EITHER REFINE THE GRID LOCALLY (h-ADAPTATION) OR ENRICH THE POLYNOMIAL BASIS (p-ADAPTATION) WILL BE EMPLOYED. THESE NOVEL ADAPTIVE STRATEGIES WILL BE APPLIED FOR THE FIRST TIME TO HYPERSONIC FLOWS ABOUT ARBITRARILY-SHAPED VEHICLES USING A NEW PARABOLIC NAVIER-STOKE ALGORITHM. THE FINAL PRODUCT WILL BE A UNIQUE AND POWERFUL SOFTWARE PACKAGE FOR MODELING THREE-DIMENSIONAL HYPERSONIC FLOWS.

VATELL CORP
PO BOX 66
CHRISTIANSBURG, VA 24073
Program Manager: JONATHAN M HAGER

Contract #:

Title: HEAT FLUX PIPE PROBE FOR HYPERSONIC COMBUSTOR RESEARCH

Topic #: AF90-195

Office: AFSC/NASP

ID #: 39816

VATELL CORPORATION PROPOSES TO FABRICATE HEAT FLUX MICROSENSOR PROBES SIMILAR TO THOSE BEING DEVELOPED IN A CURRENT AIR FORCE SBIR PROGRAM AND APPLY OUTER PROTECTIVE LAYERS TO THE SENSORS TO ENHANCE THEIR RESISTANCE TO REACTIVE FLOWS AND ACHIEVE HIGHER TEMPERATURE RATINGS. THE PRESENT PROBES ARE DESIGNED FOR APPLICATION AT 1000 DEG C. THE MODIFIED PROBES ARE DESIGNED FOR USE IN HYPERSONIC COMBUSTOR RESEARCH, IN THE PRESENCE OF HYDROGEN AND AIR COMBUSTION AT 1800 DEG TO 5000 DEG R. THREE PROBES WITH DIFFERENT OUTER PROTECTIVE LAYERS WILL BE CONSTRUCTED, CALIBRATED, TESTED FOR THERMAL SHOCK RESISTANCE, THEN DELIVERED TO THE SPONSOR. IN A PHASE II CONTINUATION, DIRECT APPLICATION OF HEAT FLUX MICROSENSORS TO HYPERSONIC COMBUSTOR COMPONENTS WILL BE EXPLORED.

MSNW INC
PO BOX 865
SAN MARCOS, CA 92069
Program Manager: DR GEORGE H REYNOLDS

Contract #:

Title: TITANIUM SILICIDE-BASED FILAMENTS FOR TITANIUM ALUMINIDE MATRIX COMPOSITES

Topic #: AF90-196

Office: AFSC/NASP

ID #: 39817

THE PHASE I RESEARCH WILL PRODUCE AND EVALUATE $Ti(5)Si(3)$ -BASED MONOFILAMENTS HAVING IMPROVED THERMOCHEMICAL AND THERMOCHEMICAL COMPATIBILITY IN GAMMA TITANIUM ALUMINIDE MATRICES. AL-CONTAINING MONOFILAMENT COMPOSITIONS WILL BE PREPARED BY DIRECT CHEMICAL VAPOR DEPOSITION ONTO SMALL DIAMETER RESISTANCE-HEATED CORE WIRES AND BY REACTIVE CONVERSION OF SMALL DIAMETER TITANIUM CORE WIRES. THE PRODUCT MONOFILAMENTS WILL BE CHARACTERIZED BY OPTICAL AND ELECTRON MICROSCOPY WITH X-RAY ANALYSIS FOR MICROSTRUCTURE AND CHEMICAL UNIFORMITY. PROTOTYPE COMPOSITES WILL BE PREPARED AND THE THERMOCHEMICAL STABILITY OF THE AL-CONTAINING MONOFILAMENTS DETERMINED BY MICROCHEMICAL ANALYSIS OF NEAR-INTERFACIAL COMPOSITION PROFILES.

UNIVERSAL ENERGY SYSTEMS INC
4401 DAYTON-XENIA RD
DAYTON, OH 45432
Program Manager: DR P R SUBRAMANIAN

Contract #:

Title: FIBER COATING DEVELOPMENT FOR ALPHA-2 TITANIUM ALUMINIDE COMPOSITES

Topic #: AF90-196

Office: AFSC/NASP

ID #: 39820

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UNIVERSAL ENERGY SYSTEMS, INC. IS PROPOSING AN SBIR PROGRAM TO DEVELOP COATINGS FOR FIBERS TO BE USED AS REINFORCEMENT IN ALPHA(2)- Ti(3)Al BASED COMPOSITES. THE REQUISITE ROLE OF THE FIBER COATINGS IN THESE COMPOSITES IS TO MINIMIZE INTERDIFFUSION AND REACTION ZONE FORMATION AND/OR TO PROVIDE REASONABLE RESIDUAL STRESS ACCOMMODATION AT THE FIBER/MATRIX INTERFACE, WHILE MAINTAINING AN EFFECTIVE LOAD TRANSFER BETWEEN THE MATRIX AND THE FIBER. THE SPUTTER DEPOSITION PROCESS IS PROPOSED FOR THE COATING DEPOSITION, PRIMARILY BECAUSE IT OFFERS LOW-TEMPERATURE PROCESSING, EXCELLENT CONTROL IN COATING CHEMISTRY, HOMOGENEITY, AND UNIFORMITY, GOOD REPRODUCIBILITY, HIGH- PURITY END-PRODUCTS, AND REALISTIC DEPOSITION RATES, COUPLED WITH EXCELLENT POSSIBILITIES OF COMMERCIALIZATION. THE PHASE I TECHNICAL OBJECTIVE IS TO DEMONSTRATE THE POTENTIAL OF THIS PROCESS FOR OBTAINING HIGHLY CONTROLLED, COMPOSITIONALLY HOMOGENEOUS, UNIFORM COATINGS OF NbC/Nb, Mo(2)C/Mo, AND TiB(x) ALPHA-BASED TITANIUM ALUMINIDE (SUPER ALPHA(2)) COMPOSITES. THE FEASIBILITY OF THIS APPROACH WILL BE ASSESSED THROUGH OPTIMIZATION OF DEPOSITION CONDITIONS AND COATING THICKNESS, EVALUATION OF COATING INTEGRITY, COMPOSITION, AND MORPHOLOGY, AND DETERMINATION OF THE INTERFACIAL STABILITY AND INTERFACIAL STRENGTHS IN THE COMPOSITES.

SPARTA INC
4520 EXECUTIVE DR - STE 210
SAN DIEGO, CA 92121
Program Manager: ROBERT M WASHBURN
Contract #:

Title: OXIDATION PROTECTION COATING FOR TITANIUM ALUMINIDES
Topic #: AF90-197 Office: AFSC/NASP ID #: 39818

TITANIUM ALUMINIDES REQUIRE OXIDATION AND HYDROGEN RESISTANT COATINGS TO ACHIEVE LONG-TERM STRUCTURAL INTEGRITY FOR USE IN MULTIMISSION HYPERSONIC VEHICLES. WE PROPOSE TO DEMONSTRATE THE FEASIBILITY OF CONTROLLING THE DIFFUSION OF OXYGEN AND HYDROGEN BY THE USE OF A NOVEL MULTILAYER GLASS-CERAMIC COATING WHICH HAS BEEN SURFACE GLAZED USING A HIGH ENERGY LASER. NEW CLASSES OF HIGH- TEMPERATURE GLASSES AND GLASS CERAMICS ARE PROPOSED WHICH CAN MATCH THE THERMAL EXPANSIONS OF TITANIUM ALUMINIDES AND CONTROL THE GASEOUS DIFFUSION. SPARTA'S NEW ALKOXIDE PROCESSING TECHNIQUES WILL BE USED TO DEPOSIT THE MULTILAYER COATINGS. PRELIMINARY SCREENING AND EVALUATION OF THE COATINGS WILL BE PERFORMED USING OPTICAL AND SCANNING ELECTRON MICROGRAPHY, GASEOUS DIFFUSION TESTS, AND 20 CYCLES OF HEATING FROM ROOM TEMPERATURE TO 1800 DEG F.

ARACOR (ADV RSCH & APPLICATIONS CORP)
425 LAKESIDE DR
SUNNYVALE, CA 94086
Program Manager: ROBERT N YANCEY
Contract #:

Title: THIN OXIDATION RESISTANT CARBON/CARBON COMPOSITE MONITORING
Topic #: AF90-199 Office: AFSC/NASP ID #: 39819

NEW GENERATION HIGH-TEMPERATURE MATERIALS ARE BEING DEVELOPED FOR A HOST OF APPLICATIONS SUCH AS THE NATIONAL AEROSPACE PLANE (NASP). CARBON-CARBON COMPOSITES SHOW GREAT PROMISE FOR THIS APPLICATION BECAUSE OF THEIR HIGH STRENGTH AND STIFFNESS AT ELEVATED TEMPERATURES. IN ORDER TO FULLY UTILIZE THE HIGH-TEMPERATURE ADVANTAGES OF CARBON- CARBON, OXIDATION COATINGS ARE BEING DEVELOPED AND APPLIED TO CARBON- CARBON TO PREVENT OXIDATION DEGRADATION OF THE PARTS AT ELEVATED TEMPERATURES. IT IS CRITICAL THAT THESE COATINGS BE DEFECT FREE. ADVANCES IN X-RAY COMPUTED TOMOGRAPH (CT) ARE PROVIDING METHODS FOR THE EVALUATION OF STRUCTURAL MATERIALS AT VERY HIGH RESOLUTIONS. IT IS PROPOSED THAT A HIGH-TEMPERATURE OVEN SYSTEM BE DESIGNED TO INTEGRATE WITH THE TOMOSCOPE HIGH-RESOLUTION CT SCAN SYSTEM SO THAT OXIDATION COATINGS OF CARBON-CARBON COMPOSITES CAN BE FULLY

SMALL BUSINESS INNOVATION RESEARCH PROGRAM - PHASE I
AIR FORCE Solicitation 90.1

EVALUATED FOR DEFECTS THROUGHOUT THE RANGE OF OPERATING TEMPERATURES. SUCH A SYSTEM WILL BE ABLE TO VIEW TINY RACKS AND VOIDS THROUGHOUT THE COATINGS WHICH COULD CAUSE RAPID OXIDATION AND FAILURE OF THE CARBON-CARBON COMPONENT. THE DESIGN OF SUCH AN INTEGRATED SYSTEM WILL REQUIRE INNOVATIVE THINKING IN OVEN DESIGN, IMAGE RECONSTRUCTION, AND DATA PRESENTATION.