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Defense Advanced Research Projects Agency



Defense Nuclear Agency



Strategic Defense Initiative Organization

DEFENSE SMALL BUSINESS INNOVATION RESEARCH PROGRAM (SBIR)

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VOLUME III AIR FORCE ABSTRACTS OF PHASE I AWARDS 1989

VOLUME III

AIR FORCE PROJECTS
ABSTRACTS OF PHASE I AWARDS
FROM
FY 1989 SBIR SOLICITATION

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April 1990

PREFACE

On September 11, 1990, the Department of Defense (DoD) announced the selection of small business firms proposals under Phase I of the Fiscal Year (FY) 1989 DoD Small Business Innovation Research (SBIR) Program to be funded upon successful completion of contract negotiations.

The selection of proposals for funding was made from proposals received by the Military Departments, the Defense Advanced Research Projects Agency (DARPA), the Defense Nuclear Agency (DNA), and the Strategic Defense Initiative Organization (SDIO) in response to the FY 1989 solicitation distributed on October 1, 1988 with a closing date of January 6, 1989.

FY 1989 Program

	<u>Number of Topics</u>	<u>Proposals Received</u>	<u>Phase I Awards</u>
Army	86	998	92
Navy	213	2139	323
Air Force	257	3479	337
DARPA	47	596	100
DNA	14	213	14
SDIO	<u>15</u>	<u>860</u>	<u>155</u>
	632	8385	1021

In order to make information available on the technical content of the Phase I projects supported by the Department of Defense SBIR Program, this report presents, in four volumes, the abstracts of those proposals which have resulted in contract awards.

This is Volume III which contains abstracts and contacts for the 337 Phase I projects funded by the Air Force from the FY 1989 SBIR Program. Projects funded by other Department of Defense components are published in separate volumes as follows:

- Volume I - Army Projects (Pages 1 - 58)
- Volume II - Navy Projects (Pages 59 - 266)
- Volume IV - DARPA, DNA and SDIO Projects (Pages 485 - 668)

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

INTRODUCTION

On July 22, 1982 the President signed the "Small Business Innovation Development Act of 1982" (Public Law 97-219). This law became effective October 1, 1982 and was designed to give small high technology firms a greater share of Federal R&D contract awards.

The SBIR Program consists of three distinct phases. Under Phase I, DoD Components make awards to small businesses, typically of one-half to one man-year effort over a period generally not to exceed six months, subject to negotiation. Phase I is to determine, insofar as possible, the scientific or technical merit and feasibility of ideas or concepts submitted in response to SBIR topics. All DoD topics address specific R&D needs to improve our defense posture. Proposals selected for contract award are those which contain an approach or idea that holds promise to provide an answer to the specific problem addressed in the topic. The successful completion of Phase I is a 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. In addition, proposals which identify a follow-on Phase III funding commitment from non-Federal sources will be given special consideration. Phase II awards will typically cover two to five man-years of effort over a period generally not to exceed 24 months, also subject to negotiation. The number of Phase II awards will depend upon the success rate of the Phase I effort and availability of funds. Phase II is the principal research or research and development effort, and will require a more comprehensive proposal which outlines the intended effort in detail.

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

Selection Criteria

Phase I proposals received in each topic area in the DoD solicitation brochure are evaluated on a competitive basis in the organization which generated the topic, by scientists and engineers knowledgeable in that area and in accordance with the following criteria:

1. The scientific/technical quality of the research proposal and its relevance to the topic description, with special emphasis on its innovation and originality.
2. Qualifications of the principal investigator, other key staff, and consultants, if any, and the adequacy of available or obtainable instrumentation and facilities.
3. Anticipated benefits of the research to the total DoD research and development effort.

4. Adequacy of the Phase I proposed effort to show progress toward demonstrating the feasibility of the concept.

The Act mandates that all Federal Agencies establish an SBIR program if their FY 1982 extramural budgets for R&D exceeded a threshold figure of \$100 million. Beginning in FY 1983, DoD must make available the following percentages of its extramural R&D budget for this program:

Public Law 99-443, the "Small Business Innovation Act of 1986" was signed by the President on October 6, 1986. This law re-authorized P.L. 97-219 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.

SUBMITTED BY

ABARIS
125 CATRON DR
RENO, NV 89512
CONTRACT NUMBER: F33657-89-C-2260
WILLIAM L MURPHY
TITLE:
NEW CONCEPTS AND INNOVATIONS TO ENHANCE THE COST ESTIMATION OF
AERONAUTICAL SYSTEMS/SUBSYSTEMS
TOPIC# 165 OFFICE: ASD/XRX IDENT#: 32261

ABARIS PROPOSES AN EXPERT SYSTEM TO AID THE AVIATION PLANNER AND COST ESTIMATOR IN DEALING WITH THE IMPACT OF NEW MATERIALS AND TECHNOLOGY AVAILABLE FOR THE DESIGN AND SUBSEQUENT MANUFACTURE OF NEW AIRCRAFT. THE NEW ADVANCED COMPOSITES; GRAPHITE AND KEVLAR FIBERS, EPOXY AND BISMALIMIDE RESINS, ETC., OFFER SIGNIFICANT WEIGHT REDUCTIONS AND OTHER OPERATIONAL ADVANTAGES, BUT REQUIRE DIFFERENT DESIGN APPROACHES AND MANUFACTURING TECHNIQUES THAN THE METALS THEY REPLACE. THIS WILL REQUIRE THE DEVELOPMENT OF NEW CER. THE PROPOSED SYSTEM WILL HAVE APPLICATION TO THE USE OF COST ESTIMATING RELATIONSHIPS FOR THE VARIETY OF COMPOSITE MATERIAL SYSTEMS, STRUCTURAL CONCEPTS, AND MANUFACTURING METHODS USED IN AIRCRAFT DEVELOPMENT AND PRODUCTION. THE BASIC EXPERT SYSTEM COULD BE EXPANDED TO INCLUDE ALL ELEMENTS OF THE AIRCRAFT COST ESTIMATING RELATIONSHIPS ONCE THE BASIC SYSTEM IS DEVELOPED.

AD-TECH SYSTEMS RESEARCH INC
1342 N FAIRFIELD RD
DAYTON, OH 45432
CONTRACT NUMBER: F33615-89-C-5640
DRS G TANDON/A CHATTERJEE
TITLE:
THEORETICAL AND EXPERIMENTAL CHARACTERIZATION OF FIBER-MATRIX INTERFACE IN SiC REINFORCED GLASS CERAMICS
TOPIC# 123 OFFICE: AFWAL/MLK IDENT#: 33489

ALTHOUGH THE USE OF CERAMIC COMPOSITES IN AEROSPACE SYSTEMS IS MONOTONICALLY INCREASING, THERE ARE NOT MANY ANALYTICAL AND EXPERIMENTAL STUDIES REVEALING THE UNIQUE CHARACTERISTICS THESE

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MATERIALS CAN PROVIDE. IT IS BELIEVED THAT THESE MATERIALS HAVE GREAT PROMISE FOR HIGH TEMPERATURE STRUCTURAL APPLICATIONS INCLUDING HOT TURBINE ENGINE COMPONENTS. WHILE FEW FIBER REINFORCED CERAMIC SYSTEMS ARE COMPLETELY UNDERSTOOD WITH RESPECT TO FAILURE MODES, LARGE INCREASES IN STRENGTHS AND TOUGHNESS CAN BE REALIZED IF THERE IS BETTER UNDERSTANDING OF THESE MECHANISMS. THE BOND STRENGTH BETWEEN THE FIBERS AND THE MATRIX IS AN ESSENTIAL PROPERTY IN ALL COMPOSITE MATERIALS. THE PROPOSED ACTIVITY IS DIRECTED TOWARD THE INVESTIGATION OF INTERFACIAL STRENGTH CHARACTERISTICS OF HIGH TEMPERATURE COMPOSITE. A METHODOLOGY WILL BE DEVELOPED TO STUDY THE INTERFACIAL FAILURE MECHANISMS IN THESE MATERIALS. AN INTERACTIVE EXPERIMENTAL AND ANALYTICAL APPROACH WILL BE FOLLOWED.

ADVANCED DECISION SYSTEMS
1500 PLYMOUTH ST
MOUNTAIN VIEW, CA 94043
CONTRACT NUMBER: F33615-89-C-1082
DARYL T LAWTON
TITLE:
3-D TARGET MODELING REPRESENTATION AND PERCEPTION
TOPIC# 91c OFFICE: AFWAL/AAOP IDENT#: 32849

CURRENTLY, CONSIDERABLE RESEARCH IN MACHINE VISION IS BEING DIRECTED TOWARD PROBLEMS IN PERCEPTUAL ORGANIZATION, WHICH INVOLVED HOW OBJECTS SUCH AS JUNCTIONS, LINES, AND REGIONS, EXTRACTED BY LOCAL PROCESSES, ARE COMBINED TO PRODUCE COHERENT PERCEPTIONS OF OBJECTS AND EVENTS. WE PROPOSE TO DEVELOP PERCEPTUAL ORGANIZATION AS A RECURSIVE ENERGY MINIMIZATION PROCESS USING A HOPFIELD NEURAL NETWORK APPROACH. OUR APPROACH IS BASED UPON THE INITIAL EXTRACTION OF SYMBOLIC TOKENS FROM AN IMAGE OR TIME-SEQUENCE OF IMAGES. THESE ARE THEN REDUCED TO PRIMITIVE TOKENS WHICH CORRESPOND TO THE NODES OF THE NETWORK. THE LINKS BETWEEN PRIMITIVE TOKEN NODES ARE THE VARIABLES OF THE HOPFIELD ENERGY FUNCTIONAL. A LOCAL OR GLOBAL ENERGY MINIMIZATION PROCEDURE IS THEN USED TO FORM STABLE PERCEPTUAL GROUPS OVER THIS NETWORK BY EXTRACTING LINKED CLUSTERS OF TOKENS. HIERARCHICAL PROCESSING IS POSSIBLE BY CREATING LINKS BETWEEN THESE STABLE CLUSTERS AND THEN APPLYING THE MINIMIZATION GROUPING PROCESS TO PRODUCE LARGER COHERENT STRUCTURES. THIS RECURSIVE COMBINATION OF PERCEPTUAL GROUPS CORRESPONDS TO A HIERARCHY OF PROCESSING

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PERFORMED BY THE NETWORK. OUR WORK WILL INVOLVE DESIGN,
IMPLEMENTATION, AND EXPERIMENTAL ANALYSIS ON BOTH ARTIFICIAL AND
REAL IMAGERY.

ADVANCED ENERGY TECHNOLOGY INC
16966 CLOUDCROFT DR
POWAY, CA 92064
CONTRACT NUMBER: F33615-89-C-2943
GARY O FITZPATRICK
TITLE:
TRANSPORT ASSESSMENT
TOPIC# 143 OFFICE: AFWAL/POMP IDENT#: 33119

STAR-C IS A HIGH PERFORMANCE NUCLEAR SPACE POWER SYSTEM THAT CAN BE
UTILIZED BY NEAR TERM MILITARY SPACE PROGRAMS FOR SURVEILLANCE AND
COMMUNICATIONS WHICH OPERATE IN THE POWER RANGE OF A FEW TO 30 kWe.
IT IS A SMALL, LOW MASS, POWER SYSTEM THAT IS EASILY INTEGRATED INTO
THE SPACECRAFT AND IT HAS VERY HIGH SURVIVABILITY CHARACTERISTICS.
STATIC HEAT TRANSFER AND REDUNDANT, STATIC POWER CONVERSION PROVIDED
HIGHLY RELIABLE PERFORMANCE. THE EXCELLENT OVERALL PERFORMANCE OF
THE STAR-C IS ACCOMPANIED BY THE USE OF RELATIVELY HIGH TEMPERATURES
IN THE REACTOR CORE. AS PART OF THE DEVELOPMENT PROGRAM IT WILL BE
NECESSARY TO DEMONSTRATE, AMONG OTHER THINGS, THAT THERE WILL BE
NO SIGNIFICANT MASS TRANSPORT OF MATERIALS FROM THE REACTOR CORE.
THE DESIGN OF THE REACTOR CORE AND THE SELECTION OF MATERIALS HAS
BEEN SPECIFICALLY BASED ON MINIMIZING THE TRANSPORT OF CORE MATERIALS.
THE PURPOSE OF THIS SBIR PROPOSAL IS TO EVALUATE THE EXTENT OF
POSSIBLE MASS TRANSPORT AND THE IDENTIFICATION OF VERIFICATION
EXPERIMENTS. MODELS WILL BE DEVELOPED FOR DESIGNING THE SYSTEM TO
MEET LIFETIME AND PERFORMANCE REQUIREMENTS.

ADVANCED OPTICAL SYSTEMS
1103 DEBORAH DR
HUNTSVILLE, AL 35801
CONTRACT NUMBER: F08635-89-C-0384
DR R L HARTMAN
TITLE:
USAF APPLICATIONS OF TERMINAL HOMING BY OPTICAL RECOGNITION (THOR)
TOPIC# 1 OFFICE: AD/PMR IDENT#: 30994

SUBMITTED BY

IMAGE RECOGNITION BY OPTICAL SIGNAL PROCESSING CAN BE APPLIED TO AIR FORCE WEAPONS SYSTEMS TO CREATE "BRILLIANT MUNITIONS." THE STATE OF THE ART NOW ALLOWS REAL TIME DETECTION, DISCRIMINATION, AND TRACKING OF PREPROGRAMMED TARGETS SUCH AS TANKS, BRIDGES, AIRFIELD FEATURES, OR HIGH VALUE TARGETS. THE OBJECTIVE OF THIS PHASE I TASK WILL BE TO SHOW HOW TERMINAL HOMING BY OPTICAL RECOGNITION (THOR) CAN WORK IN AN AIR FORCE WEAPON SYSTEM. A NEAR TERM DEMONSTRATION OF THE TECHNOLOGY USING A GBU-15 BOMB WILL BE DEVELOPED FOR IMPLEMENTATION IN PHASE II. AN OPTICAL PROCESSOR WILL BE USED FOR A LABORATORY DEMONSTRATION AND TRACK A TARGET IN AN AIR FORCE SCENARIO. (THE TERM OPTICAL MEANS THE IMAGE PROCESSING USE OF OPTICS - THE SENSOR CAN BE EO, IR, MMW, OR ANYTHING WHICH PROVIDES AN IMAGE).

ADVANCED PROJECTS RESEARCH INC
12524 WESTMONT DR
MOORPARK, CA 93021
CONTRACT NUMBER: F04701-89-C-0051
DR DARRELL W PEPPER

TITLE:
A 3-D NUMERICAL MODEL FOR PREDICTING MESOSCALE WINDFIELDS OVER
VANDENBERG AIR FORCE BASE
TOPIC# 170 OFFICE: AFSTC/OLAB IDENT#: 34354

A 3-D NUMERICAL MODEL FOR PREDICTING MESOSCALE WINDFIELDS OVER VANDENBERG AFB IS BEING DEVELOPED. THE MODEL UTILIZES AN OBJECTIVE ANALYSIS TECHNIQUE AND AVAILABLE METEOROLOGICAL DATA TO GENERATE A FIRST GUESS, MASS CONSISTENT WINDFIELD. A HYBRID FINITE ELEMENT METHOD IS THEN USED TO SOLVE THE PRIMITIVE EQUATIONS OF MOTION FOR PREDICTIVE ANALYSIS. A 3-D MESH GENERATOR IS INCLUDED WITH THE COMPUTER CODE FOR GRID REFINEMENT AND ADJUSTMENT. VANDENBURG AFB IS LOCATED ON THE CENTRAL CALIFORNIA COAST. THE TERRAIN CONSISTS OF FLATLANDS, VALLEYS, CANYONS, RIDGELINES, AND MOUNTAINS WHICH RISE TO ELEVATIONS OVER 600 m. WINDFLOW IS INFLUENCED BY SYNOPTIC, REGIONAL, AND LOCAL METEOROLOGICAL EFFECTS ASSOCIATED WITH THE TERRAIN. STRONG INVERSIONS ARE COMMON OVER THE AERA. THE NUMERICAL MODEL IS CAPABLE OF ACCURATELY CALCULATING FLOW OVER COMPLEX TERRAIN FEATURES, AND CAN BE USED TO PREDICT DISPERSION OF CONCENTRATIONS WITHIN THE MIXING LAYER. A SMALL SCALE VERSION OF THE PROGRAM (UP TO 5000 NODES -

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25,000 DEGREES OF FREEDOM) CAN BE RUN ON AN ENHANCED PERSONAL
COMPUTER.

ADVANCED RSCH & APPLICATION CORP/ARACOR
425 LAKESIDE DR
SUNNYVALE, CA 94086
CONTRACT NUMBER:
J W COPELAND
TITLE:
AUTOMATED IMAGE ANALYSIS OF SOLID PROPULSION SYSTEM DEFECTS
TOPIC# 227 OFFICE: BMO/MYSC IDENT#: 32706

COMPUTED TOMOGRAPHY (CT) IS RAPIDLY BECOMING AN IMPORTANT COMPLEMENT TO OTHER NON-DESTRUCTIVE EVALUATION (NDE) METHODS AND IS THE PREFERRED NDE TECHNIQUE WHENEVER THE PRIMARY GOAL IS TO LOCATE AND SIZE PLANAR AND VOLUMETRIC DETAIL IN THREE DIMENSIONS. HOWEVER, MODERN MILITARY CT SYSTEMS ARE CAPABLE OF GENERATING MORE THAN A GIGABYTE OF CT INSPECTION DATA PER DAY--AND EVEN HIGHER DATA RATES CAN BE EXPECTED IN THE FUTURE. THIS CREATES A SERIOUS PROBLEM, BECAUSE A COMPREHENSIVE UNDERSTANDING OF THE INTEGRITY OF SOME CRITICAL AIR FORCE COMPONENTS, SUCH AS SOLID ROCKET MOTORS, CAN ONLY BE OBTAINED BY EXAMINING CT DATA FROM THE WHOLE OBJECT IN A FULL 3D CONTEXT. TO HELP COPE WITH THIS DATA PROCESSING BOTTLENECK AND MEET AN EVER INCREASING LOAD OF INFORMATION, INNOVATIVE DISPLAY AND ANALYSIS TECHNIQUES ARE URGENTLY NEEDED. WHILE A COMPLETELY AUTOMATIC ABILITY TO ANALYZE CT IMAGE DATA AND BRING POTENTIALLY SERIOUS MATERIAL CONDITIONS TO THE ATTENTION OF THE USER MIGHT IN PRINCIPLE BE FEASIBLE, AN EXTREMELY USEFUL--AND MORE IMMEDIATELY REALIZABLE--GOAL WOULD BE TO PROVIDE ADVANCED 3D GRAPHICS TECHNIQUES TO AUTOMATE THE PRESENTATION AND ANALYSIS OF LARGE VOLUMES OF DATA BY TRAINED INSPECTORS. A PHASE I STUDY TO VALIDATE THE AUTHENTICITY OF CT DATA AGAINST KNOWN TYPES OF SRM DEFECTS AND TO EVALUATE THE EFFICACY OF ADVANCED 3D DISPLAY AND ANALYSIS TECHNIQUES IN ENHANCING THE DEFECT DETECTION ABILITIES OF USERS IS PROPOSED.

ADVANCED RSCH & APPLICATIONS CORP/ARACOR
425 LAKESIDE DR
SUNNYVALE, CA 94086
CONTRACT NUMBER:
DR L J PALKUTI
TITLE:
RADIATION-HARD ANALOG BJT TECHNOLOGY ON BESIO WAFERS
TOPIC# 219 OFFICE: BMO/MYSC IDENT#: 32625

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THE DEVELOPMENT OF ANALOG DEVICES FABRICATED ON DEFECT-FREE ADVANCED SUBSTRATES WITH INCREASED NEUTRON TOLERANCE IS PROPOSED. THIS CONCEPT WILL IMPLEMENT ULTRA-THIN, DEFECT-FREE, SILICON-ON-INSULATOR SUBSTRATES FABRICATED BY BONDING AND ETCH BACK (BESOI) TO DEMONSTRATE LATERAL BIPOLAR DEVICES WITH EXTREMELY LOW BASE RESISTANCE AND RECOMBINATION VOLUME. DEVICES WITH A CUT-OFF FREQUENCY IN EXCESS OF 10GHZ ARE PROPOSED UTILIZING CONVENTIONAL BiCMOS PROCESSING PROCEDURES. THESE DEVICES ARE EXPECTED TO IMPROVE NEUTRON-INDUCED DEGRADATION BY AN ORDER-OF-MAGNITUDE OVER CONVENTIONAL ANALOG CIRCUITS. THE PHASE I FEASIBILITY STUDY WILL INCLUDE THE FABRICATION OF SUITABLE TEST STRUCTURE ON BESOI SUBSTRATE MATERIAL; TO DETERMINE THE RECOMBINATION PARAMETERS FOR BOTH n-AND p-TYPE BASE DEVICES BOTH BEFORE AND AFTER NEUTRON IRRADIATION AND PROJECT THE CHARACTERISTICS OF A NEUTRON-HARDENED ANALOG DEMONSTRATION CHIP TO BE DESIGNED, FABRICATED AND VALIDATED IN PHASE II.

ADVANCED RSCH & APPLICATIONS CORP/ARACOR
425 LAKESIDE DR
SUNNYVALE, CA 94086
CONTRACT NUMBER: F33615-89-C-5650
DR JEREL A SMITH

TITLE:
IMPROVED DETECTOR TECHNOLOGY FOR HIGH-RESOLUTION X-RAY
NONDESTRUCTIVE EVALUATION
TOPIC# 125 OFFICE: AFWAL/MLK IDENT#: 33249

HIGH-RESOLUTION COMPUTED TOMOGRAPHY SHOWS SIGNIFICANT PROMISE IN AIDING THE DEVELOPMENT OF ADVANCED COMPOSITE MATERIALS WHICH ARE IMPORTANT IN IMPROVING AIRCRAFT PERFORMANCE. NONDESTRUCTIVE IMAGING OF THE INTERNAL STRUCTURE OF THESE MATERIALS CAN HELP IN IMPROVING PROCESSING QUALITY, IN DEVELOPING PERFORMANCE MODELS, AND IN EVALUATING MANUFACTURED COMPONENTS. CURRENT IMAGING PERFORMANCE COULD BE SIGNIFICANTLY ENHANCED BY THE INTRODUCTION OF IMPROVED HIGH-RESOLUTION DETECTORS. IMPROVEMENTS IN DETECTOR PERFORMANCE COULD ALLOW HIGHER (OR LOWER) RESOLUTION IMAGES, SCANNING OF LARGER OR MORE DENSE OBJECTS, DECREASED SCAN TIMES AND/OR REDUCED IMAGE NOISE, AND REDUCED IMAGE ARTIFACTS. PHASE I OF THIS PROJECT WILL EVALUATE SEVERAL SCHEMES FOR IMPROVED DETECTORS FOCUSING PRIMARILY

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ON IMPROVED SCINTILLATOR PERFORMANCE AND SECONDARILY ON IMPROVED LIGHT CONVERSION DEVICES. ONE OR MORE OF THE MOST PROMISING APPROACHES WILL BE EVALUATED EXPERIMENTALLY TO ASSESS PRACTICALITY. IF WARRANTED, A PHASE II PROJECT FOR IMPLEMENTATION OF A FULL SCALE DETECTOR PACKAGE AND EVALUATION OF MORE ADVANCED ALTERNATIVES WILL BE PROPOSED.

ADVANCED SYSTEM TECHNOLOGIES
12200 E BRIARWOOD AVE - STE 260
ENGLEWOOD, CO 80112

CONTRACT NUMBER:

DUANE R BALL

TITLE:

AUTOMATED ACQUISITION AND DISSEMINATION OF DISTRIBUTED SYSTEM SOFTWARE DESIGN AND KNOWLEDGE

TOPIC# 37 OFFICE: RADDC/XPX IDENT#: 31439

A NEW GENERATION OF COMPUTERS WILL BE REQUIRED TO SUPPORT THE AIR FORCE IN THE 1990'S AND BEYOND. APPLICATIONS SUCH AS INTEGRATED BATTLE MANAGEMENT, REMOTE SENSING, IMAGE PROCESSING, INTELLIGENT ROBOTICS, AND SPACE VEHICLE CONTROL WILL REQUIRE RELIABLE COMPUTING POWER WHICH EXCEEDS THAT PROJECTED FOR MONOLITHIC COMPUTING ARCHITECTURES. THE COMPUTING DEMANDS OF ADVANCE APPLICATIONS WILL REQUIRE THE EFFECTIVE USE OF DISTRIBUTED PROCESSING SYSTEMS. AS THE NEED INCREASES, THE PERFORMANCE REQUIREMENTS FOR DISTRIBUTED SYSTEM SOFTWARE DESIGN (DSSD) BECOME MORE DEMANDING. IN CURRENT DSSD PRACTICE, PERFORMANCE CONSIDERATIONS ARE EITHER IGNORED OR MISAPPLIED. THE RESULT IS SYSTEMS WHICH DO NOT MEET REQUIRED PERFORMANCE STANDARDS AND MUST UNDERGO COSTLY REDESIGN. THIS IS BECAUSE THE EXPERTISE REQUIRED TO MAKE PERFORMANCE TRADEOFFS IN DSSD IS BEYOND THE CAPABILITY OF MOST SOFTWARE DESIGNERS. THE USE OF EXPERT SYSTEMS WITH APPLICATION SPECIFIC DSSD KNOWLEDGE BASES IS A PREREQUISITE TO EFFECTIVE USE OF ADVANCED, HIGH PERFORMANCE DISTRIBUTED COMPUTING ARCHITECTURES. SUCH EXPERT SYSTEMS MUST BE ABLE TO CONSTRUCT LARGE PORTIONS OF THEIR OWN KNOWLEDGE BASES. THE TECHNIQUE PROPOSED FOR KNOWLEDGE ACQUISITION IS TO TAKE AN INITIAL SET OF GENERAL RULES PROPOSED BY HUMAN EXPERTS; A SET OF DESIGN CRITERIA; A DESCRIPTION OF A TARGET DISTRIBUTED SYSTEM; AND USE AN INDUCTIVE LEARNING ALGORITHM TO CONSTRUCT A DOMAIN SPECIFIC SOFTWARE DESIGN KNOWLEDGE

SMALL BUSINESS INNOVATION RESEARCH (SBIR) PROGRAM - PHASE 1
BY SERVICE
FISCAL YEAR 1989
AF

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BASE.

ADVANCED TECHNOLOGY & RESEARCH CORP
14900 SWEITZER LN - STE 104
LAUREL, MD 20707
CONTRACT NUMBER: F08635-89-C-0376
ROBERT HUMPHREY

TITLE:
IMPROVED AEROSOL DISCRIMINATION METHODS FOR ACTIVE OPTICAL FUZING
APPLICATIONS
TOPIC# 14 OFFICE: AD/PMR IDENT#: 31196

IT IS PROPOSED TO EXAMINE A VARIETY OF AEROSOL DISCRIMINATION
TECHNIQUES ESPECIALLY THOSE CONCERNING RECENT WORK ON PULSE SHAPE
AND ELECTRONIC SIGNAL PROCESSING TO OBTAIN IMPROVED TARGET DETECTION
PERFORMANCE FOR AN ACTIVE OPTICAL FUZE IN AN AEROSOL ENVIRONMENT.
BASED ON THIS STUDY A SYSTEM CONCEPT WILL BE DEVELOPED TO DEMONSTRATE
THE IMPROVED AEROSOL PERFORMANCE THAT IS OBTAINABLE AND THAT RELIABLE
TARGET DETECTION IN AN AEROSOL ENVIRONMENT IS FEASIBLE. EXTENSIVE
WORK HAS BEEN DONE AND WILL BE REVIEWED IN A DESCRIPTION OF THE
NATURAL AEROSOL ENVIRONMENT AND IN TARGET CHARACTERISTICS THAT
RELATE TO ACTIVE OPTICAL SENSORS. PAST EFFORTS IN DEVELOPMENT OF
AEROSOL RESISTANT ACTIVE OPTICAL SENSORS IS CITED AS WELL AS STUDIES
INDICATING ANTICIPATED IMPROVEMENTS THAT MAY BE ACHIEVED WITH
INCREASED ELECTRONIC PROCESSING.

ADVANCED TECHNOLOGY MATERIALS INC
520-B DANBURY RD
NEW MILFORD, CT 06776
CONTRACT NUMBER: F33615-89-C-2945
DR CHARLES P BEETZ JR

TITLE:
A DIAMOND FILM PHOTOCONDUCTIVE POWER SWITCH
TOPIC# 142 OFFICE: AFWAL/POMP IDENT#: 33098

IN THE PAST DECADE, STUDIES HAVE INDICATED THAT IT IS THEORETICALLY
POSSIBLE, IN A SINGLE OPTO-COUPLED SOLID STATE DEVICE, TO SWITCH

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HIGH VOLTAGES (100 KV/cm LENGTH) AND HIGH CURRENTS (10kA/cm WIDTH) WITH PHENOMENALLY FAST BURN-ON/TURN-OFF TIMES, MORE EFFICIENTLY AND COMPACTLY THAN USING EXISTING THERMIONIC OR PLASMA DEVICES. THE MOST HEAVILY STUDIED PHOTOCONDUCTORS FOR SWITCHING APPLICATIONS HAVE BEEN SEMI-INSULATING Si, GaAs, AND InP. THE MAIN LIMITATIONS OF THESE MATERIALS ARE THEIR LOW LEVELS OF MAXIMUM DC BIAS AND THERMAL RUNAWAY EFFECTS AT HIGH PULSE REPETITION RATES, DUE TO THEIR RELATIVELY LOW THERMAL CONDUCTIVITIES AND SMALL BANDGAPS. IN ORDER TO CIRCUMVENT THESE PROBLEMS, IT IS NECESSARY TO CONSIDER SEMICONDUCTING MATERIALS WITH WIDER BANDGAPS AND LARGER DIELECTRIC STRENGTHS THAT CAN SUPPORT HIGHER VOLTAGES. ONE OF THE MOST INTERESTING CANDIDATE PHOTOCONDUCTING MATERIALS IS DIAMOND BECAUSE OF ITS OVERWHELMINGLY SUPERIOR PHYSICAL PROPERTIES. DIAMOND HAS DARK RESISTIVITIES IN EXCESS OF 10^{13} OHMS-cm, ROOM TEMPERATURE THERMAL CONDUCTIVITIES UP TO FIVE TIMES THAT OF COPPER, GREATER CARRIER SATURATION DRIFT VELOCITIES AND A SIGNIFICANTLY LARGER DIELECTRIC BREAKDOWN STRENGTH THAN EITHER Si, GaAs OR InP, PERMITTING RAPID DISSIPATION OF HEAT SO THAT DARK CURRENT AND THERMAL RUNAWAY EFFECTS ARE NEGLIGIBLE. THE PURPOSE OF THE PHASE I PROGRAM IS TO INVESTIGATE THE PHOTOCONDUCTIVE RESPONSE OF DIAMOND FILMS GROWN BY PLASMA ASSISTED CHEMICAL VAPOR DEPOSITION AND TO ASSESS THEIR POTENTIAL FOR PHOTOCONDUCTIVE POWER SWITCHING APPLICATIONS. PHASE II WILL EXTEND THE PHASE I PROGRAM TO INCLUDE FABRICATION AND TESTING OF SEVERAL PROTOTYPE DEVICES.

AERO-PLASMA TECHNOLOGIES

2421 GLYNDON AVE

VENICE, CA 90291

CONTRACT NUMBER: F40600-89-C-0005

WILLIAM P PESCHEL

TITLE:

AN ADVANCED METHOD FOR STAGNATION ENTHALPY ADDITION AND

RECONSTRUCTION IN HYPERSONIC WIND TUNNEL TESTING

TOPIC# 21 OFFICE: AEDC/PKP IDENT#: 31323

THE CHARACTERIZATION OF FLIGHT BEHAVIOR IN THE HIGH-HYPERSONIC DOMAIN (MACH 5-20) AND AT ALTITUDES FROM $1-3 \times 10^5$ FEET (30-100 km) HAS GREAT RELEVANCE FOR THE DESIGN AND DEVELOPMENT OF THE AOTV, NASP, AND HYPERSONIC REENTRY VEHICLES. DEFICIENCIES IN OUR PRESENT

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KNOWLEDGE AND UNDERSTANDING OF THE THERMOCHEMICAL, MATERIAL PROPERTY AND MATERIAL BEHAVIOR DATA BASE, INTRODUCED BY LIMITATIONS IN WIND TUNNEL SIMULATION TECHNOLOGY, HAVE IMPOSED CONSTRAINTS ON THE UNDERSTANDING OF CRUCIAL AEROTHERMAL BEHAVIOR AREAS INFLUENCED BY STAGNATION HEATING AT HIGH-HYPERSONIC VELOCITIES. TO ELIMINATE THESE TEST SIMULATION DEFICIENCIES, WHICH ARE PRIMARILY MANIFESTED IN ENTHALPY DEFICIENCIES IN THE MODEL STAGNATION ZONE, WE PROPOSE AN INNOVATIVE TECHNIQUE THAT EMPLOYS MICROWAVES TO SELECTIVELY HEAT THE STAGNATION ZONE ON MODELS UNDER TEST, SO THAT THE ENTHALPY CONDITIONS OF TRUE OPERATIONAL FLIGHT CAN BE RECONSTRUCTED. IN PHASE I WE WILL DEMONSTRATE THE FEASIBILITY OF OUR APPLICATION OF MICROWAVE TECHNOLOGY, CHARACTERIZE THE KEY AEROTHERMAL AND PLASMA INTERACTION PARAMETERS, AND ESTABLISH THE BASES FOR PROOF-OF-PRINCIPLE EXPERIMENTS TO BE PERFORMED IN PHASE II. THE PROPOSED TECHNIQUE OF ENTHALPY RECONSTRUCTION COULD GUIDE THE DEVELOPMENT OF MODEL EQUATIONS AND THE VERIFICATION OF BENCH MARK COMPUTER CODES, THUS PROVIDING QUALITY AEROTHERMAL DATA FOR IMPROVED DEFINITION OF VEHICLE BEHAVIOR IN FLIGHT.

AERODYNE RESEARCH INC
45 MANNING RD
BILLERICA, MA 01821
CONTRACT NUMBER: F40600-89-C-0010
EDWARD R NIPLE
TITLE:
IN-SITU OPTICAL PROPERTY MEASUREMENT TECHNIQUE
TOPIC# 26 OFFICE: AEDC/PKP IDENT#: 31366

A TWO ELEMENT APPROACH TO MAKING IN-SITU IR OPTICAL PROPERTY MEASUREMENTS ON AIRCRAFT ENGINE EXHAUST SYSTEM COMPONENTS IS PROPOSED. THE FIRST ELEMENT IS A PORTABLE, FIELD USABLE SYSTEM TO MEASURE BRDF BASED ON A NOVEL SPECTROMETER DESIGN WITH NO MOVING PARTS AND HIGH OPTICAL THROUGHPUT. THIS MEASURES THE COMPONENT SURFACES IN-SITU WHEN THE ENGINE IS OFF. THE SECOND ELEMENT IS AN IMAGING SPECTROMETER TO MEASURE THE SPECTRAL AND SPATIAL RADIANCE DISTRIBUTION EMERGING FROM THE ENGINE IN A TEST CELL ENVIRONMENT WHEN THE ENGINE IS OPERATING. THIS REMOTELY MONITORS CHANGES IN THE OPTICAL PROPERTIES AS THE ENGINE IS TURNED ON AND BROUGHT UP TO NORMAL OPERATING CONDITIONS. A PHASE I WORK PLAN IS DESCRIBED THAT WILL

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ACHIEVE THE TWO SPECIFIC TECHNICAL OBJECTIVES THAT DEMONSTRATE THE FEASIBILITY OF THE PROPOSED APPROACH. THE FIRST IS A CAREFUL OPTICAL ANALYSIS OF THE PORTABLE INSTRUMENT TO CONVINCINGLY PROVE ITS SUPERIOR SUITABILITY FOR MAKING PORTABLE OPTICAL PROPERTY MEASUREMENTS. AERODYNE HAS PERFORMED MANY SUCH ANALYSES ON NOVEL AND CHALLENGING INSTRUMENTS. THE SECOND TECHNICAL OBJECTIVE IS A PRELIMINARY DESIGN OF THE IMAGING SPECTROMETER AND A CALCULATION OF ITS REFLECTANCE AND EMITTANCE MEASUREMENT ACCURACY IN THE STRESSING ENVIRONMENT OF AN AIRCRAFT ENGINE TEST CELL.

AERODYNE RESEARCH INC
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BILLERICA, MA 01821
CONTRACT NUMBER:
DR CHARLES E KOLB

TITLE:
ULTRAVIOLET/VISIBLE PLUME SIGNATURES OF MANEUVERING REENTRY VEHIC
TOPIC# 220 OFFICE: BMO/MYSC IDENT#: 32633

THE OPTICAL SIGNATURE OF A REENTRY VEHICLE CAN BE AN IMPORTANT DETECTION, IDENTIFICATION AND/OR TRACKING DIAGNOSTIC FOR TECHNICAL INTELLIGENCE AND/OR BALLISTIC MISSILE DEFENSE PURPOSES. BELOW APPROXIMATELY 100 km THE EMISSION AND/OR SOLAR SCATTERED SIGNATURES FROM EXHAUST PLUMES ASSOCIATED WITH ATTITUDE CONTROL JETS AND MANEUVERING ROCKETS CAN BE AN IMPORTANT COMPONENT OF THE VEHICLE'S OVERALL OPTICAL SIGNATURE. THE BALLISTIC MISSILE OFFICE (BMO) CURRENTLY USES MODIFIED VERSIONS OF THE JANNAF SPF AND SIRRM CODES TO PRODUCE ESTIMATES OF THE SHORT TO LONG WAVELENGTH INFRARED SIGNATURES ASSOCIATED WITH THESE PLUMES. THIS PROPOSAL PRESENTS A PROGRAM TO EXTEND BMO'S REENTRY VEHICLE PLUME SIGNATURE PREDICTIVE CAPABILITY INTO THE NEAR INFRARED, VISIBLE AND ULTRAVIOLET SPECTRAL REGIONS BETWEEN 2.0 AND 0.2 MICROMETERS IN WAVELENGTH.

AERODYNE RESEARCH INC
45 MANNING RD
BILLERICA, MA 01821
CONTRACT NUMBER:
DR ROGER PUTNAM

TITLE:
HIGH POWER PICOSECOND DIODE LASER
TOPIC# 89 OFFICE: AFWAL/EL IDENT#: 32794

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WE ARE PROPOSING TO BUILD A COMPACT LASER PULSE SOURCE WHICH IS THE BOTTLENECK IN THE CRITICALLY NEEDED INSTRUMENT KNOWN AS THE ULTRAFAST OPTICALLY TRIGGERED OSCILLOSCOPE. ADEQUATE LASER PULSERS PRESENTLY OCCUP 10 SQUARE FEET, REQUIRE CONTINUOUS MAINTENANCE AND CONSUMER 15 KILOWATTS OF ELECTRICITY. OUR PULSE SOURCE WILL REQUIRE 20 SQUARE INCHES, USES LOW MAINTENANCE DIODE LASERS, AND DRAWS A FEW WATTS OF POWER. THIS VERY SPECIAL INSTRUMENTATION IS NEEDED TO TEST THE NEW HIGHSPEED INTEGRATED CIRCUITS, GaAs MICROWAVE DEVICES AND PICOSECOND TRANSISTORS, FOR PICOSECOND SYNCHRONIZATION OF ELECTRON BEAM DEVICES AND HIGH ENERGY LASERS, FOR GENERATING PRECISE WAVEFORM HIGH POWER MICROWAVE BURSTS, AND FOR DRIVING ANALOG TO DIGITAL CONVERTERS WITH 30 GHz SAMPLING RATES. PICOSECOND RESOLUTION IS NEEDED TO EXTRACT THE MAXIMUM SPEED AND EFFICIENCY AND THEREFORE ECONOMIC ADVANTAGE FROM ULTRAFAST ELECTRONICS. THE PULSE OPTICAL SOURCE USES MULTIPLE SEMICONDUCTOR LASERS. OUR UNIQUE APPROACH SOLVES THE BANDWIDTH AND GROUP VELOCITY MISMATCH PROBLEMS RATHER THAN FIGHTING WITH THEM AS IS DONE IN PRESENT MODELOCKED LASERS. THE PROJECT OBJECTIVES INCLUDE A SIMPLE PRELIMINARY DEMONSTRATION OF THE CONCEPT AND ENOUGH MODELING TO INTERPRET THE RESULTS.

AIRSPACE TECHNOLOGY CORP
9 GOODYEAR
IRVINE, CA 92718
CONTRACT NUMBER: F19628-89-C-0080
DAVID B WHITNEY

TITLE:
TRANSITION PLAN FOR DEVELOPMENT OF THE AUTOMATED TACTICAL AIRCRAF
LAUNCH AND RECOVERY SYSTEM
TOPIC# 31 OFFICE: ESD/AVP IDENT#: 31590

THE NEXT GENERATION MILITARY AIR TRAFFIC CONTROL SYSTEM WILL RELY HEAVILY ON A BROADER RANGE OF EQUIPMENT/TECHNOLOGIES THAN HAS BEEN USED IN ATC APPLICATIONS TO DATE. A BASELINE TACTICAL MILITARY SYSTEM CONCEPT, THE AUTOMATED TACTICAL AIRCRAFT LAUNCH AND RECOVERY SYSTEM (ATALARS) IS A CANDIDATE FOR THE NEXT GENERATION SYSTEM. ATALARS EVOLVED FROM A SERIES OF OPERATIONAL REQUIREMENTS STUDIES/REPORTS AND SYSTEM CONCEPT STUDIES. THE SYSTEM IS BASED ON PASSIVE, LOW PROBABILITY OF INTERCEPT OPERATIONS, RELYING ON AIRCRAFT

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DERIVED POSITION DATA AND SOPHISTICATED COMMUNICATIONS, PROCESSING AND DISPLAY EQUIPMENT IN LIEU OF CONVENTIONAL PRIMARY AND SECONDARY RADARS. THIS STUDY EFFORT WILL DEVELOP A TRANSITION PLAN AND PRELIMINARY IMPLEMENTATION APPROACH FOR DEVELOPING A PROOF-OF-CONCEPT DEMONSTRATION OF THE ATALARS SYSTEM. THE APPROACH WILL BE BASED ON A NUMBER OF SYSTEMS, PLANNED OR IN DEVELOPMENT WHICH HAVE CAPABILITIES/TECHNOLOGIES APPLICABLE TO ATALARS. THE OUTCOME OF THE STUDY WILL BE A COMPILATION OF TASKINGS ASSOCIATED WITH EACH ATALARS SUBSYSTEM SHOWING MAJOR DEVELOPMENT EFFORTS AND LEADING TO A FULLY INTEGRATED SYSTEM. SUBSYSTEM DEVELOPMENT DISCUSSIONS WILL BE SUPPORTED BY PRELIMINARY PROGRAM SCHEDULES.

ALFA ENGINEERING INC
2110 WHITEHORSE TRAIL - STE E
AUSTIN, TX 78757
CONTRACT NUMBER: F33615-89-C-5732
KURT M MARSHEK

TITLE:
DESIGN SYNTHETIC REASONING: A COMPUTATIONAL MODEL FOR MECHANICAL
SYSTEM DESIGN SYNTHESIS
TOPIC# 132 OFFICE: AFWAL/MLK IDENT#: 33706

THE THRUST OF THE PROPOSED RESEARCH IS TO MATHEMATICALLY MODEL THE FUNCTION, BEHAVIOR AND STRUCTURE ASPECTS OF MECHANICAL DESIGNS AND DEVELOP COMPUTATIONAL MECHANISMS FOR THE DESIGN SYNTHESIS OF MECHANICAL SYSTEMS. THE APPROACH TO BE USED IS A COMBINATION OF THE TRANSFORMATIONAL APPROACH (USED PREVIOUSLY IN SOFTWARE ENGINEERING AND VLSI DESIGN) AND THE PROBLEM SOLVING/PLANNING APPROACH OF ARTIFICIAL INTELLIGENCE. THE DOMAINS OF APPLICATION SELECTED ARE MACHINE DESIGN AND SENSOR-TRANSDUCER DESIGN.

ALPHATECH INC
111 MIDDLESEX TNPK
BURLINGTON, MA 01803
CONTRACT NUMBER: F19628-89-C-0101
DR THOMAS KURIEN

TITLE:
E-3 SENSOR DATA FUSION ALGORITHM
TOPIC# 34 OFFICE: ESD/AVP IDENT#: 31681

SUBMITTED BY

THE OBJECTIVE OF THIS RESEARCH IS TO DEVELOP AND DEMONSTRATE AN ALGORITHM FOR E-3 AIRBORNE SURVEILLANCE WHICH WILL FUSE DATA FROM MULTIPLE SENSORS INCLUDING A RADAR, AN IFF, AND AN ESM TO TRACK AND IDENTIFY MULTIPLE TARGETS. THE CURRENT E-3 SURVEILLANCE SYSTEM HAS A RADAR AND AN IFF SYSTEM. HOSTILE TARGETS ARE UNLIKELY TO BE DETECTED BY THE IFF SYSTEM; THE EMERGENCE OF LOW-OBSERVABLE TECHNOLOGY WILL MAKE IT DIFFICULT EVEN FOR THE RADAR TO DETECT THEM. THIS INDICATES THE NEED FOR ADDITIONAL SENSORS SUCH AS AN ESM TO IMPROVE THE MISSION EFFECTIVENESS OF THE E-3; HOWEVER, UNLESS THE INFORMATION FROM ALL SENSORS IS FUSED, THE AIR PICTURE WILL NOT IMPROVE DUE TO THE MULTIPLICITY OF TRACKS PRODUCED FOR EACH TARGET BY THE DIFFERENT SENSORS. ALPHATECH PROPOSES TO ADDRESS THIS PROBLEM BY FIRST DERIVING THE MATHEMATICALLY OPTIMAL SOLUTION FOR FUSING DATA FROM MULTIPLE SENSOR TO DEVELOP A UNIFIED PICTURE OF THE TARGET TRACKS AND IDENTITIES. WE WILL THEN DEVELOP A PRACTICAL IMPLEMENTATION BY INCORPORATING HEURISTICS WITHIN THIS OPTIMAL SOLUTIONS. USING AN ALGORITHM ALREADY DEVELOPED FOR A RELATED AIRBORNE SURVEILLANCE SYSTEM, WE WILL DEVELOP A PROTOTYPE OF SUCH A FUSION ALGORITHM AND DEMONSTRATE IT WITH SIMULATED DATA.

AMHERST SYSTEMS INC

30 WILSON RD

BUFFALO, NY 14221

CONTRACT NUMBER:

CESAR BANDERA

TITLE:

TACTICAL C(3)I SYSTEMS/SUBSYSTEMS: TAC BRAWLER/AASPEM COMPARISON

TOPIC# 32 OFFICE: ESD/AVP IDENT#: 31659

OF SPECIFIC INTEREST TO THE U.S. AIR FORCE IS THE SIMULATION OF FEW VERSUS FEW AIR-TO-AIR ENGAGEMENTS TO EVALUATE NEW DESIGNS FOR WEAPON SYSTEMS, AERODYNAMICS AND TACTICS. A DIGITAL MODEL WITH THIS CAPABILITY WOULD HAVE TO SATISFY THE REQUIREMENTS OF THE INDIVIDUAL AIR FORCE APPLICATIONS, INCLUDING CONFORMITY TO ESTABLISHED AND PROPOSED MULTIPLE MODEL SIMULATION FRAMEWORKS. THE TWO MOST STRONGLY SUPPORTED AIR-TO-AIR ENGAGEMENT MODELS ARE TAC BRAWLER AND THE AIR-TO-AIR SYSTEM PERFORMANCE EVALUATION MODEL (AASPEM). DUE TO SEGREGATION IN THE MODELING COMMUNITY, THERE IS INSUFFICIENT

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COMPARATIVE DATA ON WHICH TO BASE THE SELECTION OF THE MODEL MOST APPROPRIATE FOR THE TARGET APPLICATION. AMHERST SYSTEMS PROPOSES TO EVALUATE AND COMPARE TAC BRAWLER AND AASPEM AT ALL LEVELS OF USER INVOLVEMENT AND MODEL STRUCTURE, INCLUDING THEIR ASSOCIATED DATABASES. THE APPLICABILITY OF THESE MODELS TO SIMULATION FRAMEWORKS WILL ALSO BE EVALUATED. THE PROPOSED EFFORT WILL PRODUCE A COMPREHENSIVE DOCUMENT DESCRIBING THE EVALUATION AND COMPARISON RESULTS.

AMHERST SYSTEMS INC
30 WILSON RD
BUFFALO, NY 14221
CONTRACT NUMBER: F33657-89-C-2284
DAVID A MACALUSO

TITLE:
NEW CONCEPTS AND INNOVATIONS FOR AERONAUTICAL SYSTEMS/SUBSYSTEMS:
DIGITAL RF MEMORY OPERATIONAL CONTROL TECHNIQUES
TOPIC# 162 OFFICE: ASD/XRX IDENT#: 32474

AN INCREASINGLY IMPORTANT REQUIREMENT IN ECM JAMMER SYSTEMS IS COHERENT RECEIPT OF THREAT SIGNALS, PRECISE MANIPULATION OF THE WAVEFORM AND RETRANSMISSION BACK TO THE THREAT FOR PURPOSES OF DECEPTION. THE DRFM (DIGITAL RF MEMORY) IS ONE PARTICULAR TYPE OF STORAGE DEVICE WHICH MAKES COHERENT JAMMING MODULATION SCHEMES POSSIBLE. DRFM DEVICES, HOWEVER, ARE EXPENSIVE AND HAVE SEVERAL PERFORMANCE PROBLEMS. THESE LIMITATIONS ARE LARGELY DUE TO THE PERCEIVED REQUIREMENT OF A WIDE BANDWIDTH (E.G., 500 MHz). THE PURPOSE OF THIS STUDY IS TO DETERMINE IF A NARROWER BANDWIDTH DRFM CAN ADEQUATELY SATISFY PERFORMANCE AND OPERATIONAL IMPLEMENTATION REQUIREMENTS. THE PHASE I EFFORT WILL ANALYZE DRFM REQUIREMENTS FROM AN INTEGRATED SYSTEMS VIEWPOINT. THE STUDY WILL ESTABLISH THE DATA COLLECTION AND CONTROL REQUIREMENTS FOR A RECEIVER/DRFM SYSTEM, AND PERFORM THE ANALYSES TO DETERMINE HOW A NARROWBAND SYSTEM CAN SUCCESSFULLY SUPPORT ECM REQUIREMENTS IN A REALISTIC AND DENSE COMBAT SIGNAL ENVIRONMENT. STUDY EFFORTS WILL DESCRIBE THE SIGNAL ENVIRONMENT THE DRFM JAMMER IS LIKELY TO EXPERIENCE, ANALYZE DATA COLLECTION AND CONTROL REQUIREMENTS, AND FORMULATE AN IMPLEMENTATION SCHEME BASED ON THE ADVANCED RECEIVER PROCESSOR SYSTEM PREVIOUSLY DEVELOPED BY AMHERST SYSTEMS.

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AMHERST SYSTEMS INC
30 WILSON RD
BUFFALO, NY 14221
CONTRACT NUMBER: F33615-89-C-1080
PHILIP T GLINSKI
TITLE:
THREAT IDENTIFICATION ERROR REDUCTION TECHNIQUES
TOPIC# 99 OFFICE: AFWAL/AAOP IDENT#: 32959

A TWO-PHASE INVESTIGATION OF TECHNIQUES FOR IMPROVING THE CONFIDENCE LEVEL OF EMITTER DETECTION AND IDENTIFICATION IN ELECTRONIC WARFARE SYSTEMS IS PROPOSED. PHASE I WILL CONCENTRATE ON THE DEVELOPMENT OF LOW LEVEL IMAGE PROCESSING TECHNIQUES APPLIED TO HISTOGRAMMED RADAR WARNING RECEIVER PULSE DATA IN ORDER TO LOCATE OBVIOUS EMITTERS AND AREAS OF PROBABLE AMBIGUITY. PHASE II WILL APPLY EXPERT SYSTEM ANALYSIS TECHNIQUES TO THE RESULTS OF THE (PHASE I) IMAGE ANALYSIS AND THE RESULTS OF CONVENTIONAL PROCESSING TO REDUCE ERRONEOUS EMITTER DETECTIONS AND IDENTIFICATIONS TO AN ACCEPTABLE LEVEL. THE ALGORITHMS WILL BE DEVELOPED ON COMMERCIALY AVAILABLE COMPUTERS AND TESTED BOTH AT AMHERST SYSTEMS USING IN-HOUSE ASSETS, AND AT THE U.S. AIR FORCE WRIGHT AERONAUTICAL LABORATORIES USING GOVERNMENT FURNISHED RECEIVERS/PROCESSORS.

AMHERST SYSTEMS INC
30 WILSON RD
BUFFALO, NY
CONTRACT NUMBER: F33657-89-C-2313
DAVID A MACALUSO
TITLE:
NEW CONCEPTS AND INNOVATIONS FOR AERONAUTICAL SYSTEMS/SUBSYSTEMS:
SUPPRESSOR/ACE INTEGRATION
TOPIC# 162 OFFICE: ASD/XRX IDENT#: 37993

THEATER-LEVEL MISSION ANALYSIS COMPUTER MODELS ARE GENERALLY RUNTIME EFFICIENT, YET LACK THE CAPABILITY OF MODELING EVENTS IN DETAIL. IN MOST SCENARIOS, CERTAIN EVENT OUTCOMES ARE HIGHLY SENSITIVE TO

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DETAILED MODELING PARAMETERS NOT AVAILABLE IN THE THEATER-LEVEL MODEL. A SOLUTION TO THIS PROBLEM IS TO INTERFACE THE THEATER-LEVEL MODEL TO A LOWER-LEVEL MODEL THAT CAN SIMULATE PARTICULAR EVENTS IN MORE DETAIL. THUS, RUNTIME EFFICIENCY MAY BE PRESERVED WHILE CERTAIN EVENTS MAY BE MODELED IN DETAIL AS REQUIRED. THIS STUDY WILL INVESTIGATE THE INTERFACING OF SUPPRESSOR, A LEVEL-III MISSION ANALYSIS MODEL TO ACE, A LEVEL-IV THEATER MODEL. THE PROPOSED PHASE I EFFORT WILL INCLUDE (1) DEFINING THOSE EVENTS IN ACE TO BE MODELED IN MORE DETAIL, (2) ANALYZING ACE TO DETERMINE MODEL STRUCTURE AND TO LOCATE CRITICAL EVENTS IN THE MODEL, (3) ANALYZING SUPPRESSOR TO ESTABLISH SCENARIO AND TYPE DATA BASES REQUIRED TO MODEL THE ACE EVENTS, AND (4) DEVELOP THE METHODOLOGY FOR TRANSFERRING NECESSARY DATA BETWEEN THE MODELS. A BYPRODUCT OF ESTABLISHING THE ACE-SUPPRESSOR INTERFACE METHODOLOGY IS AN UNDERSTANDING OF THE ACE MODEL AND HOW IT CAN BE INTERFACED TO OTHER ENTITIES IN ADDITION TO SUPPRESSOR. PHASE "IA" MATCHING GRANTS FROM NEW YORK STATE WILL CONTINUE THE STUDY. A TOP-DOWN DESIGN OF THE ACE-SUPPRESSOR INTERFACE WILL BE DEVELOPED. ADDITIONALLY, BASED ON KNOWLEDGE OBTAINED IN PHASE I, AN INTERFACE METHODOLOGY BETWEEN ACE AND A TERRAIN MASKING DATA BASE WILL BE ESTABLISHED.

ANALYTIC ENGINEERING CO
2810 WINTHROP RD
LINCOLN, NE 68502
CONTRACT NUMBER: F33615-89-C-3402
DR NISAR SHAIKH
TITLE:
SURFACE CRAZING MEASUREMENT TECHNIQUE FOR AIRCRAFT ACRYLIC PLASTI
TRANSPARENCIES
TOPIC# 111 OFFICE: AFWAL/FIOP IDENT#: 33630

AIRCRAFT TRANSPARENCIES REPRESENT ONE OF THE MOST SIGNIFICANT LIFE CYCLE COST TO THE U.S. AIR FORCE. THE MAJOR CAUSE FOR THE OPTICAL IMPAIRMENT IS THE DEGRADATION IN PLASTICS KNOWN AS CRAZING WHICH OCCURS DUE TO SURFACE STRESSES AND IS ACCELERATED BY THE ENVIRONMENTAL FACTORS. THE OBJECTIVE OF THE PROJECT IS TO DEVELOP THE NECESSARY TECHNIQUE TO MEASURE AND QUANTIFY THE CRAZING AND SHOW FEASIBILITY OF A PORTABLE INSTRUMENT TO CARRY OUT THE EVALUATION IN FIELD. SUCH A CAPABILITY AFFORDS USAF TO VALIDATE ACCELERATED CRAZING TESTS,

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ENABLE PURCHASE OF THE CANOPIES BASED ON LIFE CYCLE COST, OVERALL REDUCE COST AND INCREASE COMBAT READINESS. THE PRUDENT APPROACH IS WELL RESEARCHED SURFACE ACOUSTIC WAVE TECHNIQUES WHICH HAVE BEEN SUCCESSFUL IN LOCATING MINUTE CRACKS IN METALS AND CERAMICS. THE MOST IMPORTANT FACTOR IN CHOICE OF ACOUSTIC TECHNIQUE IS THEIR ABILITY TO MEASURE THE RESIDUAL STRESSES WHICH DETERMINE THE REMAINING LIFE OF OPTICAL PERFORMANCE. WE ANTICIPATE AN ELEGANT MEASUREMENT SCHEME THAT CAN CHARACTERIZE THE EXISTING CRAZES AND INDICATE THE PROBABLE TIME OF FUTURE OCCURENCE.

ANAMET LABS INC
3400 INVESTMENT BLVD
HAYWARD, CA 94545
CONTRACT NUMBER: F08635-89-C-0355
ROCKY RICHARD ARNOLD

TITLE:
COST-EFFECTIVE SPALL LINERS FOR CONCRETE STRUCTURES
TOPIC# 65 OFFICE: AFESC/RDXP IDENT#: 32035

THE OBJECTIVE OF THIS PHASE I FEASIBILITY RESEARCH IS TO IDENTIFY CONCEPTS, DESIGNS, AND MATERIALS FOR USE IN A SPALL LINER FOR PROTECTION FROM CONCRETE SPALLS CREATED BY HIGH-IMPULSE BLAST PRESSURES. PHASE I RESEARCH WILL DETERMINE THE COST-EFFECTIVENESS AND, HENCE, THE FEASIBILITY OF USING A FIBER-REINFORCED SPALL LINER INSIDE CONCRETE STRUCTURES. THE GENERAL APPROACH ADOPTED FOR THIS RESEARCH IS TO HYPOTHEZIZE THE LIKELY MECHANICAL BEHAVIORS THAT RESULT FROM A SHOCK LOADING, DEVELOP STRUCTURAL CONCEPTS FOR DEFEATING THE SPALLS, SELECT FIBER-REINFORCED MATERIALS FOR USE, PERFORM TRADE STUDIES, AND DEVELOP A SYSTEM CONCEPT DEFINITION THAT WILL BE USED BY THE AIR FORCE TO DECIDE THE VIABILITY OF USING SPALL PROTECTIVE LINERS. THE CONCEPT OF DEVELOPING SPALL LINERS WITH EFFECTIVELY NO STAND-OFF DISTANCE, SUCH AS THE PREFABRICATION HYPAR PANELS, WILL BE INVESTIGATED. THE PRINCIPAL CONSTRAINTS THAT APPLY TO ANY SYSTEM WHICH HAS MET THE REQUIRED BALLISTIC AND STRUCTURAL REQUIREMENTS ARE THOSE OF WEIGHT, EASE OF INSTALLATION, AND COST. THIS RESEARCH WILL ADDRESS ALL OF THESE CONSTRAINTS TO ESTABLISH A NUMBER OF POTENTIAL CONCEPTS/DESIGNS FOR EVALUATION DURING ANY PHASE II RESEARCH AND DEVELOPMENT.

ANAMET LABS INC
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CONTRACT NUMBER: F33615-89-C-3210
ROCKY RICHARD ARNOLD

TITLE:
NONLINEAR RESPONSE AND FATIGUE OF SURFACE PANELS BY THE TIME DOMA MONTE CARLO APPROACH
TOPIC# 102 OFFICE: AFWAL/FIOP IDENT#: 33549

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THE OBJECTIVE OF THIS PHASE I RESEARCH IS TO DEVELOP A COMPUTATIONAL PROCEDURE FOR PREDICTING THE LIFE AND RELIABILITY OF COMPOSITE STRUCTURAL PANELS SUBJECTED TO COMPLEX DYNAMIC LOADS FROM ACOUSTIC, AERODYNAMIC, AND THERMAL ENVIRONMENTS. THE PROPOSED RESEARCH USES A NONCLASSICAL VARIATIONAL APPROACH AND A TIME DOMAIN MONTE CARLO METHOD TO DEVELOP ANALYTICAL EQUATIONS OF HIGH ACCURACY AND EFFICIENCY. THE STRUCTURAL MECHANICAL MODEL WILL INCLUDE MODELING FOR TRANSVERSE SHEAR EFFECTS. THE TIME DOMAIN MONTE CARLO METHOD WILL PERMIT AN EXAMINATION OF THE EFFECTS OF PEAK STRESSES AND EXCEEDANCES; SUBSEQUENTLY, MEANINGFUL PREDICTIONS OF STRUCTURAL LIFE (FATIGUE) CAN BE MADE. PHASE I RESEARCH WILL BE USED TO VERIFY THE SYNERGISTIC COMBINING OF THE NONCLASSICAL VARIATIONAL METHODS WITH THE MONTE CARLO TIME DOMAIN ANALYSIS. THE RESULTING COMPUTATIONAL PROCEDURE WILL BE USED TO ESTABLISH THE FEASIBILITY OF THE DEVELOPING EITHER A DISCRETIZED (FINITE ELEMENT) OR NUMERICAL COMPUTER PROGRAM TO BE COMPLETED DURING ANY PHASE II EFFORT. THIS RESEARCH WILL LEAD TO A NEW TECHNOLOGY BASE FOR ESTIMATING THE NONLINEAR RESPONSE CHARACTERISTICS OF A NEW GENERATION OF AIRCRAFT EXPOSED TO SEVERE ACOUSTIC, AERODYNAMIC, AND THERMAL ENVIRONMENTS.

APPLIED RESEARCH CORP
8201 CORPORATE DR - STE 920
LANDOVER, MD 20785
CONTRACT NUMBER: F04701-89-C-0066
DR F O von BUN
TITLE:
SURVEILLANCE SATELLITE (S-SAT)
TOPIC# 179 OFFICE: AFSTC/OLAB IDENT#: 34486

THE OBJECTIVE OF THIS PROJECT IS TO PROVIDE AN ALMOST INSTANTANEOUS SPACE SURVEILLANCE CAPABILITY TO COVER A CERTAIN SPOT ON EARTH WHICH IS OF INTEREST TO THE MILITARY. THE CONCEPT IS TO USE SMALL, LOW-COST SPACECRAFT WHICH CAN SIMPLY BE STORED AND THEN LAUNCHED BY AIRCRAFT WITHIN 10 TO 20 HOURS INTO LOW-EARTH INTEGER (OR NEAR) ORBITS AT ANY INCLINATION. A SIMPLE TELESCOPE (OPTICAL AND/OR IR) IS PLANNED AS A PAYLOAD. IMAGES WILL BE SENT IN REAL TIME TO THE GROUND FORCES FOR THEIR IMMEDIATE USE. A MOTOR VEHICLE (VAN) WITH A PARABOLIC DISH WOULD SERVE AS A GROUND RECEIVING/CONTROL STATION.

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THE SPACECRAFT COULD BE CONSIDERED AS A "THROW AWAY" TYPE SYSTEM. THE PEGASUS IS PLANNED TO BE USED AS A LAUNCH VEHICLE. MORE THAN ONE SPACECRAFT WILL BE NEEDED DEPENDING ON THE NUMBER OF OBSERVATIONS PER DAY REQUIRED. IN ADDITION, IF ONE SHOULD FAIL, ANOTHER COULD BE LAUNCHED A SHORT TIME THEREAFTER. THIS ALSO REQUIRES THAT MORE THAN ONE AIRCRAFT (SIMILAR TO THE B-52, 0008) WOULD HAVE TO BE EQUIPPED WITH A PEGASUS-TYPE LAUNCH SYSTEM. THE PEGASUS IS ABLE TO LAUNCH A SPACECRAFT OF ABOUT 1 m IN DIAMETER AND 1.7 m IN HEIGHT, HAVING A MASS OF ABOUT 150 kg INTO A 900 km POLAR OR 220 kg INTO A 900 km EQUATORIAL ORBIT.

APPLIED SCIENCES INC
PO BOX 186 - 800 LIVERMORE ST
YELLOW SPRINGS, OH 45387

CONTRACT NUMBER:

MAX L LAKE

TITLE:

DIAMOND p/n JUNCTION FORMATION FOR HIGH TEMPERATURE RADIATION
RESISTANT ELECTRONICS

TOPIC# 219 OFFICE: BMO/MYSC IDENT#: 32618

CRYSTALLINE DIAMOND HAS OUTSTANDING POTENTIAL FOR USE AS A HIGH TEMPERATURE RADIATION TOLERANT ELECTRONIC MATERIAL. RECENTLY A JAPANESE GROUP WAS ABLE TO GROW LARGE AREA n-TYPE AS WELL AS p-TYPE DIAMOND CRYSTALS BY DOPING DURING VAPOR PHASE GROWTH. THE PURPOSE OF THE PROPOSED RESEARCH IS TO GROW n-TYPE DIAMOND ON TOP OF p-TYPE DIAMOND TO FORM A pn JUNCTION, AND TO ASSESS THE QUALITY OF THE DIODES THUS FORMED. IF GOOD JUNCTIONS CAN BE DEMONSTRATED IN PHASE I THEN BIPOLAR TRANSISTOR FORMATION AND PERFORMANCE EVALUATION WILL BE MADE IN PHASE II.

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CONTRACT NUMBER: F33615-89-C-5651

MAX L LAKE

TITLE:

OXIDATION PROTECTION OF HIGH TEMPERATURE CARBON-CARBON COMPOSITES

TOPIC# 122 OFFICE: AFWAL/MLK IDENT#: 33471

SUBMITTED BY

CURRENT APPLICATIONS FOR RE-ENTRY VEHICLES AND HIGH TEMPERATURE AIR BREATHING PROPULSION SYSTEMS, AND DESIGNS FOR ADVANCED AIRCRAFT AND SPACECRAFT SUCH AS THE NATIONAL AEROSPACE PLANE HAVE SIMULATED INTEREST IN A CLASS OF MATERIALS WHICH CAN OPERATE IN AN OXYGEN ATMOSPHERE AT TEMPERATURES RANGING BETWEEN 500 C AND 2200 C. CARBON-CARBON COMPOSITES ARE ATTRACTIVE FOR THIS TEMPERATURE RANGE FROM THE DUE TO COMPATIBILITY BETWEEN REINFORCEMENT AND MATRIX, MATERIAL DENSITY, MELTING TEMPERATURE, MECHANICAL PROPERTIES, RESISTANCE TO THERMAL SHOCK, COST, AND AVAILABILITY. THE ONE MAJOR DEFECT IS OXIDATION OF CARBON, LEADING TO EROSION OF THE STRUCTURE, AND RAPID LOSS OF STRENGTH. THE PROPOSED EFFORT WOULD DEVELOP A CARBON-CARBON COMPOSITE WHICH UTILIZES A HIGHLY EXIDATION-RESISTANT DOPED CARBON FIBER WHICH IS SUBSEQUENTLY COATED WITH A THIN SiC LAYER, AND INCORPORATED INTO A CARBON-CARBON COMPOSITE, THE MATRIX OF WHICH IS SIMILARLY TREATED WITH ADDITION OF BORON, AND FINALLY EXTERNALLY COATED WITH A SiC LAYER. THIS APPROACH OFFERS THE POTENTIAL FOR A HIGH STRENGTH, STABLE COMPOSITE FOR TEMPERATURES UP TO AT LEAST 1750 C.

APTEK INC
1257 LAKE PLAZA DR
COLORADO SPRINGS, CO 80906
CONTRACT NUMBER: F08635-89-C-0472
MARK D LANDON
TITLE:
AN OPTIMAL MISSILE SHAPE DESIGN PACKAGE
TOPIC# 1 OFFICE: AD/PMR IDENT#: 31003

THE OVERALL GOAL OF PHASE I AND PHASE II IS TO DEVELOP SOFTWARE THAT WILL FIND THE OPTIMAL SIZE AND SHAPE OF MISSILE DESIGNS ACCORDING TO USER DEFINED DESIGN CRITERIA. PHASE I WILL SHOW THE FEASIBILITY OF MISSILE SHAPE DESIGN OPTIMIZATION BY COMBINING A GEOMETRIC MODELER, OPTIMIZATION SOFTWARE, AND FREE-FORM DEFORMATION WITH AN ANALYSIS MODULE. THE PHASE I ANALYSIS MODULE WILL CONTAIN AERODYNAMICS, RADAR CROSS-SECTION, AND INTERNAL COMPONENT GEOMETRIC CONSTRAINTS. THE SOFTWARE WILL HELP THE USER FIND AN OPTIMAL MISSILE AERODYNAMICS/RCS SHAPE (E.G. MAXIMUM LIFT TO DRAG RATIO, OR MINIMUM OBSERVABILITY, ETC.) WITH INTERNAL COMPONENTS INSIDE THE MISSILE SHAPE AND WHILE

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SATISFYING DESIGN CONSTRAINTS (E.G. LIMITS ON SURFACE AREA, VOLUME, PRESSURE, LENGTH, WIDTH, ETC.). PHASE II WILL ENHANCE THE DESIGN PACKAGE BY INCLUDING OTHER ANALYSIS CODES (I.E. STRUCTURAL, ABLATION, AEROHEAT, INTERNAL COMPONENT PACKAGING, STABILITY, TRAJECTORY, ECT.) NECESSARY FOR MISSILE DESIGN SYNTHESIS.

APTEK INC
1257 LAKE PLAZA DR
COLORADO SPRINGS, CO 80906
CONTRACT NUMBER: F08635-89-C-0387
BARBARA B LEWIS
TITLE:
CONCRETE SPALL PROTECTION DEVELOPMENT
TOPIC# 65 OFFICE: AFESC/RDXP IDENT#: 32038

HIGH PRESSURE BLAST OR IMPACT LOADS ON THE OUTSIDE OF A CONCRETE WALL CAN CAUSE SPALLING OF THE INSIDE OF THE WALL. FLYING SPALL FRAGMENTS ARE DANGEROUS TO PERSONAL AND EQUIPMENT INSIDE CONCRETE BUILDINGS SUBJECTED TO ATTACK OR ACCIDENTIAL EXPLOSION. THIS PROPOSAL DETAILS THE LOGICAL, STEP-BY-STEP DEVELOPMENT OF A SPALL PROTECTION SYSTEM THAT CAN BE APPLIED TO NEW AND EXISTING CONCRETE WALLS. THE STEPS INVOLVED IN THE PROGRAM INCLUDE DEFINITION OF LOADS AND MATERIAL MODELS, IDENTIFICATION OF SPALL PREVENTION CONCEPTS, DEFINITION OF GEOMETRIC AND MATERIAL REQUIREMENTS, IDENTIFICATION OF SUITABLE MATERIALS, AND FINAL EVALUATION OF CANDIDATE SPALL PROTECTION SYSTEMS. FACTORS WHICH WILL BE EVALUATED INCLUDE COST, EASE OF INSTALLATION, AND MAINTAINABILITY. THE RESULTS OF THE STUDY WILL BE PRESENTED IN A FINAL REPORT.

ARROW TECH ASSOCS
PO BOX 4218
SOUTH BURLINGTON, VT 05401
CONTRACT NUMBER: F08635-89-C-0356
WAYNE HATHAWAY
TITLE:
ANALYSIS OF BALLISTIC RANGE DATA USING ARTIFICIAL INTELLIGENCE
TOPIC# 7 OFFICE: AD/PMR IDENT#: 31097

SUBMITTED BY

THE ANALYSIS OF AEROBALLISTIC RANGE DATA IS A TEDIOUS AND TECHNICALLY CHALLENGING TASK. THE SOPHISTICATED ANALYSIS PROCEDURES AND REQUIRED SOFTWARE (COMPUTER PROGRAMS) HAVE BEEN REFINED EXTENSIVELY DURING THE PAST FIFTEEN TO TWENTY YEARS WITH THE ADDITION OF THE SIX-DEGREE-OF-FREEDOM CODES EMPLOYING THE MAXIMUM LIKELIHOOD METHOD. THE REQUIRED PROFICIENCY TAKES BETWEEN THREE AND FIVE YEARS UNDER THE TUTELAGE OF AN EXPERT AEROBALLISTICIAN. THE INCORPORATION OF A USER FRIENDLY EXPERT SYSTEM INTO THE CURRENT AEROBALLISTIC RANGE DATA ANALYSIS PROCEDURES WILL ENHANCE THE QUALITY AND TIMELINESS OF THE REPORTED RESULTS, WHILE AT THE SAME TIME REQUIRE LESS ENGINEERING MANPOWER, THEREBY REDUCING COST. ARROW TECH AND WPI HAVE DEVELOPED A COMPREHENSIVE PLAN WHICH WILL RESULT IN A SUCCESSFUL DEMONSTRATION OF AN AI EXPERT SYSTEM CAPABLE OF GUIDING THE USER THROUGH THE PROCESS OF DEVELOPING THE PROPER INPUTS WHICH ASSURE AN APPROPRIATE LINEAR THEORY ANALYSIS, AND FEEDBACK WITH RESPECT TO INTERPRETATION OF THE RESULTS.

ARTIFICIAL INTELLIGENCE ATLANTA INC
119 E COURT SQ
DECATUR, GA 30030
CONTRACT NUMBER: F33615-90-C-5000
HENRY HEXMOOR

TITLE:

A MULTI-AGENT EPISTEMIC PLANNING MODEL FOR MANUFACTURING MANEGEME
TOPIC# 137 OFFICE: AFWAL/MLK IDENT#: 33769

THIS EFFORT ADDRESSES THE NEED FOR ADEQUATE REPRESENTATIONS OF MANAGEMENT AND MANUFACTURING KNOWLEDGE AND ADEQUATE REASONING STRATEGIES UTILIZING THIS KNOWLEDGE TO SUPPORT AUTOMATED PLANNING PREDICTION AND EXPLANATION OF ORGANIZATIONAL ACTIVITIES. MANAGEMENT DECISION MAKING IS OFTEN BASED ON INCOMPLETE AND UNCERTAIN INFORMATION AND ON BELIEFS AND KNOWLEDGE THAT ARE CHANGING OVER TIME. MANAGEMENT INVOLVES THE INTERACTION OF MULTIPLE AGENTS WITH DIFFERENT PERSPECTIVES WHOSE CONCLUSIONS MAY BE CONFLICTING AND CONTRADICTORY. UNDERSTANDING OF PERSONAL INTERACTIONS IN MANAGEMENT INVOLVES CONCEPTS SUCH AS ABILITY, PERMISSIBILITY AND OBLIGATION. THE TRADITIONAL AI PLANNING PARADIGM REQUIRES PRECONDITIONS AND POSTCONDITIONS OF ACTIONS BE KNOWN. THIS PARADIGM IS NOT USEFUL

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IN THE MANAGEMENT PLANNING DOMAIN WHERE KNOWLEDGE IS INCOMPLETE,
UNCERTAIN, AND BASED ON CHANGING BELIEFS ABOUT INTENTIONS,
CAPABILITIES, OBLIGATIONS, ETC. OUR APPROACH TO THIS PROBLEM IS TO
REPRESENT EPISTEMIC, MODAL, AND INTENTIONAL CONCEPTS AS EXTENSIONS
OF FIRST ORDER LOGIC AND TO FORMULATE AUTOMATED PLANNING MODEL BASED
ON DEDUCTIVE, PREDICTIVE AND HYPOTHETICAL REASONING STRATEGIES FOR
THIS EXTENDED LOGIC.

ARTIFICIAL INTELLIGENCE RESEARCH INC
8820 BUSINESS PARK DR - STE 100
AUSTIN, TX 77006
CONTRACT NUMBER: F33615-89-C-5731
DR FRANK M BROWN
TITLE:
EPISTEMIC PLANNING FOR MANAGEMENT AND MANUFACTURING
TOPIC# 137 OFFICE: AFWAL/MLK IDENT#: 33770

THE LONG TERM OBJECTIVE OF THIS PROJECT IS TO DEVELOP AND IMPLEMENT
A GENERAL SELF-EXTENSIBLE KNOWLEDGE BASED REASONING TECHNOLOGY
SPECIFICALLY TARGETED FOR USE IN COMPREHENSIVE MANUFACTURING AND
MANAGEMENT OPERATIONS SYSTEMS. THIS TECHNOLOGY SHOULD PROVIDE
MANUFACTURING AND MANAGEMENT OPERATIONS SYSTEMS WITH AN AUTOMATED
REASONING MECHANISM FOR INFERRING THE POTENTIAL CONSEQUENCE, OF
ACTIONS AND FOR PLANNING SEQUENCES OF MANUFACTURING AND MANAGEMENT
OPERATIONS TO ACHIEVE SPECIFIC ORGANIZATIONAL GOALS.

ASTRON RESEARCH & ENGINEERING
130 KIFER CT
SUNNYVALE, CA 94086
CONTRACT NUMBER: F04611-89-C-0046
TAKASHI NAKAMURA
TITLE:
DEVELOPMENT OF A PHOTOVOLTAIC POWER GENERATOR FOR THE OPTICAL
WAVEGUIDE SOLAR POWER SYSTEM
TOPIC# 187 OFFICE: AFAL/TSTR IDENT#: 31746

AN INNOVATIVE SOLAR POWER GENERATION CONCEPT NAMED OPTICAL WAVEGUIDE

SUBMITTED BY

(OW) SOLAR POWER SYSTEM IS PROPOSED. IN THIS SYSTEM SOLAR RADIATION IS COLLECTED BY CONCENTRATOR PANEL CONSISTING OF A MATRIX OF LENSES OR MIRRORS. THE OW CONSISTING OF OPTICAL FIBERS AND OTHER OPTICAL COMPONENTS TRANSFERS THE CONCENTRATED SOLAR RADIATION TO A CENTRAL LOCATION WHERE THE SOLAR POWER IS CONVERTED TO ELECTRICITY OR OTHER FORMS OF USEFUL POWER WITHIN A SHIELDED ENCLOSURE. THE FLEXIBLE OW LINKAGE ALLOWS THE CONVERTER TO BE PLACED AT THE LOCATION WHICH IS BEST SUITED FOR EFFICIENT POWER GENERATION AND SECURELY PROTECTED AGAINST HOSTILE SPACE ENVIRONMENTS. AN EXPLORATORY RESEARCH PROGRAM PERTAINING TO THE BASIC FEASIBILITY OF THE PROPOSED SYSTEM WAS RECENTLY INITIATED UNDER AFAL SUPPORT. IN ORDER TO ACHIEVE TIMELY DEVELOPMENT OF THIS UNIQUE CONCEPT, WE PROPOSE A PROGRAM TO DEVELOP A PHOTOVOLTAIC (PV) POWER GENERATOR FOR THE OW SOLAR POWER SYSTEM. THE SCOPE OF THE PHASE I IS TO ESTABLISH THE DATABASE, OPTIMIZE THE COMPONENT PERFORMANCE, CONCEPTUALIZE AND EVALUATE THE PV POWER GENERATOR SYSTEM DESIGN. THE SPECIFIC OBJECTIVES OF THE PHASE I RESEARCH WILL PERTAIN TO SPACECRAFT POWER REQUIREMENTS, PERFORMANCE CHARACTERISTICS OF PV CELLS, CONCEPTUAL DESIGN OF PV GENERATOR, EVALUATION OF PV GENERATOR AND PROOF OF PRINCIPLE MODEL DESIGN.

ASTRON RESEARCH & ENGINEERING
130 KIFER CT
SUNNYVALE, CA 94086
CONTRACT NUMBER:
CHARLES POWARS
TITLE:
EFFECT OF BOOSTER ACCELERATION ON INSULATOR EROSION
TOPIC# 213 OFFICE: BMO/MYSC IDENT#: 32582

DATA FROM RECOVERED ROCKET MOTORS HAS CONVINCINGLY SHOWN THAT MORE CHARRING/EROSION OCCURS ON FORWARD DOME INSULATION DURING FLIGHT THAN IN STATIC FIRING. THE PROBLEM OF FLIGHT AMPLIFICATION OF CHARRING/EROSION HAS GREATLY INCREASED TO COMPLEXITY OF THE DESIGN PROCESS FOR FUTURE ROCKET MOTORS, ESPECIALLY THOSE SUBJECTED TO HIGH ACCELERATION. LARGE SAFETY FACTORS MUST OFTEN BE APPLIED RESULTING IN THICK, HEAVY INSULATION WITH UNCERTAIN RELIABILITY. A MECHANISTIC MODEL COUPLED WITH NEW LABORATORY TEST METHODS ARE NEEDED TO PROVIDE A METHODOLOGY WHICH CAN BE RELIABLY USED TO SCREEN NEW METHODS. THIS PHASE I PROGRAM WILL DEMONSTRATE A RELATIVELY SIMPLE LABORATORY TEST

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TECHNIQUE WHICH PROMISES TO CLARIFY THE DOMINANT MECHANISMS GOVERNING THE FLIGHT AMPLIFICATION PROBLEM. THE TECHNIQUE EMPLOYS A SMALL WIND TUNNEL COMBINING RADIATIVE HEATING AND OSCILLATORY ACCELERATION OF THE TEST SAMPLE TO ALLOW INDEPENDENT VARIATION OF EACH CRITICAL PARAMETER. BY INDEPENDENTLY VARYING EACH PARAMETER WE CAN DETERMINE THE RELATIVE IMPORTANCE OF EACH ONE, AND WHICH ONES ARE DOMINANT. ULTIMATELY DATA FROM THESE SIMPLE TESTS, PULSE DATA FROM MORE COMPREHENSIVE TESTS, CAN BE COUPLED TO WELL VALIDATED COMPUTER MODELS, SUCH AS THE CHARRING MATERIALS ABLATOR (CMA) CODE, TO PRODUCE A RELIABLE PREDICTIVE TOOL.

ASTRON RESEARCH & ENGINEERING
130 KIFER CT
SUNNYVALE, CA 94086
CONTRACT NUMBER: F33615-89-C-3008
LLOYD R NORRIS
TITLE:
CFD MODELS FOR THE SUPPORTABILITY OF UNITED STATES AIR FORCE (USA)
AIRCRAFT AERODYNAMICS
TOPIC# 105 OFFICE: AFWAL/FIOP IDENT#: 33575

ASTRON RESEARCH AND ENGINEERING PROPOSES TO ASSESS THE FEASIBILITY OF IMPLEMENTING A USAF-WIDE DATABASE OF CFD MODELS FOR THE SUPPORTABILITY OF AERODYNAMIC OF USAF AIRCRAFT. THIS STUDY WILL INCLUDE (1) AN EXAMINATION OF VARIOUS AIR FORCE ORGANIZATIONS AND THEIR CURRENT METHODS AND REQUIREMENTS FOR CFD MODEL DEVELOPMENT, ANALYSIS, AND DATA TRANSFER, (2) A SURVEY OF THE AVAILABLE SOFTWARE WHICH MAY BE USED FOR THE DEVELOPMENT OF A CENTRALIZED CFD DATABASE, (3) A SPECIFICATION OF THE NECESSARY SOFTWARE AND SOFTWARE INTERFACES REQUIRED FOR CREATING THIS DATABASE, (4) A PLAN FOR IMPLEMENTING THE DATABASE, AND (5) AN ASSESSMENT OF THE RELATIVE COSTS FOR DEVELOPING AND IMPLEMENTING THE DATABASE USAF-WIDE. BOTH TANGIBLE AND INTANGIBLE BENEFITS WILL BE CONSIDERED IN THE ASSESSMENT OF THE FEASIBILITY OF THE CENTRALIZED DATABASE.

ASTRONAUTICS CO
11519 TURNBRIDGE LN
RESTON, VA 22094
CONTRACT NUMBER: F04701-89-C-0068
DR RICK FLEETER
TITLE:
SPACE APPLICATIONS OF THE SOLAR PUMPED LASER
TOPIC# 181 OFFICE: AFSTC/OLAB IDENT#: 34516

SUBMITTED BY

FIVE MILITARY SPACE LASER APPLICATIONS, LOCAL AND GLOBAL WIND MAPPING, ATMOSPHERIC CHEMISTRY MEASUREMENTS, AIR AND SPACE BORNE OBJECT ID AND SURVEILLANCE, SUBMARINE COMMUNICATIONS AND INTERSATELLITE POWER RELAY HAVE BEEN IDENTIFIED. THESE APPLICATIONS ALL REQUIRE 100 TO 1000 WATTS OF CONTINUOUS LASER POWER. THE ONLY PRACTICAL WAY TO ORBIT LASER RESOURCES OF THIS HIGH POWER IS THE SOLAR PUMPED LASER (SPL) WHICH CONVERT SUNLIGHT TO HIGH QUALITY LASER RADIATION AT 10% TO 15% EFFICIENCY, MORE THAN 10 TIMES THE EFFICIENCY OF CONVENTIONAL ELECTRIC LASERS. THE PROPOSED PROGRAM GOAL IS TO TRANSITION THE SPL FROM THE LABORATORY TO SPACE APPLICATION.

ATEAM CORP
7920 CHAMBERSBURG RD
DAYTON, OH 45424
CONTRACT NUMBER: F33657-89-C-2227
DAVID W GILLESPIE
TITLE:
MATE GUIDE EXPERT PRESENTATION SYSTEM
TOPIC# 160 OFFICE: ASD/AEE IDENT#: 32494

THIS PROPOSAL APPLIES EXPERT SYSTEM TECHNOLOGY TO ENHANCE THE USABILITY AND MAINTAINABILITY OF THE MATE GUIDES. THE CENTRAL THEME PRESENTED IN THIS PROPOSAL IS THE IDEA OF REPRESENTING THE TECHNICAL INFORMATION CONTAINED IN THE MATE GUIDES IN A WAY THAT CORRESPONDS TO THE NEEDS OF EVERY AUDIENCE LEVEL. THE STRUCTURE OF THE INFORMATION IS GEARED TOWARD THE NEEDS OF THE AUDIENCE, NOT BASED ON THE STRUCTURE OF THE PAPER FORM THE GUIDES CURRENTLY TAKE. THE EXPERT SYSTEM DEVELOPED BY THIS PROJECT WILL PRESENT ALTERNATIVE PATHS THROUGH THE MATE GUIDES' CONTENT IN GRAPHIC AND TEXTUAL FORMAT, WITH THE USER DECIDING THE PATH TO TAKE. THE EXPERT SYSTEM WILL ENABLE THE USER TO MOVE EASILY BETWEEN INTRODUCTORY AND ADVANCED MATERIAL, OR BETWEEN TEXT EXPLANATION AND GRAPHIC REPRESENTATIONS. THE USER INTERFACE IS AUTOMATICALLY TAILORED TO THE USER'S EXPERIENCE LEVEL AND TECHNICAL PERSPECTIVE. A NOVICE USER WILL HAVE A COMPUTER AIDED INSTRUCTION INTERFACE; THE EXPERIENCED USER WILL HAVE A GRAPHICAL INTERFACE AND THE EXPERT WILL HAVE A NATURAL LANGUAGE INTERFACE. ACQUISITION MANAGERS CAN SELECT ACQUISITION ORIENTED MATERIAL WITH

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PATHS AVAILABLE TO THE DETAILED DESIGN FUNCTIONS RELATED TO EACH ACQUISITION TASK. DESIGN ENGINEERS CAN JUMP DIRECTLY TO THE DETAILED DESIGN TASKS WITH PATHS AVAILABLE TO THE RELATED ACQUISITION REFERENCES. EACH OF THESE INTERFACES IS INTERLINKED WITH THE OTHERS, THUS MAKING ALL DATA RAPIDLY AVAILABLE TO EACH USER WITHOUT THE INTIMIDATING BULK OF THE GUIDES.

ATEAM CORP
7920 CHAMBERSBURG RD
DAYTON, OH 45424
CONTRACT NUMBER: F33657-89-C-2228
KENNETH D WILKINSON
TITLE:
AUTOMATIC TEST EQUIPMENT (ATE) REQUIREMENTS SPECIFICATION AUTHORI
TOOL
TOPIC# 159 OFFICE: ASD/AEE IDENT#: 32515

THIS PROPOSAL APPLIES EXPERT SYSTEM TECHNOLOGY TO AID IN THE COMPLEX AND TIME CONSUMING TASK OF CREATING A REQUEST FOR PROPOSAL (RFP) FOR THE DEVELOPMENT OF AUTOMATIC TEST EQUIPMENT (ATE) IN ACCORDANCE WITH MODULAR AUTOMATIC TEST EQUIPMENT (MATE) GUIDES, SPECIFICATIONS AND APPLICABLE MILITARY STANDARDS (MIL-STD). THE PROBLEM OF CREATING THE ATE REQUIREMENTS SPECIFICATION IS MADE LARGER BY THE NATURE OF THE ACQUISITION PROCESS, THE LACK OF KNOWLEDGE REGARDING APPLICATION OF THE MATE GUIDES, MIL-STD'S, AND THE COMPLEXITY OF WRITING AN RFP. THE PROPOSED SOLUTION TO THIS PROBLEM IS AN EXPERT TAILORING ASSISTANT FOR ATE REQUIREMENTS SPECIFICATION (ETAARS). ETAARS WILL BE USED BY PROGRAM MANAGEMENT PERSONNEL TO CREATE THE RFP, SOW, CONTRACT DATA REQUIREMENTS LIST (CDRL), DATA ITEM DESCRIPTIONS (DID) AND SOURCE SELECTION CRITERIA. THE RESULTING ATE REQUIREMENTS SPECIFICATION ADHERES TO MATE GUIDE SPECIFICATIONS AND APPLICABLE MIL-STD REQUIREMENTS AND IS TAILORED TO THE END USER'S PRIME SYSTEM AND ATE MISSION REQUIREMENTS. DURING AN AUTHORING SESSION, THE RFP AUTHOR RESPONDS TO QUESTIONS POSED BY ETAARS. BASED ON THE AUTHOR'S RESPONSES, ETAARS AUTOMATICALLY GENERATES THE SOW TEXT, CRDL'S, DID'S AND SOURCE SELECTION CRITERIA.

ATLANTIC AEROSPACE ELECTRONICS CORP
6404 IVY LN - STE 300
GREENBELT, MD 20770
CONTRACT NUMBER: F19628-89-C-0103
SVEN SPOERRI
TITLE:
A NEW APPROACH TO E-3 (AWACS) SENSOR DATA FUSION USING MORPHOLOGICAL
PROCESSING TECHNIQUES
TOPIC# 34 OFFICE: ESD/AVP IDENT#: 31683

SUBMITTED BY

THIS RESEARCH PROPOSAL IS AIMED AT THE EVALUATION OF A PROMISING PROCESSING TECHNOLOGY, MORPHOLOGICAL FILTERING, TO THE SENSOR DATA FUSION PROBLEM. THE E-3, AWACS FUSION PROBLEM, IS A DIFFICULT ONE BECAUSE OF THE PROJECTED LARGE NUMBER OF DYNAMIC AIRCRAFT TARGETS (UP TO 4000) AND LARGE NUMBER OF SENSORS (UP TO 10) BEING CONSIDERED AS SOURCES TO BE FUSED. FAST MOVING AND MANEUVERING TARGETS OBSERVED BY DIFFERENT SENSORS AT DIFFERENT (NOT SYNCHRONIZED) TIMES CAN LEAD TO PROBLEMS WITH CONFUSED AND MIS-IDENTIFIED TRACKS, PARTICULARLY IN REGIONS WHERE TARGETS ARE LOCALLY DENSE. THIS PROPOSED TECHNIQUE OF MORPHOLOGICAL FILTERING, COMBINED WITH A PARTICULAR SYSTEM ARCHITECTURE OFFERS THE PROMISE OF IMPROVED FUSED TRACK QUALITY WHILE BEING CAPABLE OF IMPLEMENTATION IN PRACTICAL HARDWARE FOR REAL TIME OPERATION ON THE E-3 AIRCRAFT. THIS PHASE I PROPOSAL OFFERS A FEASIBILITY DEMONSTRATION OF THE SUBJECT APPROACH.

ATLANTIC AEROSPACE ELECTRONICS CORP
6404 IVY LN - STE 300
GREENBELT, MD 10770
CONTRACT NUMBER: F33615-89-C-1094

TAMAR PELI

TITLE:

3-D OBJECT RECOGNITION IN A NEURAL NETWORK THAT PERFORMS SENSOR FUSION

TOPIC# 91 OFFICE: AFWAL/AAOP IDENT#: 32851

THE FUSION OF SENSOR DATA TO PERFORM 3-D TARGET RECOGNITION FROM 2-D VIEWS IS AN INHERENTLY COMPLEX, COMPUTE-BOUND PROBLEM CHARACTERIZED BY AN OVERWHELMING AMOUNT OF PIXEL DATA WHICH MUST BE PROCESSED AND INTEGRATED INTO A SINGLE COHERENT DESCRIPTION OF OBJECTS IN AN IMAGE. NEURAL NETWORKS OFFER THE PROMISE OF PRACTICAL SOLUTIONS TO COMPUTER-BOUND PROBLEMS. ATLANTIC HAS BEEN PERFORMING LOW LEVEL FEATURE EXTRACTION USING NEURAL NETS, AND HAS BEEN DEVELOPING A FEATURE EXTRACTOR WHOSE GOAL IS THE RELIABLE DETECTION OF PERCEPTUALLY IMPORTANT PHYSICAL FEATURES IN A PARALLEL FASHION. OUR JET-BASED SINGULARITY NETWORK ACHIEVES THIS BY USING FUNDAMENTAL CONSTRAINTS UPON THE RANGE OF POSSIBLE SIGNIFICANT IMAGE FEATURES. THE MANNER THAT THE NETWORK FORMS THESE FEATURES LEADS TO A SIMPLE AND NATURAL SYMBOLIC REPRESENTATION. WE PROPOSE TO EXTEND UPON OUR

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NEURAL NETWORK WORK IN SINGULARITY EXTRACTION TO INCORPORATE THE INFORMATION FROM SENSORS, SUCH AS PASSIVE INFRARED AND LASER RADAR INTENSITY, WHICH INHERENTLY PRODUCE AREA INFORMATION. IN OUR PROPOSED APPROACH, THIS LOW LEVEL PIXEL ORIENTED DATA WILL BECOME THE FIRST STAGE OF A NEURAL NET PROCESSING HIERARCHY WHICH DEVELOPS PROGRESSIVELY MORE COMPLEX FEATURES FROM THE SENSOR DATA, AND FINALLY USES A NETWORK BASED THREE DIMENSIONAL MODEL TO ACHIEVE THE FINAL IDENTIFICATION OF THE OBJECT. THIS PROCESSING HIERARCHY WILL ALLOW FOR THE FUSION OF INPUT FROM MULTIPLE SENSORS AND ALLOW TARGET IDENTIFICATION WITHOUT DIRECTION CONSTRAINTS WHILE PROVIDING THE CAPABILITY FOR THE IDENTIFICATION OF MULTIPLE OBJECTS IN A SINGLE IMAGE.

ATMOSPHERIC & ENVIRONMENTAL RSCH INC
840 MEMORIAL DR
CAMBRIDGE, MA 02139
CONTRACT NUMBER:
R G ISAACS/S A CLOUGH
TITLE:
DEVELOPMENT OF REMOTE SENSING ALGORITHM FOR ATMOSPHERIC PATH
VARIABLES FROM RADIOMETRIC DATA
TOPIC# 196 OFFICE: AFGL/XOP IDENT#: 31814

WE PROPOSE AN INNOVATIVE APPROACH FOR THE RETRIEVAL OF ARBITRARY ATMOSPHERIC PATH VARIABLES FROM RADIOMETRIC DATA. SPECIFICALLY, WE WILL EXTEND OUR CURRENT APPROACH TO THE CHARACTERIZATION OF THERMODYNAMIC PATH VARIABLES INCLUDING TEMPERATURE, DENSITY AND THE CONCENTRATIONS OF RELEVANT ABSORBING GASES BASED ON EXPLOITATION OF THE INFORMATION CONTENT OF HIGH RESOLUTION SPECTRAL SIGNATURES (ISAACS, 1988) TO ASPECTS OF THE NON-LOCAL THERMODYNAMIC EQUILIBRIUM (NLTE) PROBLEM, AND WILL OBTAIN INFORMATION ON PATH VARIABLES SUCH AS THOSE RELATED TO PARTICULATE SCATTERING, CLOUD PROPERTIES, AND SURFACE SIGNATURES FOR WHICH SPECTRAL PROPERTIES VARY SLOWLY WITH FREQUENCY. THE METHODOLOGY IS MATHEMATICALLY PLEASING AND COMPUTATIONALLY EFFICIENT SINCE ALL PATH VARIABLES ARE TREATED WITHIN THE "SIMULTANEOUS INVERSION" FRAMEWORK. THE PROPOSED ALGORITHM IS UNIQUE IN THE RETRIEVAL COMMUNITY IN THAT THE INTERFACE ROUTINES FOR IMPLEMENTATION WITH FASCOD3 HAVE ALREADY BEEN DEVELOPED AT AER.

ATMOSPHERIC & ENVIRONMENTAL RSCH INC
840 MEMORIAL DR
CAMBRIDGE, MA 02139
CONTRACT NUMBER: F04701-89-C-0055
HOWARD J SCHULTZ
TITLE:
CLOUD TOP EVALUATIONS AND CLOUD MOTION RETRIEVALS FROM STEREOSCOP
SATELLITE IMAGERY
TOPIC# 172 OFFICE: AFSTC/OLAB IDENT#: 34379

SMALL BUSINESS INNOVATION RESEARCH (SBIR) PROGRAM - PHASE 1
BY SERVICE
FISCAL YEAR 1989
AF

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THE ABILITY TO INFER CLOUD TOP ELEVATIONS AND CLOUD MOTION FROM SATELLITE OBSERVATIONS IS CRUCIAL FOR THE DEVELOPMENT OF ATMOSPHERIC MONITORING SYSTEMS. THE IMPROVED ACCURACY AND SENSITIVITY OF THE NEW GENERATION OF GOES-NEXT SATELLITES WILL ENABLE ROUTINE THREE-DIMENSIONAL CLOUD COVER ANALYSIS OVER MUCH OF THE WESTERN HEMISPHERE. AS A RESULT, THE DEVELOPMENT OF AUTOMATIC SYSTEMS FOR DETERMINING THREE-DIMENSIONAL INFORMATION FROM THESE DATA SOURCES IS AN ACTIVE TOPIC OF RESEARCH. THE PROPOSED RESEARCH WILL DEVELOP AN AUTOMATIC RETRIEVAL SYSTEM THAT WILL ENABLE ROUTINE THREE-DIMENSIONAL ANALYSIS OF CLOUD TOPOGRAPHY AND CLOUD MOTION. BECAUSE OF THE EXPECTED HIGH DATA VOLUME, LARGE NUMBER OF POTENTIAL USERS, AND WIDE VARIETY OF APPLICATIONS, THE SYSTEM WILL BE SIGNIFICANTLY MORE ACCURATE AND COMPUTATIONALLY EFFICIENT THAN CURRENT STEREOSCOPIC ANALYSIS SYSTEMS, AND CAPABLE OF OPERATING IN A WIDE VARIETY OF COMPUTER ENVIRONMENTS. THE PROPOSED CLOUD MONITORING SYSTEM WILL BE BASED ON A HIGHLY EFFICIENT AND FLEXIBLE PROPRIETARY AUTOMATIC STEREO IMAGE PROCESSING (ASIP) SYSTEM THAT REPRESENTS A SIGNIFICANT IMPROVEMENT OVER CURRENTLY AVAILABLE SYSTEMS.

ATMOSPHERIC & ENVIRONMENTAL RSCH INC
840 MEMORIAL DR
CAMBRIDGE, MA 02139
CONTRACT NUMBER: F04701-89-C-0056
RONALD G ISAACS

TITLE:

A UNIFIED RETRIEVAL METHODOLOGY FOR THE DMSP METEOROLOGICAL SENSO
TOPIC# 173 OFFICE: AFSTC/OLAB IDENT#: 34389

WE PROPOSE A UNIFIED RETRIEVAL SYSTEM FOR ATMOSPHERIC METEOROLOGICAL PARAMETERS APPLICABLE TO THE ANALYSIS OF SENSOR PAYLOAD DATA SETS OF THE DEFENSE METEOROLOGICAL SATELLITE PROGRAM (DMSP) SPACECRAFT. THE APPROACH PROVIDES AN EFFICIENT, SELF-CONSISTENT DATA FUSION TECHNIQUE TO PROVIDE DESIRED ENVIRONMENTAL DATA RECORDS (EDRs) FROM THE ENSEMBLE OF SENSOR DATA 5D-3 SENSORS: OLS, SSM/T, SSM/T-2, AND SSM/I. IT IS EASILY EXTENDED TO ADVANCED SENSOR CONCEPTS SUCH AS SSM/IS AND IS EQUALLY VALID FOR MULTICHANNEL, HIGH SPECTRAL RESOLUTION ADVANCED SOUNDERS PROPOSED IN THE CONTEXT OF BLOCK 6. REQUIRED PARAMETERS TREATED INCLUDE TEMPERATURE AND WATER VAPOR

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PROFILES, SURFACE TEMPERATURE AND EMISSIVITY, CLOUD PROPERTIES, AND PRECIPITATION. THE HYBRID RETRIEVAL APPROACH EMPLOYS BOTH STATISTICAL AND PHYSICAL RETRIEVAL CONCEPTS, EXPLOITING EXISTING DMSP OPERATIONAL EXPERIENCE WITH STATISTICAL METHODS TO PROVIDE A FIRST GUESS CAPABILITY. THE FIRST GUESS IS UPGRADED, IF NECESSARY, USING A PHYSICALLY BASED, SIMULTANEOUS RETRIEVAL. REQUIRED CLOUD PROPERTIES ARE OBTAINED BY IMAGE PROCESSING HIGH SPATIAL RESOLUTION VISIBLE AND INFRARED DATA FROM A COLOCATED IMAGER. THE PROPOSED APPROACH IS OPTIMALLY DESIGNED TO SUPPORT SATELLITE DATA INGEST BY THE AFGWC GLOBAL SPECTRAL NUMERICAL WEATHER PREDICTION MODEL (GSM).

ATSS INC
606 E MILL ST - STE 2044
SAN BERNARDINO, CA 92408
CONTRACT NUMBER:
HENRY L MOODY
TITLE:
HIGH TEMPERATURE INSULATOR
TOPIC# 226 OFFICE: BMO/MYSC IDENT#: 32688

THE PURPOSE OF THE PHASE I PROGRAM IS TO DEVELOP AN IMPROVED AEROSHELL DESIGN FOR STRATEGIC REENTRY VEHICLES. THE IMPROVED DESIGN USES A HIGH STRENGTH HEATSHIELD MATERIAL THAT CAN ALSO PROVIDE A STRUCTURAL ROLE IN THE AEROSHELL. ANALYSES AND GROUND TESTS SHOW THAT THE MATERIAL HAS EQUIVALENT THERMAL PERFORMANCE AS CURRENT CARBON PHENOLIC HEATSHIELDS, HAS IMPROVED STRENGTH OVER CURRENT AEROSHELL DESIGNS AND RESULTS IN AEROSHELL WEIGHT REDUCTIONS OF OVER 20%.

ATSS INC
606 E MILL ST - STE 2044
SAN BERNARDINO, CA 92408
CONTRACT NUMBER:
HENRY L MOODY
TITLE:
DEVELOPMENT OF A HEATSHIELD
TOPIC# 227 OFFICE: BMO/MYSC IDENT#: 32692

SUBMITTED BY

THE PURPOSE OF THE PHASE I PROGRAM IS TO DEVELOP DESIGN METHODS AND MATERIALS FOR THE IMPROVEMENT OF STRATEGIC REENTRY VEHICLE HEATSHIELD/SUBSTRUCTURE CAPABILITIES TO RESULT IN INCREASED STRENGTH AND/OR REDUCED WEIGHT. THE INTEGRATION OF LARGE MICROWAVE ANTENNA WINDOW ASSEMBLIES IN BOTH BALLISTIC AND MANEUVERING SYSTEMS SHALL BE INVESTIGATED. THE DESIGN IMPROVEMENTS SHALL ADDRESS USING SPECIAL HEATSHIELD COMPOSITE MATERIALS AND SPECIALTY SEGMENTS TO INCREASE THE STRUCTURAL CAPABILITIES OF THE REENTRY VEHICLE FRUSTUM.

ATSS INC
606 E MILL ST - STE 2044
SAN BERNARDINO, CA 92408
CONTRACT NUMBER:
LIAM S GROENER
TITLE:
IMPROVED STRENGTH CARBON-CARBON FACEPLATE HEATSHIELD FOR PHASED
ARRAY ANTENNA WINDOWS
TOPIC# 101 OFFICE: AFWAL/FIOP IDENT#: 33542

SENSOR SYSTEMS FOR HYPERSONIC REENTRY SYSTEMS CAN REQUIRE LARGE ARRAYS WHICH MUST OPERATE IN SEVERE HEATING ENVIRONMENTS FOR LONG DURATIONS. IN SOME DESIGNS, THESE ARRAYS ARE PROTECTED FROM THE ENVIRONMENT BY INDIVIDUAL DIELECTRIC WINDOWS OVER EACH ARRAY ELEMENT, WITH A HIGH TEMPERATURE STRUCTURAL MATERIAL (FACEPLATE) SEPARATING THE WINDOWS. NORMALLY THE STRUCTURAL MATERIAL IS SOME FORM OF CARBON COMPOSITE, BUT IN CONVENTIONAL WEAVES, THE CARBON FIBER CONTINUITY IS DISTURBED BY HOLES DRILLED FOR THE WINDOWS. THIS DRASTICALLY REDUCES THE STRENGTH OF THE FACEPLATE. AN INVESTIGATION OF ALTERNATE WEAVING AND PROCESSING APPROACHES TO IMPROVE THE STRENGTH OF COMPOSITE FACEPLATES IS PROPOSED.

ATSS INC
606 E MILL ST - STE 2044
SAN BERNARDINO, CA 92408
CONTRACT NUMBER:
HENRY L MOODY
TITLE:
HYBRID COWL LEADING EDGE FOR HYPERSONIC FLIGHT SYSTEMS
TOPIC# 248 OFFICE: AFSC/NAT IDENT#: 37986

SUBMITTED BY

ENGINE INLETS FOR HYPERSONIC VEHICLES ARE CRITICAL TECHNOLOGY AREAS BECAUSE OF THE POSSIBLE OCCURANCE OF SHOCKWAVE IMPINGEMENT, THE NEED FOR SHARP LEADING EDGE RADII AND THE REQUIREMENT OF MULTI-MISSION USE. THIS STUDY PROPOSES THE DESIGN AND DEVELOPMENT OF AN ENGINE INLET LEADING EDGE CONCEPT THAT CAN ACCOMMODATE THE HIGH HEAT FLUXES INDUCED BY HYPERSONIC ASCENT/REENTRY HEATING AND THE OCCURANCE OF AUGMENTED HEATING INDUCED BY THE IMPINGEMENT OF A FOREBODY-GENERATED SHOCKWAVE. THE DESIGN IS BASED ON A HYBRID CONCEPT THAT UTILIZES BOTH TRANSPARATION AND INTERNAL IMPINGEMENT COOLING TO MINIMIZE THE AMOUT OF COOLANT THAT IS INJECTED INTO THE EXTERNAL BOUNDARY LAYER THAT COULD OTHERWISE BE USED IN THE PROPULSION SYSTEM. INNOVATIVE DESIGN AND MATERIAL CONSTRUCTION METHODS ARE USED TO GENERATE A LEADING EDGE WITH THE STRENGTH AND INTERNAL POROSITY NECESSARY TO ACCOMMODATE THE AEROHEATING AND STRUCTURAL LOADS.

BELTRAN INC
1133 E 35TH ST
BROOKLYN, NY 11210
CONTRACT NUMBER:
THOMAS C KOSVIC
TITLE:
DEVELOPMENT OF A STORABLE INJECTANT SYSTEM FOR SOLID ROCKET
PERFORMANCE IMPROVEMENT
TOPIC# 214 OFFICE: BMO/MYSC IDENT#: 32586

THE CONCEPT OF INJECTING HYDROGEN INTO THE COMBUSTION CHAMBER OF SOLID ROCKET MOTORS TO INCREASE PERFORMANCE HAS, THEORETICALLY, SUBSTANTIAL BENEFITS. THE HYDROGEN, OR OTHER LOW MOLECULAR WEIGHT COMPOUNDS, MAY PRODUCE A SIGNIFICANT INCREASE IN SPECIFIC IMPULSE BY DEPRESSING THE MOLECULAR WEIGHT OF THE COMBUSTION PRODUCTS. THE GOAL OF THIS EFFORT IS TO DEVELOP A CONCEPT THROUGH WHICH A STORABLE SYSTEM COULD BE USED TO INJECT A LIQUID OR GAS TO IMPROVE THE PERFORMANCE OF A SOLID ROCKET. METHODS OF GENERATING A LOW MOLECULAR WEIGHT COMPOUND, SUCH AS HYDROGEN, IN A GASEOUS FORM FOR INJECTION INTO THE SOLID ROCKET EXHAUST GASES WILL BE DEVELOPED. SOME APPROACHES TO BE CONSIDERED FOR HYDROGEN GENERATION WILL BE: (1) REACTION OF AN ACID OR WATER WITH A METAL, (2) DECOMPOSITION OF A

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METAL HYDRIDE, OR (3) DECOMPOSITION OF AN ORGANIC HYDRIDE. THESE APPROACHES WILL RESULT IN ESSENTIALLY A SEPARATE GAS GENERATOR TO SUPPLY A LOW MOLECULAR WEIGHT COMPOUND TO THE SOLID PROPELLANT GRAIN. ANOTHER APPROACH IS DIRECT INJECTION OF A METALLIC HYDRIDE WHICH WOULD LIBERATE HYDROGEN DURING THERMAL DECOMPOSITION FOR MOLECULAR WEIGHT REDUCTION, WHICH MAY ALTER THE COMPOSITION OF THE PROPELLANT GRAIN. THE KEY ISSUES TO BE RESOLVED ON THE CONCEPTUAL LEVEL IN THIS EFFORT ARE THE FOLLOWING DETERMINATIONS: (1) THE OPTIMAL INJECTION FOR VARIOUS SOLID FUEL COMPOSITIONS, (2) A PRACTICAL MEANS OF PRODUCING AND INJECTING THE FLUID, AND (3) THE IMPACTS ON OVERALL VEHICLE PERFORMANCE.

BERKELEY APPLIED SCIENCE & ENGINEERING
PO BOX 10104
BERKELEY, CA 94709
CONTRACT NUMBER:
DR G R GHANIMATI

TITLE:
DEVELOPMENT OF AN ADVANCED CONTINUUM THEORY FOR COMPOSITE LAMINAT
TOPIC# 237 OFFICE: AFOSR/XOT IDENT#: 34291

ADVANCED MATERIALS FOR AEROSPACE STRUCTURAL, POWER AND PROPULSION APPLICATION OFFER SIGNIFICANT ADVANTAGES IN TERMS OF EFFICIENCY AND COST. A WIDESPREAD APPLICATION OF COMPOSITE MATERIALS REQUIRES A DETAILED AND RELIABLE KNOWLEDGE OF THEIR PHYSICAL PROPERTIES. THIS HAS LED TO DEVELOPMENT OF DIFFERENT LINEAR THEORIES FOR COMPOSITES IN RECENT YEARS. TO UTILIZE COMPOSITE MATERIALS TO THEIR FULL POTENTIALS, HOWEVER, ONE SHOULD ACCOUNT FOR THE EFFECT OF MICRO-STRUCTURE, NONLINEARITY AND COMPLEX GEOMETRY OF THE COMPOSITE. THIS IS A KEY STEP TOWARDS THE EFFICIENT USE OF COMPOSITE MATERIALS IN THE NEXT GENERATION AEROSPACE STRUCTURAL, PROPULSION AND POWER SYSTEMS. THIS PROPOSED INVESTIGATION IS AN ANSWER TO SUCH A NEED AND ATTEMPTS TO DEVELOP A NONLINEAR CONTINUUM THEORY FOR LAMINATED COMPOSITE MATERIALS THAT (i) ACCOUNTS FOR THE EFFECT OF MICRO-STRUCTURE, (ii) EXPLAINS AND PREDICTS THE BEHAVIOR OF THE COMPOSITE BASED ON PHYSICAL AND GEOMETRICAL PROPERTIES OF THE CONSTITUENTS, AND (iii) IS APPROPRIATE FOR PROBLEMS INVOLVING NONLINEARITIES AND COMPLEX GEOMETRIES. THE PROPOSED RESEARCH IS THE FIRST STEP FOR MORE ACCURATE AND MORE EFFECTIVE ANALYSIS, DESIGN AND TESTING OF

SMALL BUSINESS INNOVATION RESEARCH (SBIR) PROGRAM - PHASE 1
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AF

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COMPOSITE MATERIALS FOR AEROSPACE AND COMMERCIAL UTILIZATION. THE RESULTS OF THE INVESTIGATION IS A KEY TO THE TECHNOLOGY DEVELOPMENT OF THE NEXT GENERATION OF AEROSPACE VEHICLES AND STRUCTURES.

BERNER LANPHIER & ASSOCS INC
7315 WISCONSIN AVE - STE 429W
BETHESDA, MD 20814
CONTRACT NUMBER: F04701-89-C-0065
STEVEN D BERNER
TITLE:
INNOVATIVE CONCEPTS FOR FORCE SUPPORT FROM SPACE
TOPIC# 179 OFFICE: AFSTC/OLAB IDENT#: 34487

OPERATIONAL MILITARY FORCES ARE IN NEED OF TIMELY, ALL-WEATHER TARGETING DATA. THIS IS PARTICULARLY TRUE OF FORCES IN THE EUROPEAN THEATER, WHICH NEED TARGETING SUPPORT TO MEET THE OBJECTIVE OF THE NEW FOLLOW ON FORCES ATTACK (FOFA) STRATEGY FOR THE DEFENSE OF EUROPE. WE PROPOSE AN ASSESSMENT OF THE UTILITY AND FEASIBILITY OF A SPACE-BASED, PHASED ARRAY SYNTHETIC APERTURE RADAR (SAR) FOR PROVIDING THE REQUISITE TARGETING SUPPORT. WE ALSO PROPOSE TO ASSESS APPLICATIONS OF A SPACE-BASED TARGETING SAR OUTSIDE THE EUROPEAN THEATER. WE WILL QUANTIFY THE CONTRIBUTION THAT THE TARGETING SAR CAN MAKE TO INCREASING THE EFFECTIVENESS OF CURRENTLY AVAILABLE OR PLANNED STRIKE SYSTEMS. WE WILL THEN ESTABLISH DESIGN REQUIREMENTS FOR THE SAR SENSOR, PROCESSOR, AND SPACECRAFT. WE WILL PARTICULARLY EXPLORE TECHNICAL AND OPERATIONAL CONCEPTS THAT MAY ALLOW THE TARGETING-SUPPORT REQUIREMENTS TO BE MET WITH RELATIVELY SMALL, LIGHTWEIGHT SPACECRAFT. WE PROPOSE TO INVESTIGATE CONCEPTS THAT WILL ALLOW THE USE OF SURVIVABLE LAUNCH VEHICLES TO LAUNCH OR RECONSTITUTE THE SPACECRAFT CONSTELLATION. FINALLY, WE PROPOSE TO DEVELOP A FULL SIMULATION OF THE SAR TARGETING SYSTEM.

BETAC CORP
1401 WILSON BLVD
ARLINGTON, VA 22209
CONTRACT NUMBER: F41622-89-C-0019
WILLIAM McBRIDE
TITLE:
INTELLIGENT FORWARD OBSERVER TRAINER
TOPIC# 73 OFFICE: HSD/SORT IDENT#: 34762

SUBMITTED BY

AN INTELLIGENT TUTORING SYSTEM (ITS) WILL BE DEVELOPED AND INCORPORATED INTO A PROTOTYPE PC-BASED DESKTOP TRAINER FOR COMBAT FORWARD OBSERVERS AND FORWARD AIR CONTROLLERS. THIS TRAINER WILL USE DIGITAL VIDEO INTERACTIVE (DVI) TECHNOLOGY TO PRESENT THE TRAINEE WITH A SERIES OF HIGHLY REALISTIC INTERACTIVE SIMULATIONS OF THE FORWARD OBSERVER/CONTROLLER'S COMBAT ENVIRONMENT. THIS TRAINER MAKES EXTENSIVE USE OF THE UNIQUE MULTI-MEDIA PRESENTATION CAPABILITIES OFFERED BY DVI, INCLUDING FULL-MOTION COLOR VIDEO, HIGH RESOLUTION STILL IMAGERY, 3-D GRAPHICS, AND MULTIPLE CHANNELS OF AUDIO. THE INTELLIGENT TUTORING MODULE WILL BE INTEGRATED INTO THE SIMULATION, AND WILL INCLUDE DYNAMIC MODELS OF THE "TRAINEE", "EXPERT", AND "TUTOR." THE USER INTERFACE WILL BE SUPPORTED BY WRITING EXTENSIONS TO THE DVI SOFTWARE LIBRARY. THE FIRST PHASE OF THIS PROJECT WILL CONCENTRATE ON DEVELOPING, IMPLEMENTING AND TESTING THE ITS ON A SINGLE SKILL AREA SELECTED FROM THE SKILLS INVENTORY OF TYPICAL USERS. THE ITS STRUCTURES AND KNOWLEDGE-BASES WILL BE BUILT USING OBJECT-ORIENTED DESIGN METHODOLOGIES AND COMMERCIALY-AVAILABLE EXPERT SYSTEM DEVELOPMENT TOOLS. FUTURE WORK WILL ENCOMPASS FULL IMPLEMENTATION, TESTING AND REFINEMENT, AND INTEGRATION OF THE REMAINING FORWARD OBSERVER SKILLS INTO THE ITS.

BIO QUANTUM TECHNOLOGIES
3100 W ALABAMA - #114
HOUSTON, TX 77098
CONTRACT NUMBER:
JAMES R MORRIS
TITLE:
PASSIVE COUNTERMEASURES AGAINST LASER TARGET ILLUMINATORS
TOPIC# 208 OFFICE: AFWL/PRC IDENT#: 31911

A GREAT NEED EXISTS TO DEVELOP AN EFFECTIVE COUNTERMEASURE AGAINST HOSTILE WEAPONS, UTILIZING LASER TARGET ILLUMINATOR GUIDANCE SYSTEMS. MANY AIR FORCE ASSETS COULD BE AT GREAT RISK FROM THESE SYSTEMS, DUE TO THEIR INHERENT ACCURACY AND MOBILE CHARACTERISTICS. LASER TARGET ILLUMINATORS (LTI) ARE CURRENTLY DEPLOYED IN A VARIETY OF GROUND AND AIR BASED WEAPONS SYSTEMS. THESE FACTORS COUPLED WITH THE SHORT LOCK-ON TIMES TYPICAL OF LTIS DISABLE OR IMPARE TRADITIONAL COUNTERMEASURES. THE IDEAL COUNTERMEASURE WOULD ABSORB LASER

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RADIATION OF ANY WAVELENGTH, BE ECONOMICAL TO INSTALL, NOT INTERFERE WITH THE FUNCTION OR OPERATION OF THE ASSET AND BE EFFECTIVE IN SEVERE WEATHER AND BATTLEFIELD CONDITIONS. PROPOSED HERE IS A PROGRAM TO DEVELOP AN LTI COUNTERMEASURE, LASER ABSORBING COATING TO ACHIEVE THESE IDEALS. SEVERAL COATING COMPOSITIONS HAVE BEEN TESTED AND FOUND TO ABSORB GREATER THAN 99% AT 1.06 AND 10.6 MICRONS, WAVELENGTHS WIDELY UTILIZED BY LTI SYSTEMS. THESE COATINGS HAVE EXCELLENT WEAR AND ADHERENCE PROPERTIES, ARE INEXPENSIVE, CAN BE APPLIED TO A VARIETY OF ASSETS AND WOULD NOT INTERFERE WITH THE ASSETS FUNCTION. THIS PROGRAM WILL ASSESS LTI TECHNOLOGY, TEST ABSORPTION CHARACTERISTICS OF NEW AND WORN COATING SAMPLES AT KNOWN LTI WAVELENGTHS AND ASSESS THE COSTS OF IMPLEMENTATION.

BIO-METRIC SYSTEMS INC
9924 W 74TH ST
EDEN PRAIRIE, MN 55344
CONTRACT NUMBER: F41622-89-C-0023
DR PETER H DUQUETTE
TITLE:
RAPID ENZYME IMMUNOASSAY FOR DESIGNER DRUGS
TOPIC# 70 OFFICE: HSD/SORT IDENT#: 34862

RECENTLY, MUCH ATTENTION HAS BEEN FOCUSED ON THE USE OF ILLICIT AND/OR DESIGNER DRUGS BY PEOPLE FROM ALL FACETS OF AMERICAN LIFE. ONE OF THE MOST POPULAR OF THE DESIGNER DRUGS ARE THE FENTANYLS WHICH ARE VERY POTENT AND VERY DIFFICULT TO DETECT IN BIOLOGICAL FLUIDS. THESE POTENT DRUGS ARE BEING USED BY PEOPLE FROM ALL SEGMENTS OF OUR SOCIETY INCLUDING HEALTH CARE WORKERS, MILITARY PERSONNEL, AND PROFESSIONAL ATHLETES. BECAUSE OF THIS PROBLEM, MANY COMPANIES, INCLUDING THE U.S. MILITARY, ARE NOW BEGINNING TO DEMAND THAT EMPLOYEES SUSPECTED OF DRUG USE UNDERGO DRUG TESTING. A VARIETY OF METHODS ARE AVAILABLE FOR THE SPECIFIC AND SENSITIVE DETERMINATION OF FENTANYLS IN BIOLOGICAL FLUIDS. HOWEVER, MOST OF THE AVAILABLE ASSAYS (I.E., GC, GC-MS) REQUIRE EXPENSIVE EQUIPMENT, TRAINED PERSONNEL, AND ARE SLOW IN DETERMINING IF FENTANYLS HAVE BEEN CONSUMED. USE OF RADIOIMMUNOASSAY (RIA) PROCEDURES PRODUCES THE ADDITIONAL PROBLEM OF RADIOACTIVE WASTE DISPOSAL WHICH IS PRESENTLY, AND WILL INCREASINGLY BECOME, A MAJOR PROBLEM IN THE FUTURE. WE PROPOSE TO DEVELOP AN ENZYME IMMUNOASSAY (EIA) WHICH WILL BE USEFUL

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FOR THE DETECTION OF LOW CONCENTRATIONS OF FENTANYL IN BIOLOGICAL FLUIDS BY HIGH VOLUME SCREENING FACILITIES. THIS ASSAY IS SIMPLE, INEXPENSIVE, RAPID, AND MAY ALSO BE ADAPTABLE FOR THE DETECTION OF OTHER ILLICIT DRUGS.

BIO-TECHNICAL RESOURCES INC
1035 S 7TH ST
MANITOWOC, WI 54220
CONTRACT NUMBER: F33615-89-C-5642
ALAN D GRUND
TITLE:
BIOLOGICAL SYNTHESIS OF PHENYLACETYLENE
TOPIC# 135 OFFICE: AFWAL/MLK IDENT#: 33747

ACETYLENE-TERMINATED RESINS REPRESENT ONE CLASS OF POLYMERS HAVING GREAT POTENTIAL UTILITY IN THE AEROSPACE INDUSTRY. THIS TYPE OF RESIN POSSESSES DESIRABLE PHYSICAL PROPERTIES SUCH AS TEMPERATURE, MOISTURE AND SHEAR RESISTANCE. A NECESSARY PRECURSOR FOR SYNTHESIS OF THESE RESINS IS PHENYLACETYLENE, WHICH IS DIFFICULT AND EXPENSIVE TO MANUFACTURE THROUGH CHEMICAL MEANS. THE PHASE I RESEARCH PROGRAM DESCRIBED IN THIS PROPOSAL DETAILS A BIOLOGICAL ALTERNATIVE FOR PHENYLACETYLENE SYNTHESIS. THE APPROACH TAKEN WILL BE TO EXAMINE THE POSSIBILITY OF AN ENZYME MEDIATED BIOCONVERSION OF A SUITABLE SUBSTRATE TO PHENYLACETYLENE. THE INITIAL STEP WILL BE THE ISOLATION FROM THE ENVIRONMENT OF MICROORGANISMS CAPABLE OF PARTIAL OR COMPLETE UTILIZATION OF PHENYLACETYLENE. STUDIES ON THE REACTIONS INVOLVED IN PHENYLACETYLENE BIOSYNTHESIS, WILL BE DETERMINED IN A CELL-FREE SYSTEM. THERE ARE NUMEROUS EXAMPLES IN THE LITERATURE OF ENZYME AND REACTION CONDITIONS BEING MODIFIED SUCH THAT NEW AND REVERSE REACTIONS CAN OCCUR. THE GOAL OF THE PROPOSED RESEARCH IS TO DETERMINE THE TECHNICAL FEASIBILITY OF A BIOLOGICAL SYNTHESIS OF PHENYLACETYLENE USING A BIOCATALYTIC CONVERSION PROCESS.

BIODYNAMIC RESEARCH CORP
9901 IH 10 W - STE 1000
SAN ANTONIO, TX 78230
CONTRACT NUMBER: F41622-89-C-0024
DR JAMES H RADDIN JR
TITLE:
AN ACTIVE NECK PROTECTION SYSTEM FOR CREWMEMBERS OF HIGH PERFORMANCE AIRCRAFT
TOPIC# 68 OFFICE: HSD/SORT IDENT#: 34832

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NECK STRAINS ARE FREQUENT AND NECK FRACTURES ARE OCCASIONALLY EXPERIENCED AMONG PILOTS AND HIGH PERFORMANCE AIRCRAFT. CURRENT ACCELERATION PROTECTION TECHNIQUES HAVE CONCENTRATED ON PHYSIOLOGICAL PROTECTION AND LARGELY IGNORE NECK PROTECTION REQUIREMENTS. PREVIOUSLY PROPOSED NECK PROTECTION SCHEMES PRIMARILY RELY UPON LIMITING HEAD DISPLACEMENTS, LEADING TO UNACCEPTABLE OPERATIONAL LIMITATIONS. THE PROPOSED EFFORT WILL ESTABLISH A SYSTEM DESIGN CONCEPT, INCLUDING BASIC SYSTEM DESIGN CRITERIA, FOR AN ACTIVE NECK PROTECTION DEVICE SUITABLE FOR USE BY HIGH PERFORMANCE AIRCRAFT CREWMEMBERS. THE SYSTEM WILL DETERMINE POTENTIALLY INJURIOUS HEAD AND NECK MOTIONS AT THEIR ONSET AND PROVIDE SUITABLE ALTERNATE LOAD PATHS TO ACCOMPLISH HEAD SUPPORT AND NECK PROTECTION. DURING THOSE TIMES WHEN INJURIOUS MOTIONS ARE NOT OCCURRING, THE PROPOSED SYSTEM WILL PROVIDE VIRTUALLY UNRESTRICTED HEAD AND NECK MOTION. THE PROPOSED EFFORT WILL UTILIZE COMPUTER SIMULATION WITH A SUITABLE HEAD-NECK MATHEMATICAL MODEL TO ENSURE THAT SYSTEM DESIGN CRITERIA WILL MEET OPERATIONAL PERFORMANCE REQUIREMENTS FOR CURRENT AND FUTURE HIGH PERFORMANCE AIRCRAFT MANEUVERS. THE PRODUCT OF THE EFFORT WILL BE A SYSTEM DESIGN CONCEPT WITH SPECIFIC SYSTEM PERFORMANCE CRITERIA TO ALLOW FOLLOW-ON CONSTRUCTION AND HUMAN TESTING OF A PROTOTYPE DEVICE.

BIODYNAMIC RESEARCH CORP
9001 IH 10 W - STE 1000
SAN ANTONIO, TX 78230
CONTRACT NUMBER: F41622-89-C-0025
DR JAMES H RADDIN JR
TITLE:
CONCEPT FEASIBILITY ANALYSIS FOR A LARGE RADIUS TRACK-CENTRIFUGE
TOPIC# 68 OFFICE: HSD/SORT IDENT#: 34833

CURRENT DEFENSE CENTRIFUGES FOR HUMAN EXPERIMENTATION ARE MORE THAN 25 YEARS OLD, ARE LIMITED IN THE PROFILES WHICH THEY REPRODUCE, AND INTRODUCE SIGNIFICANT SIMULATION ARTIFACT. A RANGE OF SIGNIFICANT PROFILES EXISTS WHICH CANNOT BE ADEQUATELY SIMULATED WITH CURRENT CENTRIFUGES, IMPACT FACILITIES, OR SPATIAL DISORIENTATION TRAINERS. THE PROPOSED EFFORT WILL EXPLORE THE POTENTIAL PROFILES WHICH COULD BE PROVIDED BY A LARGE RADIUS TRACK-CENTRIFUGE FACILITY. THE EFFORT

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WILL ESTABLISH THE DESIGN CONCEPT FOR SUCH A FACILITY BASED UPON AN ORIGINAL CONCEPT PREVIOUSLY ADVANCED BY THE PRINCIPAL INVESTIGATOR. MATHEMATICAL MODELS AND COMPUTER SIMULATIONS WILL BE UTILIZED TO EXPLORE THE RANGE OF PROFILES POSSIBLE USING POTENTIAL, PHYSICALLY REALIZABLE DESIGN PARAMETERS. SELECTED OPERATIONALLY RELEVANT PROFILES, OF WHICH THE ENVISIONED FACILITY WOULD BE CAPABLE, WILL BE DEFINED AND COMPARED WITH PROFILES AVAILABLE ON CURRENT FACILITIES. A SENSITIVITY ANALYSIS WILL BE PERFORMED TO ASSESS THE CRITICALITY OF THE CHOSEN FACILITY PERFORMANCE PARAMETERS IN DEFINING THE PROFILES THAT CAN BE ACHIEVED. THE RESULT OF THE EFFORT SHOULD BE A DEFINITION OF THE BENEFITS TO BE GAINED BY PURSUING THE DEVELOPMENT OF A LARGE RADIUS TRACK-CENTRIFUGE. THESE BENEFITS CAN THEN BE SUBSEQUENTLY COMPARED TO THE COSTS OF THE FACILITY SO THAT KNOWLEDGEABLE PROGRAM INITIATION DECISIONS CAN BE MADE.

BLANCHARD & CO INC
27 GLEN ALPINE RD
PHOENIX, MD 21131
CONTRACT NUMBER: F41622-89-C-0011
WILLIAM C BLANCHARD

TITLE:
TESTING THE EFFECTIVENESS OF USING CW SENSORS IN THE SCPS SYSTEM
TOPIC# 80 OFFICE: HSD/SORT IDENT#: 34717

THIS RESEARCH AND DEVELOPMENT PROJECT INVOLVES THE USE OF CW REAL TIME SENSORS IN THE USAF SCPS SHELTER SYSTEM. IT TESTS THE USEFULNESS OF HAVING REAL TIME SENSORS BY EXAMINING THE ANTICIPATED EFFECT ON LIFE CYCLE COST. THIS WILL BE ACCOMPLISHED BY EVALUATING ALL AVAILABLE SENSOR SYSTEMS, CURRENT PROCEDURES, AND DEVELOPING NEW INNOVATIVE TECHNIQUES. THE EFFECT ON TRAINING AND ACCESS TIMES WILL BE CALCULATED. THIS PROJECT PROVIDES THE TRADE-OFF STUDIES AND SYSTEM DESIGN THAT ARE REQUIRED IN PHASE II TO BUILD AND TEST THE ANTICIPATED ENHANCEMENTS.

BONNEVILLE SCIENTIFIC INC
918 E 900RD S
SALT LAKE CITY, UT 84105
CONTRACT NUMBER: F41622-89-C-0027
ALLEN R GRAHN

TITLE:
ANTHROPOMORPHIC CUTANEOUS TACTILE SENSING ON DEXTEROUS MECHANICAL HANDS
TOPIC# 68 OFFICE: HSD/SORT IDENT#: 34857

SUBMITTED BY

ALTHOUGH SPECIALLY DESIGNED END-EFFECTORS HAVE PROVIDED PRESENT DAY ROBOTS AND TELEOPERATOR SYSTEMS WITH THE ABILITY TO DO MANY INTRICATE TASKS, TRUE MANIPULATOR DEXTERITY WILL ONLY COME THROUGH THE USE OF MULTI-FINGERED ANTHROPOMORPHIC MECHANICAL HANDS. STABLE GRASPING OF IRREGULAR OBJECTS, OBJECT RECOGNITION, PRECISION ASSEMBLY, AND PERFORMANCE OF MANY INTRICATE TASKS NOW CONFINED TO HUMANS WILL BE ABLE TO BE PERFORMED IN A TELEOPERATION MODE IN HAZARDOUS CONDITIONS WITH SUCH SYSTEMS. HOWEVER, CONTROLLING SUCH A TELEOPERATION SYSTEM DURING THE PERFORMANCE OF INTRICATE TASKS WITHOUT SENSORY FORCE FEEDBACK IS VIRTUALLY IMPOSSIBLE. THIS PROPOSAL PRESENTS AN APPROACH TO DEVELOP A NEAR-ANTHROPOMORPHIC TACTILE SENSING SYSTEM FOR THE UTAH/MIT DEXTEROUS HAND WHICH WILL FULFILL THE NEED FOR A SOPHISTICATED MAN/MACHINE INTERFACE FOR TELEOPERATION IN MILITARY AND OTHER APPLICATIONS.

BOULDER NONLINEAR SYSTEMS INC
2000 - 5TH ST/UNIT B
BOULDER, CO 80302

CONTRACT NUMBER:

GARY D SHARP

TITLE:

OPTICAL PROCESSORS FOR LIDAR APPLICATIONS

TOPIC# 92 OFFICE: AFWAL/AAOP IDENT#: 32872

DEVELOPMENTS WHICH IMPROVE THE PERFORMANCE OF LASER-BASED DETECTION AND RANGING SYSTEMS ARE OF MORE VALUE IF THEY CAN BE APPLIED IN A WIDE VARIETY OF APPLICATIONS. LASER RADAR SYSTEMS ARE GENERALLY APPLICATION SPECIFIC DEVELOPMENTS AND HAVE LARGE POSSIBLE VARIATIONS IN DESIGN. AN APPROACH WHICH OFFERS DISTINCT PERFORMANCE IMPROVEMENTS, CAN BE EASILY IMPLEMENTED WITHIN THE DESIGN, AND SIMPLY EXTENDS A REQUIRED SYSTEM FUNCTION WILL BE ATTRACTIVE TO ALL LASER-RADAR DEVELOPERS. THIS PROPOSAL PRESENTS A NOVEL MIXING TECHNIQUE WHICH HAS SUCH ATTRIBUTES FOR COHERENT LASER RADAR APPLICATIONS. IN THE PHASE I EFFORT, THE FEASIBILITY OF USING CONTROLLED OPTICAL WAVE-FRONT MIXING TO IMPROVE NOISE REJECTION, INCREASE DYNAMIC RANGE AND REDUCE SYSTEM COMPLEXITY WILL BE INVESTIGATED. A UNIQUE OPTICAL PROCESSOR IS USED TO PRECISELY CONTROL THE PHASE RELATIONSHIPS OF THE OPTICAL WAVE FRONTS SUCH THAT THE MIXING TECHNIQUE IS INDEPENDENT

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OF FREE-SPACE PATHLENGTHS. THE WAVE-FRONT PROCESSOR USES A NON-LINEAR CRYSTAL WHICH ACTS AS A WAVEGUIDE AND PHASE SHIFTER.

CAELUM RESEARCH CORP
11229 LOCKWOOD DR
SILVER SPRING, MD 20901
CONTRACT NUMBER:
DR PANOS A LIGOMENIDES
TITLE:
VERSATILE NEURAL RING ARCHITECTURES FOR VISION AND NATURAL
LANGUAGE PROCESSING APPLICATIONS
TOPIC# 36 OFFICE: RADC/SPS IDENT#: 38866

VISION AND NATURAL LANGUAGE PROCESSING IS BASED ON INDUCTIVE INFERENCE, WHICH IS REALIZABLE BY LARGE SCALE NEURAL NETWORKS. CONSTRUCTING FULLY PARALLEL, LARGE SCALE, NEURAL NETWORKS IS FRUSTRATED BY THE PROBLEMS OF PROVIDING FOR MASSIVE INTER-CONNECTIVITY AND FOR OVERCOMING FAN IN/OUT LIMITATIONS IN AREA-EFFICIENT VLSI/WSI REALIZATIONS. A MODULAR BUSED NEURAL RING (MBNR) ARCHITECTURE IS PROPOSED HEREIN, WHICH SOLVES THESE PROBLEMS. ITS REAL TIME DYNAMIC EXPANDABILITY AND RECONFIGURABILITY ALLOWS FOR ON-LINE EXPERIMENTATION AND TESTING OF NEURAL MODELS AND MECHANISMS, CONCERNING APPLICATIONS TO VISION AND NATURAL LANGUAGE PROCESSING. IN THIS PROJECT WE PROPOSE A PHASE I INVESTIGATION OF FEASIBILITY OF THE MBNR ARCHITECTURE AND ITS SUITABILITY FOR IMPLEMENTATION AND PERFORMANCE EVALUATION OF NEURAL MODELS FOR VISION AND NATURAL LANGUAGE PROCESSING.

CAMBRIDGE HYDRODYNAMICS INC
PO BOX 1403
PRINCETON, NJ 08542
CONTRACT NUMBER: F08635-89-C-0383
DR STEVEN A CRSZAG
TITLE:
COMPUTATIONAL MODEL OF PROJECTILE IMPACT INTO FUEL TANKS
TOPIC# 13 OFFICE: AD/PMR IDENT#: 31189

THE OBJECTIVE OF THIS WORK IS TO INVESTIGATE THE UTILITY OF

SUBMITTED BY

COMPUTATIONAL FLUID DYNAMIC (CFD) MODELS TO SIMULATE REACTIONS WITHIN FLUID-FILLED TANKS IMPACTED BY WARHEAD FRAGMENTS. IN PHASE I, WE WILL DEVELOP A TWO-DIMENSIONAL (CYLINDRICAL GEOMETRY) MODEL WHICH CONTAINS THE SALIENT PHYSICAL FEATURES NECESSARY TO PARAMETRIZE THE COMPLEX PROCESSES ASSOCIATED WITH FRAGMENT IMPACT ON FUEL TANKS. WE USE A MODIFIED ARBITRARY LAGRANGIAN EULERIAN (ALE) FLUID MODEL WHICH CONTAINS SPECIAL FEATURES NECESSARY TO CALCULATE THE PENETRATION PROCESS, INCLUDING ELASTIC-PLASTIC PHYSICS AND THE ACCURATE TREATMENT OF MATERIAL BOUNDARIES THROUGH A NOVEL VOF SCHEME. WE SHALL ALSO USE RENORMALIZATION GROUP (RNG) METHODS, DEVELOPED RECENTLY BY US, TO TREAT THE INTERACTION BETWEEN THE SHOCK AND FLUID TURBULENCE IN THE TANK. BY CARRYING OUT SYSTEMATIC NUMERICAL SIMULATIONS, WE WILL DETERMINE THE CHARACTER OF THE HIGHLY TRANSIENT EVENTS OF TANK PENETRATION AND THE ACCOMPANYING MOMENTUM ENERGY TRANSFER TO THE FLUID WITHIN THE TANKS SUBSEQUENT TO PENETRATION. TRANSIENT PRESSURE SIGNATURES AND STRESSES CAN THEN BE EXTRACTED FROM THE COMPUTATIONS AND USED TO TEST FOR TANK RUPTURE.

CAMBRIDGE HYDRODYNAMICS INC

PO BOX 1403

PRINCETON, NJ 08540

CONTRACT NUMBER:

DR STEVEN A ORSZAG

TITLE:

NUMERICAL MODELLING OF KINETICS-TURBULENCE INTERACTION IN HIGH MACH NUMBER FLOWS

TOPIC# 252 OFFICE: AFSC/NAT IDENT#: 31285

WE PROPOSE TO DEVELOP METHODS TO SOLVE ONE OF THE CRITICAL PROBLEMS OF TURBULENCE MODELLING INVOLVED IN HYPERSONIC FLOW IN WHICH ALL TRADITIONALLY USED TURBULENCE MODELS FAIL, NAMELY MODELLING OF KINETIC MIXING AND CHEMICAL REACTION PROCESSES IN HIGH MACH NUMBER ($Ma \sim 6-25$) TURBULENT FLOWS. WE PROPOSE TO DEVELOP DIFFERENTIAL TRANSPORT MODELS BASED ON OUR NEW RENORMALIZATION-GROUP (RNG) THEORY FOR TURBULENT HEAT, MASS, MOMENTUM TRANSFER COMBINED WITH CHEMICAL REACTION PROCESSES FOR HIGH MACH NUMBER FLOWS. PRELIMINARY RESULTS FOR APPLICATION OF THESE NOVEL, NEW MODELS TO NON-STATIONARY AND SEPARATE INCOMPRESSIBLE AND COMPRESSIBLE FLOWS, INCLUDING FLOW OVER A BACKWARD-FACING STEP, OSCILLATORY PIPE FLOW, SHOCK-INDUCED

SUBMITTED BY

SEPARATION ON AIRFOILS, AND LOW AND HIGH PRANDTL NUMBER TURBULENT HEAT TRANSFER SUGGEST THAT THE MODELS WILL BE VERY EFFICIENT FOR THE PRESENT CLASS OF DIFFICULT FLOW PROBLEMS. IN ADDITION, RECENT EXTENSIONS OF THE RNG METHOD GIVE A DESCRIPTION OF TURBULENT COMBUSTION THAT PROMISES SIGNIFICANT ADVANCES IN OUR ABILITY TO MODEL REACTING FLOW PROBLEMS.

CAMBRIDGE HYDRODYNAMICS INC

PO BOX 1403

PRINCETON, NJ 08540

CONTRACT NUMBER:

DR STEVEN A ORSZAG

TITLE:

NUMERICAL MODELLING OF MIXING AND CHEMICAL REACTIONS IN TURBULENT FLOWS

TOPIC# 205 OFFICE: AFWL/PRC IDENT#: 31878

WE SHALL DEVELOP METHODS TO SOLVE ONE OF THE CRITICAL PROBLEMS OF TURBULENCE MODELLING IN WHICH ALL TRADITIONALLY USED TURBULENCE MODELS FAIL, NAMELY MODELLING OF MIXING AND CHEMICAL REACTIONS IN COMPLEX TURBULENT FLOWS. WE PROPOSE TO DEVELOP A THREE-DIMENSIONAL COMPUTER CODE INCORPORATING RENORMALIZATION-GROUP (RNG) BASED DIFFERENTIAL TRANSPORT MODELS FOR TURBULENT HEAT, MASS, MOMENTUM TRANSFER COMBINED WITH CHEMICAL REACTION PROCESSES IN STRONGLY NON-STATIONARY, TURBULENT FLOWS. PRELIMINARY RESULTS FOR APPLICATION OF THESE NOVEL, NEW MODELS TO NON-STATIONARY AND SEPARATED FLOWS, INCLUDING FLOW OVER A BACKWARD-FACING STEP, OSCILLATORY PIPE FLOW, SHOCK-INDUCED SEPARATION ON AN AIRFOIL, AND LOW AND HIGH PRANDTL NUMBER TURBULENT HEAT TRANSFER SUGGEST THAT THE MODELS WILL BE VERY EFFECTIVE FOR THE PRESENT CLASS OF DIFFICULT FLOWS. IN ADDITION, RECENT EXTENSIONS OF THE RNG METHOD GIVE A DESCRIPTION OF TURBULENT COMBUSTION THAT PROMISES SIGNIFICANT ADVANCES IN OUR ABILITY TO MODEL REACTING FLOW PROBLEMS.

CANETICS INC

PO BOX 70549 - 21 N SYCAMORE AVE

PASADENA, CA 91107

CONTRACT NUMBER:

CHIALIN WU

TITLE:

PROGRAMMABLE SIGNAL PROCESSOR FOR REAL-TIME LIDAR WIND MEASUREMENT

TOPIC# 198 OFFICE: AFGL/XOP IDENT#: 31828

SUBMITTED BY

THIS PROPOSAL PRESENTS A PRELIMINARY EVALUATION FOR A PROGRAMMABLE DIGITAL SIGNAL PROCESSOR FOR REAL-TIME PRODUCING OF LIDAR WIND PARAMETER MEASUREMENTS. A TECHNICAL BACKGROUND OF THE ART OF PERIPHERAL DIGITAL SIGNAL PROCESSORS IS PRESENTED. THE PROPOSED LIDAR INSTRUMENT PARAMETERS ARE EXAMINED. A SET OF PRELIMINARY PROCESSOR DESIGN REQUIREMENTS ARE FORMULATED. A CONCEPTUAL DESIGN OF THE PROCESSOR IS ALSO INCLUDED TO PROVIDE AN EARLY EVALUATION OF THE FEASIBILITY OF IMPLEMENTING A REAL-TIME LIDAR PROCESSOR USING EXISTING SINGLE CHIP DIGITAL SIGNAL PROCESSING (DSP) DEVICES. THE CONCLUSION AS PRESENTED HERE SHOWS SUCH AN IMPLEMENTATION IS FEASIBLE. THE PROPOSING COMPANY INDEED HAS DSP BOARDS SUITABLE FOR THE LIDAR PROCESSOR. FURTHER, THE PROPOSED PRINCIPLE INVESTIGATOR HAS EXTENSIVE EXPERIENCE IN DESIGNING AND IMPLEMENTING SIGNAL PROCESSORS FOR SPACE BASED COHERENT DOPPLER SENSORS. THE PROPOSED PHASE I DEVELOPMENT APPROACH SHALL PROVIDE LIDAR PERFORMANCE MODELING, OPTIMAL PROCESSING ALGORITHMS, ARCHITECTURAL DEMONSTRATION, DETAILED DESIGN, AND AN EVALUATION OF THE SPACE LIDAR REQUIREMENTS. THE OBJECTIVE OF THE SPACE REQUIREMENTS IS TO GUIDE THE PROPOSED DEVELOPMENT TOWARDS BECOMING A STEPPING STONE FOR A FUTURE ONBOARD LIDAR PROCESSOR.

CEMCO ENGINEERING
2648 EDGEWATER DR
NICEVILLE, FL 32578
CONTRACT NUMBER: F08635-89-C-0422
FRED H CARLEY

TITLE:
THE RELIABILITY OF STORAGE CONTAINERS TO PROVIDE EXTENDED SHELF
LIFT FOR WEAPONS
TOPIC# 5 OFFICE: AD/PMR IDENT#: 31086

WELL DESIGNED SHIPPING AND STORAGE CONTAINERS HAVE THE POTENTIAL FOR PROVIDING PROTECTION TO WEAPONS FOR AN INDEFINITE PERIOD OF TIME WITH VERY LITTLE MAINTENANCE REQUIRED. WHETHER OR NOT THIS DEGREE OF PROTECTION HAS BEEN ACHIEVED WITH CURRENT CONTAINER TECHNOLOGY HAS NOT BEEN CONCLUSIVELY DETERMINED. THIS PROPOSED INVESTIGATION IS TO MAKE AN IN-DEPTH EVALUATION OF THE RELIABILITY OF CURRENT CONTAINERS TO PROVIDE A LONG TERM ENVIRONMENT AROUND WEAPONS WHICH WOULD

SUBMITTED BY

PRECLUDE THE INITIATION OF CORROSION, AND TO IDENTIFY SHORTFALLS IN CONTAINER DESIGNS WHICH MAY ADVERSELY AFFECT THE ACHIEVEMENT OF THIS GOAL. THE PHASE I INVESTIGATION WILL FOCUS ON THOSE WEAPON SYSTEMS PLACED IN SERVICE PRIOR TO 1980 AND TO WHICH CURRENT CONTAINER TECHNOLOGY WAS APPLIED. DATA GATHERING TECHNIQUES TO BE USED INCLUDE RECORDS RESEARCH, FIELD VISITS AND BROAD DISSEMINATION OF AN APPROPRIATE QUESTIONNAIRE. IT IS ANTICIPATED THAT AN ANALYSIS OF THESE DATA WILL PERMIT THE RELIABILITY OF CONTAINERS TO PROTECT WEAPONS IN STORAGE TO BE FULLY DOCUMENTED, AND WILL IDENTIFY OPPORTUNITIES FOR ADVANCING CONTAINER TECHNOLOGY.

CHARLES RIVER ANALYTICS INC

55 WHEELER ST
CAMBRIDGE, MA 02138

CONTRACT NUMBER:

DR ALPER K CAGLAYAN

TITLE:

AN INVESTIGATION OF FUNCTIONAL AND RELIABILITY TESTING FOR PARALL
SOFTWARE

TC#IC# 39

OFFICE: RADC/XPX

IDENT#: 31459

WITH ADVANTAGES IN VLSI AND PARALLEL PROCESSING TECHNOLOGY, IT IS NOW FEASIBLE TO BUILD COMPLEX COMPUTERS WITH ARCHITECTURES RANGING FROM COARSE-GRAIN TO FINE-GRAIN PARALLEL SYSTEMS. HOWEVER, THE PRODUCTION OF HIGH QUALITY SOFTWARE MATCHING THE HIGH PERFORMANCE POTENTIAL OF THESE PARALLEL ARCHITECTURES HAS PROVED TO BE VERY DIFFICULT, DUE TO THE INSUFFICIENCY OF SOFTWARE DEVELOPMENT ENVIRONMENTS, AND, IN PARTICULAR, PARALLEL SOFTWARE TESTING TOOLS. CLEARLY, THERE IS AN URGENT NEED FOR SOFTWARE TOOLS FOR FUNCTIONAL AND RELIABILITY TESTING OF PARALLEL SOFTWARE. HERE, WE PROPOSE TO PERFORM A REVIEW OF FUNCTIONAL AND RELIABILITY TESTING TECHNIQUES FOR CONVENTIONAL SOFTWARE IN ORDER TO DEFINE POTENTIAL GENERALIZATIONS, IDENTIFY INNOVATIVE APPROACHES TO TESTING PARALLEL SOFTWARE EXPLOITING THE UNDERLYING HARDWARE REDUNDANCY, AND ANALYZE DEBUGGING AIDS ADDRESSING THE UNIQUE ATTRIBUTES OF PARALLEL PROGRAMMING ENVIRONMENTS. OUR PROPOSED STUDY INCLUDES THE PROOF-OF-CONCEPT DEMONSTRATIONS OF THE MORE PROMISING APPROACHES AND THE REQUIREMENTS DEFINITION OF A FULL-SCALE PROTOTYPE TOOL FOR TESTING PARALLEL SOFTWARE.

SUBMITTED BY

CHARLES RIVER ANALYTICS INC
55 WHEELER ST
CAMBRIDGE, MA 02138
CONTRACT NUMBER: F33615-89-C-3606
DR ALPER K CAGLAYAN
TITLE:
AN EXPERT SYSTEM APPROACH TO GLOBAL FAULT DETECTION AND ISOLATION
DESIGN
TOPIC# 104 OFFICE: AFWAL/FIOP IDENT#: 33569

RECONFIGURABLE FLIGHT CONTROL SYSTEMS COMPENSATE FOR THE EFFECTS OF ONBOARD HARDWARE FAILURE AND SURFACE DAMAGE CONDITIONS USING INFORMATION SUPPLIED BY A GLOBAL FAULT DETECTION AND ISOLATION SYSTEM. A GLOBAL FDI ALGORITHM PERFORMS ITS FUNCTION BY ASSESSING THE GLOBAL EFFECTS OF A HARDWARE FAULT AND SURFACE DAMAGE ON THE CLOSED-LOOP AIRCRAFT DYNAMICS. SINCE CHANGES IN THE FLIGHT CONTROL LAW AFFECT THE SIGNATURE OF A HARDWARE FAULT AND SURFACE DAMAGE, THE DESIGN OF A GLOBAL FDI ALGORITHM IS DEPENDENT ON THE FLIGHT CONTROL LAW PERFORMANCE CHARACTERISTICS. HENCE, IT IS DESIRABLE TO AUTOMATE THE GLOBAL FDI DESIGN PROCESS IN ORDER TO REDUCE THE DEVELOPMENT TIME, COST AND RISK FOR ADVANCED FLIGHT CONTROL SYSTEMS. HERE, WE PROPOSE THE DEVELOPMENT AND PROTOTYPE DEMONSTRATION OF A GLOBAL FDI DESIGN ASSISTANT BASED ON EXPERT SYSTEMS TECHNOLOGY. SUCH A SYSTEM WOULD INCORPORATE AN EXTENSIVE DATA BASE OF FAILURE DETECTION AND ISOLATION DETAILS AND PROCEDURES, ENCAPSULATE AERODYNAMIC MODELLING AND FLIGHT CONTROL SYSTEM KNOWLEDGE, AND BE CAPABLE OF SUGGESTING DESIGN REITERATION PROCEDURES TO THE USER. A SECONDARY OBJECTIVE OF OUR PROPOSED STUDY IS TO INVESTIGATE HOW EXPERT SYSTEMS CAN BE INTEGRATED INTO THE IMPLEMENTATION OF FDI ALGORITHMS.

CHEMICAL TESTING & CONSULTING CO
64 PINCKNEY ST - #3
BOSTON, MA 02114
CONTRACT NUMBER: F33615-89-C-2939
RICHARD H CLARKE
TITLE:
MICRO-SAMPLE ANALYSIS OF AVIATION TURBINE FUELS BY RAMAN SPECTROSCOPY
TOPIC# 147 OFFICE: AFWAL/POMP IDENT#: 33180

SUBMITTED BY

WE SEEK TO UTILIZE LASER RAMAN SCATTERING TO DETERMINE THE CHEMICAL MAKEUP OF AVIATION TURBINE FUELS. SINCE THE MAKEUP OF FUEL MIXTURES REQUIRES CAREFUL BALANCE AMONG COMPONENTS AND REPRODUCIBLE CONSISTENCY OF MIXTURE, IT IS ESSENTIAL TO BE ABLE TO QUICKLY AND RELIABLY DETERMINE THE IDENTITY AND RELATIVE AMOUNTS OF THE ACTIVE CHEMICAL COMPONENTS PRESENT IN THE FUEL BATCH. SUCH TESTING SHOULD NOT ONLY BE QUICK, BUT ALSO BE CAPABLE OF HIGH RESOLUTION AMONG COMPONENTS, AND BE OBTAINABLE ON SMALL QUANTITIES OF FUEL SAMPLE. FOR SUCH A TASK, THE ANALYTICAL TECHNIQUE OF LASER RAMAN SCATTERING IS IDEAL. THE SPECTRAL FEATURES FROM LASER RAMAN SPECTROSCOPY ARE SO WELL DEFINED FOR A GIVEN TYPE OF FUEL THAT WE EXPECT THAT THE RAMAN SPECTRAL BANDS FROM SUCH FUEL MIXTURES MAY SERVE TO PROVIDE A CLEAR AND REPRODUCIBLE STANDARD FOR THE DETERMINATION OF BATCH CONTENT AND MIXTURE PROPORTIONS, SUITABLE FOR THE STATED OBJECTIVES OF AIR FORCE SOLICITATION AF89-147.

CIM SYSTEMS INC
2425 N CENTRAL EXPWY - STE 432
RICHARDSON, TX 75080
CONTRACT NUMBER: F19628-89-C-0129
STEVE HICKMAN
TITLE:
DESIGN COMPLIANCE ASSESSMENT TOOL (DCAT) FOR ELECTRONIC SYSTEMS
TOPIC# 33 OFFICE: ESD/AVP IDENT#: 31677

MOVING FROM PROTOTYPE TO PRODUCTION DESIGN IS NOT ALWAYS A SMOOTH TRANSITION. INTERACTIONS BETWEEN PARTS CAN SURFACE THAT WERE PREVIOUSLY UNNOTICEABLE BUT ARE NOW WORRISOME OR EVEN FATAL TO THE GOAL OF THE DESIGN. IN ORDER TO ELIMINATE THIS COSTLY SCENARIO, DESIGNERS NEED A TOOL THAT WILL EXPOSE THESE INTERACTIONS AS SOON AS POSSIBLE - PREFERABLY, BEFORE THE DESIGNERS ARE COMMITTED TO A GIVEN IMPLEMENTATION. THIS PROJECT OBJECTIVE IS TO INVESTIGATE AND DETERMINE THE FACTORS THAT AFFECT ELECTRONIC DESIGNS IN THIS TRANSITION AND USE THIS INFORMATION TO CREATE A DESIGN COMPLIANCE ASSESSMENT TOOL. BY USING KNOWLEDGE BASES FROM ALL AREAS OF ELECTRONIC DESIGN - MATERIALS AND LAYOUT TO ELECTROMAGNETIC THEORY - THIS TOOL WILL PROVIDE DESIGNERS WITH THE IMPLICATIONS TO THEIR DESIGN DECISIONS AND SUGGEST ALTERNATIVES WHEN THESE IMPLICATIONS

SUBMITTED BY

INDICATE POTENTIAL PROBLEMS.

CLEVELAND CRYSTALS INC
19306 REDWOOD AVE
CLEVELAND, OH 44110
CONTRACT NUMBER: F33615-89-C-5635
GRETCHEN KENNEDY
TITLE:
NONLINEAR OPTICAL MATERIALS
TOPIC# 126 OFFICE: AFWAL/MLK IDENT#: 33294

ORGANIC CRYSTALLINE MATERIALS HAVE BEEN REPORTED AS HAVING OPTICAL NONLINEAR COEFFICIENTS 10 TO 200 TIMES THAT OF CONVENTIONAL INORGANIC MATERIALS. 2-METHYL-4-NITROANILINE (MNA), IS ONE SUCH MATERIAL. ITS PROPERTIES HAVE BEEN EVALUATED BY THE SECOND-HARMONIC POWDER TECHNIQUE AND EXPERIMENTS USING THIN PLATES OF MNA CRYSTALS OF VARIABLE OPTICAL QUALITY. THE REPORTED NONLINEAR COEFFICIENTS FOR MNA ARE $d_{11}=150\text{pm/V}$ AND $d_{12}=23\text{pm/V}$. THE ELECTRO-OPTIC COMPONENT, r_{11} , HAS BEEN REPORTED TO BE $67+/-25 \times 20(-12)\text{m/V}$. GIVEN THESE PROPERTIES, MNA MAY BE USEFUL FOR HARMONIC GENERATION OF LOW INTENSITY SOURCES AND OPTICAL SWITCHING. UNFORTUNATELY, MNA IS NOT AVAILABLE AS LARGE HIGH QUALITY SINGLE CRYSTALS. THE OBJECTIVE OF THIS PROPOSAL IS TO INVESTIGATE THE VARIOUS GROWTH PARAMETERS NECESSARY TO ESTABLISH A SOLUTION GROWTH METHOD FOR MNA IN ORDER TO GROW LARGE HIGH QUALITY CRYSTALS. THESE SHOULD BE OF SUFFICIENT SIZE TO ALLOW ACCURATE, QUANTITATIVE TESTING OF TRANSMITTANCE, BULK DAMAGE THRESHOLD AND SHG EFFICIENCY. THE CRYSTALS WILL BE GROWN IN A MODIFIED HOLDEN TEMPERATURE LOWERING CRYSTALLIZER. TO BE SUCCESSFUL, IMPURITIES, TEMPERATURE FLUCTUATIONS AND SPURIOUS NUCLEI MUST BE KEPT TO A MINIMUM. THIS RESEARCH COULD LAY THE BASIS FOR A COMMERCIAL MNA CRYSTAL GROWTH METHOD WHICH MIGHT ALSO BE APPLICABLE TO OTHER ORGANIC CRYSTALS.

COHERENT TECHNOLOGIES INC
PO BOX 7488
BOULDER, CO 80306
CONTRACT NUMBER:
SAMMY W HENDERSON
TITLE:
DEVELOPMENT OF A 10 mJ/PULSE 200 Hz DIODE LASER-PUMPED 2um TRANSMITTER FOR COHERENT LASER RADAR SYSTEMS
TOPIC# 92 OFFICE: AFWAL/AAOP IDENT#: 32873

SUBMITTED BY

MANY TACTICAL AND STRATEGIC REMOTE SENSING APPLICATIONS WOULD BENEFIT FROM A NARROW-BAND EFFICIENT EYESAFE SOLID-STATE LASER SOURCE. RECENT PROGRESS IN DIODE LASER-PUMPING OF THULIUM (Tm)- AND Tm:HOLMIUM (Ho)-DOPED SOLID-STATE LASERS HAS DEMONSTRATED THAT LOW POWER CW DEVICES CAN OPERATE AT OR NEAR ROOM TEMPERATURE VERY EFFICIENTLY. ANALYSIS INDICATES THESE LASERS SHOULD ALSO WORK WELL UNDER Q-SWITCHED OPERATION AT ROOM TEMPERATURE. AT THIS TIME, DEMONSTRATIONS OF Q-SWITCHING THESE MATERIALS UNDER DIODE-LASER-PUMPING HAVE NOT BEEN REPORTED. DURING THE PROPOSED PHASE I EFFORT, WE WILL PERFORM ANALYSIS AND EXPERIMENTS TO PROVE FEASIBILITY FOR THE DEVELOPMENT OF A PRACTICAL 10 mJ/PULSE 200-Hz DIODE LASER-PUMPED Q-SWITCHED Tm:YAG OR Tm:Ho:YAG LASER OPERATING AT ROOM TEMPERATURE OR COOLED SLIGHTLY BELOW ROOM TEMPERATURE USING THERMO-ELECTRIC COOLERS. THE FEASIBILITY EXPERIMENTS WILL INCLUDE A MATERIAL OPTIMIZATION PROGRAM IN WHICH THE Q-SWITCHED PERFORMANCE OF SEVERAL Tm:YAG AND Tm:Ho:YAG CRYSTALS WITH VARYING Tm AND Ho CONCENTRATION WILL BE COMPARED.

COLEMAN RESEARCH CORP
401 WYNN DR
HUNTSVILLE, AL 35805
CONTRACT NUMBER: F08635-89-C-0351
IRVIN L KRULAC

TITLE:
IMPACT OF EXTENDED STORAGE PERIODS ON VARIOUS ADVANCED COMPOSITE MATERIALS
TOPIC# 6 OFFICE: AD/PMR IDENT#: 31090

COMPOSITE MATERIALS ARE FORMULATED FROM COMBINATIONS OF FIBROUS AND SOLID (PLASTICS AND/OR METALS) WHICH ARE DESIGNED TO IMPROVE THE LIFE SPAN OF THE BASE MATERIAL. THIS STUDY WILL BE REQUIRED TO GATHER DATA ON STATE-OF-THE-ART COMPOSITE MATERIALS AND ESTABLISH A DATABASE TO DETERMINE THE ENVIRONMENTAL EFFECTS ON THESE MATERIALS IN LONG TERM STORAGE CONDITIONS. PRIMARILY, THESE MATERIALS ARE DESIGNED INTO AIR-TO-AIR (AIM) AND AIR-TO-GROUND (AGM) TYPE MISSILES. STORAGE ENVIRONMENTAL EFFECTS ON THE COMPOSITE MATERIALS ARE THE BASIS FOR THIS STUDY. THE FOLLOWING STEPS ARE TO BE PURSUED IN THIS STUDY: PERFORM A SEARCH OF GOVERNMENT AGENCY DATA FOR USE OF THIS

SUBMITTED BY

TYPE OF COMPOSITE MATERIAL. SOME EXAMPLES ARE: EPOXY FIBERGLASS, POLYIMIDE FIBERGLASS, EPOXY ARAMID FIBERGLASS, POLYIMIDE ARAMID FIBER, EPOXY QUARTZ (FUSED SILICA), POLYIMIDE QUARTZ (FUSED SILICA), FIBERGLASS/ARAMID FIBER COMPOSITE, FIBERGLASS/FEP, PORCELAINED COPPER INVAR CLAD (INVAR). IDENTIFY THE EFFECTS OF STORAGE CONDITIONS; ESTABLISH A DATABASE FOR THE VARIOUS PARAMETERS TO BE TESTED; PERFORM ANALYSES ON THE BEHAVIOR OF THE MATERIALS PROPERTIES; RECOMMENDED TESTS TO BE PERFORMED ON LONG TERM ENVIRONMENTAL STRESS EFFECTS, AND SELECT LABORATORY EQUIPMENT AND DESIGN TESTS TO BE PERFORMED.

COLORADO BIOTECHNOLOGY ASSOCS

PO BOX 3042

CASPER, WY 82602

CONTRACT NUMBER:

DR RODGER A RAUBACH

TITLE:

DERIVATIZED RESINS FOR PROTECTION AGAINST CHEMICAL AGENTS

TOPIC# 80 OFFICE: HSD/SORT IDENT#: 39405

THE USE OF DERIVATIZED POLYSTYRENE RESINS FOR ABSORPTION AND CHEMICAL NEUTRALIZATION OF CHEMICAL AGENTS IS PROPOSED. DERIVATIZED RESINS WILL BE SYNTHESIZED AND EVALUATED FOR THEIR ABILITY TO BOTH ABSORB AND TO CHEMICALLY NEUTRALIZE TOXIC CHEMICAL AGENTS SUCH AS SULFUR MUSTARDS AND ORGANOFUOROPHOSPHATES. IT IS ANTICIPATED THAT USE OF SUCH DERIVATIZED RESINS WILL YIELD IMPROVED DECONTAMINATION OF SENSITIVE EQUIPMENT, IMPROVED FILTERS IN RESPIRATORY APPARATUS AND IMPROVED PROTECTIVE CLOTHING FOR USE IN A CHEMICAL ENVIRONMENT. COMMERCIAL DEVELOPMENT OF THIS TECHNOLOGY MAY PROVIDE IMPROVED PROTECTION FOR FACTORY WORKERS OR OTHERS WHO MAY BE AT RISK FOR EXPOSURE TO REACTIVE CHEMICAL AGENTS.

COMPLEX INC

4749 TIPTON

TROY, MI 48098

CONTRACT NUMBER: F08635-89-C-0419

SCOTT A BECK

TITLE:

PLASTIC REPLACEMENTS FOR ALUMINUM EXTRUSIONS

TOPIC# 20 OFFICE: AD/PMR IDENT#: 31237

SUBMITTED BY

DUE TO RISING COSTS OF ALUMINUM, MILITARY CONTAINERS USING ALUMINUM EXTRUSIONS WILL BE STUDIED TO DETERMINE IF PLASTICS CAN ACHIEVE A COST AND WEIGHT EFFECTIVE REPLACEMENT OF TYPICAL PROFILES. BOTH THERMOPLASTICS (TP) AND THERMOSETS (TS) CAN BE MADE TO THE SAME PROFILES AS ALUMINUM EXTRUSIONS, BUT PERFORMANCE OF THE PROFILE WILL BE QUESTIONABLE. REINFORCEMENTS CAN BE ADDED IN THE FORM OF PARTICULATE OR FIBERS (CONTINUOUS, CHOPPED, OR MILLED) THAT CAN SUBSTANTIALLY IMPROVE PROPERTIES AND MAKE THE PROFILE PERFORM AS WELL AS ALUMINUM. OTHER CONCERNS SUCH AS WEATHERABILITY WILL BE ADDRESSED FOR THE MAJOR POLYMER CATEGORIES TO DETERMINE IF THE TWENTY YEAR LIFE EXPECTANCY IS FEASIBLE.

COMPUTER AIDED PLANNING & SCHEDULING INC
2900 PACES FERRY RD - BLDG D
ATLANTA, GA 30339
CONTRACT NUMBER:
WILLIAM G NULTY
TITLE:
AN INTEGRATED CONCEPT FOR SCHEDULING TRANSPORTATION NETWORKS
TOPIC# 244 OFFICE: AFOSR/XOT IDENT#: 34041

THE FOCUS OF THIS PROPOSED EFFORT IS THE INTEGRATION OF OPTIMIZATION, SIMULATION, HUMAN INTERACTION, AND EXPERT SYSTEMS TO ADDRESS THE PROBLEMS OF SCHEDULING TRANSPORTATION NETWORKS. TRANSPORTATION NETWORKS ARE THE FOUNDATIONAL STRUCTURES ASSOCIATED WITH THE MOVEMENT AND STORAGE OF MATERIAL. MILITARY TRANSPORTATION NETWORKS INCLUDE AIR NETWORKS SUCH AS THE ONE RUN BY THE MILITARY AIRLIFT COMMAND (MAC), AND GROUND TRANSPORTATION NETWORKS SUCH AS THOSE RUN BY THE MILITARY TRAFFIC MANAGEMENT COMMAND (MTMC). SCHEDULING TRANSPORTATION NETWORKS INVOLVES COMPLEX INTERACTIONS BETWEEN VARIOUS SYSTEM ELEMENTS. TRADITIONALLY, MATHEMATICAL OPTIMIZATION BASED METHODS AND SIMULATION HAVE BEEN VIEWED AS COMPETING APPROACHES FOR SOLVING SCHEDULING PROBLEMS. WHILE THESE CONCEPTS IN ISOLATION HAVE SERIOUS LIMITATIONS, THE INTEGRATION OF OPTIMIZATION AND SIMULATION UNDER A KNOWLEDGE BASED SYSTEM, ALSO OUR ABILITY TO SOLVE THESE PROBLEMS, VALIDATE AND INTERPRET THE SOLUTIONS RETURNED BY THE MODELS, AND MAKE SCHEDULING REFINEMENTS IN RESPONSE TO THE REAL WORLD EXECUTION OF THE SCHEDULES.

SMALL BUSINESS INNOVATION RESEARCH (SBIR) PROGRAM - PHASE 1
BY SERVICE
FISCAL YEAR 1989
AF

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SUBMITTED BY

CONCEPT ANALYSIS CORP
14789 KEEL ST
PLYMOUTH, MI 48170
CONTRACT NUMBER: F04611-89-C-0043
DR DAVE ROURK
TITLE:
DETERMINATION OF THE FEASIBILITY OF FABRICATING ROLL UP
SELF-DEPLOYING SPACE STRUCTURES
TOPIC# 188 OFFICE: AFAL/TSTR IDENT#: 38860

CONCEPT ANALYSIS CORPORATION (CAC) PROPOSES TO DETERMINE THE FEASIBILITY OF FABRICATING SELF DEPLOYING SPACE STRUCTURES WHICH DO NOT USE ACTUATORS. IN PHASE I, CAC WILL EVALUATE THE CHARACTERISTICS OF THE PLASTIC MEMORY PHENOMENA WHICH COULD BE USED AS A SELF DEPLOYING MECHANISM. PHASE II IS ENVISIONED FOR DEVELOPMENT AND FULL SCALE TESTING. PLASTIC MEMORY IS RECOGNIZED AS THE TENDANCY OF A STRUCTURE TO RETURN TO ITS ORIGINAL SHAPE AFTER BEING DEPLOYED UNDER LOAD AND HEAT. COMPACT ROLLABILITY FOR SPACE TRAVEL, THEN SELF DEPLOYMENT ARE THE GOALS AT WHICH PLASTIC MEMORY IS AIMED. THERMOPLASTIC MATERIALS ARE PROPOSED BECAUSE OF THREE GENERAL PROPERTIES; REFORMABILITY, PLASTIC MEMORY RETENTION, AND HIGH IMPACT RESISTANCE. CAC BELIEVES THESE PROPERTIES ALLOW THERMOPLASTIC COMPOSITES THE BEST CHANCE OF FULFILLING MISSION REQUIREMENTS. THE MATRIX MATERIALS PROPOSED FOR THIS PHASE I INVESTIGATION ARE POLYETHER ETHER KETON (PEEK) AND POLYBUTYLENE TERAPHTHALATE (PBT). THESE POLYESTERS ARE PROPOSED BECAUSE THEY ARE NOT RADIATION SENSITIVE, HAVE LOW MOISTURE ABSORPTION AND EXHIBIT A LARGE DIFFERENCE IN THEIR RESPECTIVE GLASS TRANSITION TEMPERATURE (A STUDY VARIABLE). LOW MODULUS GRAPHITE IS PROPOSED AS THE FIBER MATERIAL IN ORDER TO PROMOTE MEMORY RETENTION.

CONTINENTAL SYSTEMS TECHNOLOGY CORP
1017 MANSELL RD
ROSWELL, GA 30076
CONTRACT NUMBER: F33657-89-C-2269
JOHN T (JACK) STITZEL
TITLE:
PRIMARY AIRCRAFT TRAINER SYSTEM (PATS) ALTERNATIVES/REQUIREMENTS
DEFINITION
TOPIC# 167 OFFICE: ASD/XRX IDENT#: 32293

SMALL BUSINESS INNOVATION RESEARCH (SBIR) PROGRAM - PHASE 1
BY SERVICE
FISCAL YEAR 1989
AF

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THE ADVENT OF THE SPECIALIZED UNDERGRADUATE PILOT TRAINING SYSTEM (SUPT), AND THE AGE OF THE T-37 AIRCRAFT CURRENTLY USED IN USAF PRIMARY TRAINING, REQUIRE THAT DECISIONS BE MADE WHICH WILL MOVE THE TRAINING INTO THE 21ST CENTURY. THE AIRCRAFT MUST BE PART OF A TOTAL TRAINING SYSTEM THAT WILL INTERFACE WITH THE RECONNAISSANCE-ATTACK-FIGHTER TRAINING SYSTEM (RAFTS) AND THE TANKER-TRANSPORT TRAINING SYSTEM (TTTS). THE SUPT HAS NOT YET BEEN FULLY DEFINED. WHILE THERE IS AN URGENCY TO REPLACE/MODIFY THE T-37 AIRCRAFT FOR PATS, THERE ARE A MULTITUDE OF EXISTING AND PROPOSED TRAINING AIRCRAFT OF DIVERSE CHARACTERISTICS TO BE EVALUATED FOR THE REPLACEMENT ROLE. CRITERIA WILL BE DEVELOPED TO HELP COMPARE THESE CANDIDATES RATIONALLY. THE BIDDER'S DETAILED APPRECIATION OF ALL THE ELEMENTS OF A TRAINING SYSTEM AND HOW THEY CONTRIBUTE TO THE TRAINING PROCESS, ASSURES THE AIR FORCE OF VALUABLE SUPPORT TO THE DECISION-MAKING PROCESS FOR PATS.

CREARE INC
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HANOVER, NH 03755
CONTRACT NUMBER: F33615-89-C-2927
DR VICTOR IANNELLO
TITLE:
HIGH TEMPERATURE MAGNETIC BEARINGS FOR TURBINE ENGINES
TOPIC# 152 OFFICE: AFWAL/POMP IDENT#: 33223

A SIGNIFICANT GAIN IN PERFORMANCE AND REDUCTION IN WEIGHT IS AFFORDED BY INCREASING THE OPERATING TEMPERATURES OF TURBINE ENGINES. PRESENT LIQUID-LUBRICATED BEARINGS ARE A MAJOR OBSTACLE IN ACHIEVING THIS GOAL DUE TO TEMPERATURE LIMITATIONS OF THE OIL LUBRICANT. MAGNETIC BEARINGS OFFER AN ATTRACTIVE ALTERNATIVE IN THAT THEIR CONTACT-FREE OPERATION ELIMINATES THE NEED FOR BEARING LUBRICATION. CREARE PROPOSES TO DEVELOP AN ACTIVE MAGNETIC BEARING CAPABLE OF HIGH TEMPERATURE OPERATION. THE INNOVATION LIES IN A HIGH TEMPERATURE OPTICAL POSITION SENSOR FOR THE SHAFT, AS WELL AS A BEARING CONFIGURATION THAT SUPPORTS BOTH AXIAL AND RADIAL LOADS. THE FEASIBILITY OF THE CONCEPT WILL BE ASSESSED DURING PHASE I OF THE PROJECT. PRELIMINARY ANALYSES WILL BE PERFORMED, AND CANDIDATE HIGH TEMPERATURE MATERIALS ASSESSED. THE RESULT OF PHASE I WILL BE

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A PRELIMINARY DESIGN FOR THE BEARING AND ITS ASSOCIATED CONTROL CIRCUITRY. IF SHOWN FEASIBLE, THE PROTOTYPE BEARING WILL BE BUILT AND TESTED AT PROTOTYPICAL OPERATING TEMPERATURES IN PHASE II.

CREARE INC
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CONTRACT NUMBER: F33615-89-C-3404
DR JAVIER A VALENZUELA
TITLE:
HEAT EXCHANGER FOR SENSOR SYSTEM CRYOCOOLERS
TOPIC# 107 OFFICE: AFWAL/FIOP IDENT#: 33599

THE OVERALL CYCLE EFFICIENCY (HENCE, INPUT POWER REQUIREMENTS) OF REVERSE-BRAYTON CRYOCOOLERS FOR SPACE APPLICATIONS IS HIGHLY SENSITIVE TO THE THERMAL EFFECTIVENESS OF THE HEAT EXCHANGERS. APPLICATIONS FOR THESE CRYOCOOLERS IN SPACE DICTATE THAT THESE HEAT EXCHANGERS BE AS SMALL AND LIGHT AS POSSIBLE. TO DATE, ONLY HEAT EXCHANGERS EMPLOYING ORGANIC MATERIALS HAVE BEEN ABLE TO ACHIEVE THE HIGH THERMAL EFFECTIVENESS VALUES REQUIRED FOR THESE SYSTEMS WITHIN THE DESIRED SIZE AND WEIGHT LIMITATIONS. HOWEVER, HEAT EXCHANGERS WITH ORGANIC MATERIALS DEGRADE CYCLE PERFORMANCE BY LEAKAGE AND SYSTEM CONTAMINATION THUS LIMITING THE LIFE OF THE SYSTEM. THEREFORE, A COMPACT, ALL-METAL EXCHANGER WITH HIGH THERMAL EFFECTIVENESS IS HIGHLY DESIRABLE. THIS PROPOSAL DESCRIBES A PROGRAM TO DEVELOP AN ULTRA-LIGHT, HIGH PERFORMANCE HEAT EXCHANGER FOR SPACE-BORNE CRYOCOOLERS. THE PROPOSED HEAT EXCHANGER WOULD HAVE ALL-METAL CONSTRUCTION TO AVOID CONTAMINATION OF THE WORKING GAS AND WOULD BE CAPABLE OF ACHIEVING EFFECTIVENESS BETTER THAN 0.99 WITH A SPECIFIC MASS OF LESS THAN 0.1 kg/(W/K). THIS REPRESENTS A FACTOR OF TWO REDUCTION IN THERMAL LOSSES OVER THE BEST ALL-METAL HEAT EXCHANGER BUILT TO DATE AND TWO ORDERS OF MAGNITUDE REDUCTION IN SPECIFIC MASS. IN PHASE I WE WILL DEMONSTRATE THE FEASIBILITY OF FABRICATING THE PROPOSED HEAT EXCHANGER AND DESIGN A PROTOTYPE HEAT EXCHANGER TO BE BUILT AND TESTED IN PHASE II.

CREARE INC
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CONTRACT NUMBER: F41622-89-C-0022
WALTER L SWIFT
TITLE:
MINIATURE GAS BEARING TURBOEXPANDER FOR AIRCRAFT ON-BOARD OXYGEN GENERATING SYSTEMS
TOPIC# 68 OFFICE: HSD/SORT IDENT#: 34813

SUBMITTED BY

THIS PROJECT ADDRESSES THE NEED FOR EFFICIENT AND EFFECTIVE SUPPLY OF OXYGEN ON BOARD COMBAT AND TRANSPORT AIRCRAFT. THE PROPOSED EFFORT SPECIFICALLY INVOLVES THE DEVELOPMENT OF A MINIATURE HIGH SPEED TURBOEXPANDER FOR A HYBRID OXYGEN SYSTEM FOR ON-BOARD OXYGEN GENERATION AND STORAGE. THE TURBOEXPANDER IS A CRITICAL COMPONENT IN AN OPEN CYCLE REFRIGERATION STAGE WHICH USES ENGINE BLEED AIR TO LIQUEFY OXYGEN SUPPLIED FROM AN OXYGEN CONVERTER. IN PHASE I, THE PRELIMINARY DESIGN OF THE TURBOEXPANDER WILL BE ESTABLISHED. THE KEY ISSUES TO BE ADDRESSED INCLUDE THE TURBOEXPANDER'S PERFORMANCE AND THE ROBUSTNESS OF THE GAS BEARING SYSTEM OVER THE RANGE OF ANTICIPATED OPERATION IN THE OPEN CYCLE ENVIRONMENT.

CREW SYSTEMS CONSULTANTS

PO BOX 926

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CONTRACT NUMBER: F33615-89-C-3804

RICHARD L NEWMAN

TITLE:

COCKPIT SITUATIONAL AWARENESS: FLIGHT EXPERIMENT DESIGN

TOPIC# 112 OFFICE: AFWAL/FIOP IDENT#: 33646

REPORTS ON ACCIDENTS OF MODERN MILITARY FIGHTERS INCREASINGLY IMPLICATE PILOT DISORIENTATION AS A FACTOR. WHILE SPATIAL DISORIENTATION OF PILOTS HAS BEEN A PROBLEM IN AVIATION SINCE THE BEGINNINGS OF INSTRUMENT FLIGHT, IT HAS BEEN A GROWING CONCERN IN HIGH PERFORMANCE JET COCKPITS. THE HEAD-UP DISPLAY (HUD) HAS BEEN IMPLICATED AS A CONTRIBUTOR TO DISORIENTATION. RECENT RESEARCH HAS DEVELOPED SEVERAL HUD SYMBOLOGIES WHICH HOLD PROMISE FOR MINIMIZING SUSCEPTIBILITY TO DISORIENTATION. A PROGRAM TO CONDUCT FLIGHT TESTS OF A PROGRAMMABLE HUD HAS BEEN PROPOSED. THIS PROGRAM WILL CONDUCT AN INFLIGHT EVALUATION OF CANDIDATE SYMBOLOGIES UNDER BOTH VISUAL AND SIMULATED INSTRUMENT CONDITIONS. AT THE SAME TIME THESE INFLIGHT SYMBOLOGY EVALUATIONS ARE BEING CONDUCTED, HUD-SPECIFIC INSTRUMENT FLIGHT TECHNIQUES WILL BE TESTED AND EVALUATED. PHASE I OF THIS PROGRAM WILL PREPARE A FLIGHT TEST PLAN, BASED ON PREVIOUS AND CURRENT HUD RESEARCH. THE ACTUAL FLIGHT TESTS WILL BE CONDUCTED DURING PHASE II.

CRYSTALLUME

125 CONSTITUTION DR

MENLO PARK, CA 94025

CONTRACT NUMBER:

DR K V RAVI

TITLE:

POLYCRYSTALLINE DIAMOND JFETS

TOPIC# 219 OFFICE: BMO/MYSC IDENT#: 32626

SUBMITTED BY

THE OBJECTIVE OF THIS PROGRAM IS TO DETERMINE THE FEASIBILITY OF AN ALL DIAMOND JUNCTION FIELD EFFECT TRANSISTOR (JFET). THIS DEVICE IS CONSTRUCTED FROM LARGE GRAIN (5-10 MICRONS), DOPED CVD DIAMOND FILMS AND INCORPORATES GRAIN BOUNDARY PASSIVATION WITHIN THE ACTIVE CHANNEL REGION. CURRENT FLOW IN THE JFET IS CONFINED TO THE SINGLE CRYSTAL REGIONS IN THE POLYCRYSTALLINE FILM ELIMINATING THE IMPACT OF GRAIN BOUNDARY SCATTERING ON DEVICE SPEED. THE DEVICE IS CONSTRUCTED WITH A THICK (2-10 MICRON) SUBSTRATE LAYER OF COMPENSATED CVD DIAMOND, A BORON DOPED CHANNEL AND A NITROGEN DOPED GATE. A DIAMOND JFET WILL HAVE A BUILT IN VOLTAGE OF APPROXIMATELY 4.0 VOLTS AND IS WELL MATCHED TO THE BANDGAP OF DIAMOND SO AS TO ALLOW VERY HIGH TEMPERATURE OPERATION WHILE ALSO OPERATING AT ROOM TEMPERATURE. IN THIS PROPOSED DEVICE CONFIGURATION THE N+ DIAMOND GATE ALSO FUNCTIONS AS A GATE INSULATOR ALLOWING LARGE VOLTAGE SWINGS OF EITHER POLARITY WITHOUT CONDUCTING SIGNIFICANT CURRENT. THE NITROGEN DOPED GATE LAYER FUNCTIONS AS BOTH GRAIN BOUNDARY AND DEVICE PASSIVATION LAYER.

CRYSTALLUME

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CONTRACT NUMBER:

DR K V RAVI

TITLE:

DIAMOND-SILICON HETEROSTRUCTURE BIPOLAR TRANSISTORS USING
POLYCRYSTALLINE CVD DIAMOND FILMS

TOPIC# 219 OFFICE: BMO/MYSC IDENT#: 32627

IN ORDER TO BEST USE NEW GENERATION CVD DIAMOND FILMS FOR ADVANCED ELECTRONIC APPLICATIONS, WE PROPOSE COMBINING DIAMOND THIN FILMS WITH SINGLE CRYSTAL SILICON TO PRODUCE DIAMOND-SILICON HETEROSTRUCTURE (DSH) BIPOLAR TRANSISTORS FOR INCREASED PERFORMANCE. DIAMOND-SILICON HETEROSTRUCTURE OFFER THE POSSIBILITY OF HIGH SPEED, HIGH DENSITY BIPOLAR DEVICES COMPATIBLE WITH COMMERCIAL SILICON SEMICONDUCTOR TECHNOLOGIES. THE OBJECTIVE OF THIS RESEARCH PROGRAM IS TO FABRICATE AND CHARACTERIZE DIAMOND-SILICON HETEROSTRUCTURE (DSH) BIPOLAR TRANSISTORS AS AN INITIAL STEP TOWARDS COMMERCIAL PRODUCTION OF DSH BIPOLAR INTEGRATED CIRCUITS. PHASE I WILL FOCUS

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ON THE MATERIAL ISSUES WHICH DETERMINE THE FEASIBILITY OF THIS APPROACH. IF FEASIBILITY IS SUCCESSFULLY DEMONSTRATED, PHASE II WILL BE DEVOTED TO FABRICATING AND CHARACTERIZING DSH BIPOLAR DEVICES. PHASE I ACTIVITIES INCLUDE: P-TYPE DOPING AND CHARACTERIZATION OF CVD DIAMOND FILMS; DETERMINATION OF DIAMOND MORPHOLOGY AND GRAIN BOUNDARY EFFECTS ON ELECTRONIC PROPERTIES; AND DEMONSTRATION AND CHARACTERIZATION OF PN HETEROJUNCTIONS COMPOSED OF P-TYPE DIAMOND ON N-TYPE SILICON.

CYBERCOM RESEARCH CORP (ICT34)
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PALO ALTO, CA 94306
CONTRACT NUMBER: F19628-89-C-0152
DR GENE HILBORN

TITLE:
SECURE DATA RELEASE/TRANSFER BETWEEN C3I SYSTEMS ACROSS SECURITY LEVEL BOUNDARIES
TOPIC# 32 OFFICE: ESD/AVP IDENT#: 31656

THE OBJECTIVE OF THIS R&D IS TO DEMONSTRATE THE FEASIBILITY OF PRODUCING AND USING, A FAMILY OF INEXPENSIVE, TRUSTED INTERFACE DEVICES TO SUPPORT CONTROLLED, SECURE TRANSFER OF DATA BETWEEN C3I SYSTEMS ACCREDITED TO OPERATE IN DEDICATED OR SYSTEM HIGH MODE AT UNEQUAL CLASSIFICATION LEVELS OR OTHER MANDATORY CONTROL CATEGORIES (E.G. SCI COMPARTMENTS, FOREIGN RELEASABILITY CONTROLS, AND OTHER SPECIAL ACCESS DESIGNATIONS). WITH THIS APPROACH, NO NEW HARDWARE OR SOFTWARE SECURITY REQUIREMENTS ARE IMPOSED ON THE PRIMARY MISSION ADP COMPONENTS. ALL ACCESS CONTROL POLICY REQUIREMENTS FOR THE INTERCONNECTIONS ARE ENFORCED BY THE TRUSTED INTERCONNECTING DEVICES. THE PHASE I EFFORT WILL SHOW HOW THESE RELATIVELY INEXPENSIVE GENERIC DEVICES CAN BE COMBINED WITH EXISTING ADP COMPONENTS (BOTH STAND ALONE AND NETWORKED) TO SUPPORT CONTROLLED, RELIABLE, AND SECURE SHARING OF INFORMATION ACROSS SECURITY LEVEL/CATEGORY BOUNDARIES. ARCHITECTURES, CONCEPTS, PRELIMINARY SPECIFICATIONS AND DESIGNS WILL BE PRODUCED FOR A BASELINE FAMILY OF GENERIC, TRUSTED INTERCONNECT DEVICES (TIDS).

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RAPID CITY, SD 57709
CONTRACT NUMBER: F33615-89-C-1097
DONALD K LEFEVRE

TITLE:
A NEW METHOD FOR LINEAR SEQUENCE GENERATOR CONFIGURATION ESTIMATION
TOPIC# 96 OFFICE: AFWAL/AAOP IDENT#: 32914

SUBMITTED BY

THERE IS A NEED TO IMPROVE RECEPTION OF AND SYNCHRONIZATION OF WIDEBAND SIGNALS OF UNKNOWN PARAMETERS. FURTHER DEVELOPMENT OF THE MATHEMATICAL THEORY OF THE ESTIMATION OF GENERATOR CONFIGURATIONS FROM THEIR OUTPUTS WILL HELP TO ACCOMPLISH THIS GOAL. A PROMISING APPROACH IS TO APPLY SHIFT-AND-ADD AND OTHER PROPERTIES OF LINEAR SEQUENCES TO THE DETERMINATION OF THE GENERATOR CONFIGURATION. A PROPOSED ESTIMATION METHOD, THE ATE ALGORITHM, OF CYNETICS CORP., PROMISES FAST ESTIMATION OF THE GENERATOR TAP CONFIGURATION WHILE USING RELATIVELY SIMPLE METHODS WHICH ARE WELL PROVEN IN OTHER APPLICATIONS. THE GOAL OF THE PROPOSED RESEARCH IS TO ANALYZE THE NEW ALGORITHM AND SO DETERMINE ITS FEASIBILITY. THIS WILL BE ACCOMPLISHED BY THEORETICAL ANALYSES AND LIMITED, SIMPLE COMPUTER SIMULATION. THIS RESEARCH IS ATTRACTIVE SINCE THE METHOD IS EXPECTED TO PERFORM WELL, BASED ON THE PAST EXPERIENCE WITH RELATED ALGORITHMS.

DCS CORP
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CONTRACT NUMBER: F33615-89-C-1085
PETE LAMBECK
TITLE:
DECOMPOSED INFRARED (IR) MODELING FOR MODEL BASED VISION (MBV)
TOPIC# 91 OFFICE: AFWAL/AAOP IDENT#: 32854

MODEL BASED VISION IS A PROMISING TECHNIQUE FOR RADAR AUTOMATIC TARGET RECOGNITION. ITS APPLICATION TO INFRARED IMAGERY HAS BEEN STYMIED BY TWO PROBLEMS. FIRST, MOST IR SIGNATURE MODELS WERE DEVELOPED FOR REDESIGN APPLICATIONS AND ARE NOT WELL SUITED FOR USE IN MODEL BASED VISION. SECOND, THERE HAS BEEN INSUFFICIENT OVERLAP BETWEEN THE AI MBV COMMUNITY AND THE IR MODELING COMMUNITY. DCS PROPOSES TO COMBINE THEIR EXPERIENCE IN IR MODELING FOR ATR WITH THE AI MBV EXPERIENCE OF ADS TO DETERMINE SPECIFIC WAYS TO INCORPORATE IR MODELS INTO THE SAR EXPERT MBV TEST BED SYSTEM. TO CREATE ACCURATE, EXPLICIT REPRESENTATIONS OF PHENOMENOLOGY AND OBJECTS SUITABLE FOR IMPLEMENTATION IN MBV, DCS WILL APPLY VALIDATED LUMPED PARAMETER THERMAL MODELING TECHNIQUES WHICH AVOID PROBLEMS ASSOCIATED WITH NODAL NETWORKS. BY CREATING AN INTERMEDIATE FEATURE SPACE AND MAKING

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SUPPORTABLE SIMPLIFYING ASSUMPTIONS, DECOMPOSITION OF TARGET AND BACKGROUND FEATURES WILL BE ACCOMPLISHED WHICH ALLOS REASONING AT MULTIPLE LEVELS OF GEOMETRIC AND SIGNAL LEVEL RESOLUTION, EXPLICITE UNCERTAINTY ESTIMATION (BASED UPON WEATHER CONDITIONS), AGGREGATE TARGET FEATURE PREDICTION, AND AUTOMATED HYPOTHESIS GENERATION AND RESOLUTION. ADS WILL DETERMINE THE CHANGES NECESSARY TO THE SAR EXPERT SYSTEM TO ACCOMMODATE THE THERMAL MODEL AND WILL PRODUCE AN IMPLEMENTATION PLAN.

DEFENSE ELECTROMAGNETIC ANALYSIS CO
5 MORaine CT
CHAMPAIGN, IL 61821
CONTRACT NUMBER:
SHUNG-WU LEE

TITLE:
RADAR SIGNATURE CALCULATIONS TO REENTRY VEHICLE'S ANTENNA WINDOWS
TOPIC# 220 OFFICE: BMO/MYSC IDENT#: 32635

FOR A CONE-SHAPED REENTRY VEHICLE, THE ANTENNA WINDOWS CAN BE THE NUMBER ONE CONTRIBUTOR TO THE VEHICLE'S RADAR SIGNATURE AT CERTAIN RESONNANCE FREQUENCIES. WE PROPOSE TO DEVELOP A COMPUTER MODEL FOR PREDICTING THE RADAR-CROSS-SECTION (RCS) OF THE ANTENNA WINDOW BASED ON AN EXACT MODE MATCHING TECHNIQUE IN ELECTROMAGNETIC THEORY. IN PHASE II, THIS CODE IS TO BE EXPANDED SO THAT THE RCS OF THE ENTIRE VEHICLE CAN BE ACCURATELY CALCULATED OVER A 10 : 1 FREQUENCY RANGE.

DELPHI RESEARCH INC
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ALBUQUERQUE, NM 87102
CONTRACT NUMBER:
DR PATRICK M DHOOGHE

TITLE:
DEVELOPMENT OF LOW INFRARED (IR) REFLECTING COATING FOR AEROSPACE APPLICATIONS
TOPIC# 208 OFFICE: AFWL/PRC IDENT#: 31902

THE AIR FORCE HAS A REQUIREMENT FOR PASSIVE ABSORBING COATINGS TO

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DEFEAT DETECTION BY MULTISPECTRAL ILLUMINATION. ORGANIC COATINGS CONTAINING A VARIETY OF FUNCTIONAL GROUPS CAN ABSORB INFRARED RADIATION ACROSS A BROAD WAVELENGTH RANGE. HOWEVER, THESE MATERIALS ARE DIFFICULT TO FORMULATE AND MAY HAVE A LIMITED ABILITY TO BE COLORED. AN EFFORT IS PROPOSED TO SYNTHESIZE A CLEAR, EASILY APPLIED ORGANIC MOLECULAR COATING CONTAINING A VARIETY OF FUNCTIONALITIES WHICH WILL ABSORB INFRARED RADIATION WITHOUT SIGNIFICANTLY AFFECTING THE COLORING SCHEME OR RADIATION-ABSORBING ABILITIES OF THE SUBSTRATE. THE TASKS IN THE EFFORT WILL BE TO SYNTHESIZE THE MATERIAL, PREPARE COATINGS ON TEST ARTICLES AND MEASURE THE TEST ARTICLES FOR INFRARED REFLECTION, TEMPERATURE TOLERANCE AND ADHESION.

DESILUBE TECHNOLOGY INC
904 BREEZEWOOD LN
LANSDALE, PA 19446
CONTRACT NUMBER: F33615-89-C-2940
JAMES P KING

TITLE:

SOLID LUBRICANTS FOR ADVANCED TURBINE ENGINE POWDER DELIVERY SYST
TOPIC# 154 OFFICE: AFWAL/POMP IDENT#: 33236

IN ORDER TO ACHIEVE THE TECHNOLOGY AND LIFE CYCLE GOALS TARGETS FOR THE ADVANCED TURBINE ENGINES OPERATING BETWEEN -60 DEG AND 1500 DEG F, SOLID LUBRICANTS OFFER A VIABLE APPROACH. DURABILITY LIMITATIONS FOR SUCH ENGINES RESULT FROM HIGH OPERATING TEMPERATURES AND THE ELIMINATION OF COOLING SYSTEMS. THESE FACTORS MINIMIZE THE EFFECTIVENESS OF CONVENTIONAL OIL OR GREASE LUBRICANT DUE TO THERMAL AND OXIDATION DEGRADATION. MOST OF THE CONVENTIONAL SOLID LUBRICANTS, SUCH AS MOLYBDENUM SULFIDE, GRAPHITE, LEAD OXIDE, ETC., EITHER POSSESS LOWER THAN THE DESIRED TEMPERATURE LIMIT OR PROVIDE LUBRICANT FOR A NARROW TEMPERATURE RANGE. A KEY ELEMENT FOR ACHIEVING THE DESIRED FRICTION AND WEAR PROPERTIES USED UNDER SEVERE OPERATING CONDITIONS IS TO IDENTIFY A SOLID LUBRICANT WHICH CAN EXHIBIT OUTSTANDING THERMAL AND OXIDATION STABILITIES, SHOW GOOD RESPONSE TO CERAMICS AND HIGH TEMPERATURE ALLOYS OVER A BROAD TEMPERATURE RANGE, AND PROVIDE GOOD LUBRICATING PROPERTIES BETWEEN -60 DEG AND 1500 DEG F. A CLASS OF EMERGING COMPLEX SULFUR-CONTAINING COMPOUNDS (E.G., OXYTHIOMOLYBDATES) IS AMONG THE PRIME CANDIDATES. TO FURTHER

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ENHANCE THE OXIDATION STABILITY OF THE IDENTIFIED SOLID LUBRICANTS AND TO IMPROVE DURABILITY FOR PROLONGED USAGE IN A RECIRCULATING POWDER DELIVERY SYSTEM, MICROENCAPSULATION OF THE SOLID LUBRICANT WITH A SUITABLE, HIGH TEMPERATURE INORGANIC COMPOSITION WILL BE INVESTIGATED.

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SOLANA BEACH, CA 92075
CONTRACT NUMBER:
DAVID M ZIMMERMAN
TITLE:
HARDENED HIGH VOLTAGE POWER SUPPLY FOR RING LASER GYROS
TOPIC# 222 OFFICE: BMO/MYSC IDENT#: 32662

IT IS THE PURPOSE OF THIS DEVELOPMENT EFFORT TO DESIGN, BUILD, AND VALIDATE A HIGH VOLTAGE POWER SUPPLY FOR A RING LASER GYRO. IT IS ALSO A REQUIREMENT OF THIS DEVELOPMENT EFFORT TO DESIGN A POWER SUPPLY THAT IS RADIATION HARDENED. THE HARDENING OF THE POWER SUPPLY SHALL BE ACCOMPLISHED BY APPROPRIATE DESIGN, SCREENING OF RADIATION RESISTANT PART TECHNOLOGIES, DESIGN ANALYSIS, AND RADIATION ENVIRONMENT VERIFICATION TESTING. DUE TO THE LIKELY MISSION REQUIREMENTS, IT IS NECESSARY THAT THE POWER SUPPLY SIZE, WEIGHT, AND POWER CONSUMPTION BE MINIMIZED. PARTICULAR ATTENTION SHALL BE GIVEN TO MINIMIZING THESE PARAMETERS. THIS SHALL BE ACCOMPLISHED BY ADVANCED POWER CONVERSION DESIGNS UTILIZING HIGH FREQUENCY/HIGH EFFICIENCY COMPONENTS.

DONMAR LTD
4 GRFTEL CT
NEWPORT BEACH, CA 92663
CONTRACT NUMBER: F08635-89-C-0380
A DONALD GOEDEKE
TITLE:
CHARACTERIZATION OF OPTICAL FIRE DETECTOR FALSE ALARM SOURCES AND DEVELOPMENT OF QUALIFICATION TEST PROCEDURES FOR IMMUNITY
TOPIC# 63 OFFICE: AFESC/RDXP IDENT#: 32018

SUBMITTED BY

OPTICAL FIRE DETECTORS (OFDS) THAT OPERATE IN UV AND/OR IR BANDS CAN "FALSE ALARM" TO NON-HYDROCARBON RADIATION EMISSIONS IN AND NEAR OPERATIONAL AIRCRAFT HANGERS, THEREBY CAUSING AUTOMATIC FIRE SUPPRESSION SYSTEMS (FPS) TO FALSE DUMP SUPPRESSANT AGENT INTO THE ATMOSPHERE. SUCH "ACCIDENTS" CAN RESULT IN THE INTERRUPTION OF INTEGRATED COMBAT TURNS AND OTHER OPERATIONS (CAUSING LONG DELAYS IN GETTING CRITICAL WEAPON SYSTEMS AIRBORNE). THEY CAN ALSO RESULT IN THE LACK OF FIRE PROTECTION FOR 12-24 HOURS OR MORE WHILE THE FPS IS BEING REFURBISHED, THUS RISKING FIRE EXPOSURE TO WEAPON SYSTEMS AND PERSONNEL. OFDS/OFD SUBSYSTEMS CAN BE MADE IMMUNE TO COMBINATIONS OF MOST RADIATION SOURCES AS LONG AS DESIGN SPECIFICATIONS AND QUALIFICATION TESTING PROCEDURES ARE PROVIDED TO INDUSTRY. AS OF THIS DATE NO DEFINITIVE LISTING AND CHARACTERIZATION OF FALSE ALARM SOURCES EXISTS, NOR DOES ANY SPECIFICATION OF TEST PROCEDURES. A USAF "STANDARD" IS NECESSARY FOR PROCUREMENTS OF AUTOMATIC FPS IN ORDER TO GUARANTEE ELECTRONIC AND SYSTEM MISSION SUCCESS RELIABILITIES REQUIRED FOR THESE SYSTEMS IN ALL OPERATIONAL HANGARS. THIS PROGRAM WILL RESULT IN SUCH SPECIFICATIONS AND PROVIDE THE USAF WITH UNIFORMITY IN OFD PROCUREMENTS AS WELL AS PROVEN RELIABILITY AND FALSE ALARM IMMUNITY.

DOYLE B MATERIALS TECHNOLOGY
3 CLIFTON RD
NATICK, MA 01760
CONTRACT NUMBER: F41622-89-C-0028
BRIAN DOYLE
TITLE:
IMPROVED ANTI-G GARMENT MATERIALS AND DESIGNS
TOPIC# 68 OFFICE: HSD/SORT IDENT#: 34863

WORK IS PROPOSED TO IMPROVE ANTI-G GARMENT COVERAGE AND RESPONSE TIME THROUGH THE DEVELOPMENT OF LOW STRETCH FABRICS. THE TECHNOLOGY FOR THIS CLOTH IS UNCOMMON IN THE TEXTILE INDUSTRY AS A WHOLE, BUT IS COMMONLY PRACTICED IN THE SMALL, SPECIALIZED BUSINESS OF SAILCLOTH. THE DEVELOPMENT OF THIS CLOTH IS EXPECTED TO CREATE THE POTENTIAL FOR IMPROVEMENTS IN THE DESIGN OF THE GARMENTS. IMPROVEMENTS IN ATTACHMENT, DONNING, AND FIT ADJUSTMENTS ARE EXPECTED THROUGH THE USE OF BUCKLES AND FASTENERS IN PLACE OF ZIPPLERS. THIS IS MADE

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POSSIBLE WITH SAILCLOTH-LIKE MATERIAL WHICH CAN SPREAD THE PRESSURE FROM SUCH POINT LOADS. DEVELOPMENT OF HEAT SEALABLE LAMINATES WITH THE NEW FABRIC IS EXPECTED TO LEAD TO MORE SIMPLE GARMENT DESIGNS WITH FEWER COMPONENTS AND LAYERS OF MATERIAL.

DYNA EAST CORP
3201 ARCH ST
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CONTRACT NUMBER: F08635-89-C-0450
RICHARD M WEST
TITLE:
METAL ACCELERATION BY MULTI-POINT INITIATION
TOPIC# 10 OFFICE: AD/PMR IDENT#: 31140

IN THE DESIGN AND ANALYSIS OF MULTI-POINT INITIATED WARHEAD SYSTEMS CURRENT WORK CENTERS ON FULL-SCALE TESTING OF WARHEADS AND ON THREE-DIMENSIONAL HYDROCODE SIMULATION. RECENTLY AT DYNA EAST DEVELOPMENT OF SIMPLE ANALYTICAL MODELS WAS INITIATED TO PROVIDE FIRST-CUT DESIGN TOOLS AND PERFORM PARAMETRIC SENSITIVITY STUDIES. ALL DESIGN TOOLS SUFFER FROM A LACK OF ACCURACY IN PREDICTING THE MACH INTERACTION AND METAL ACCELERATION DUE TO A NON-UNIFORM PRESSURE FIELD. THE OBJECTIVE OF THE PROPOSED PHASE I PROGRAM IS TO DEVELOP A SIMPLE EXPERIMENTAL METHOD FOR ANALYZING THE MACH INTERACTION AND METAL ACCELERATION BY NON-UNIFORM PRESSURE FIELDS IN EXPLOSIVES. A COST-EFFICIENT APPROACH WITH WIDE APPLICABILITY WILL BE SOUGHT SO ALL IMPORTANT EFFECTS CAN BE STUDIED. THE DATA GENERATED FROM THE EXPERIMENTS WILL PROVIDE A MEANS FOR EVALUATION AND IMPROVEMENT OF ANALYTICAL PREDICTIVE TOOLS.

E-TEK DYNAMICS INC
1885 LUNDY AVE
SAN JOSE, CA 95131
CONTRACT NUMBER: F08635-89-C-0375
J J PAN
TITLE:
INNOVATIVE METHODS FOR FABRICATION AND POLISHING ON CONICAL FIBER OPTIC ARRAYS
TOPIC# 15 OFFICE: AD/PMR IDENT#: 31203

SUBMITTED BY

OPTICAL PHASED-ARRAY USING SEMICONDUCTOR LASERS PROVIDES EXCELLENT AIR-TO-AIR, AIR-TO-SURFACE AND SPACE TARGET DETECTION/TRACKING/POINT SYSTEMS. THE DOME ARRAY USING OPTIC FIBERS AND LASER DIODES HAS HEMISPHERICAL FIELD-OF-VIEW, NANOSECOND BEAM STEERING SPEED, 0.02 METER RANGE RESOLUTION, AND TRACKING/POINTING/DETECTION DISTANCE UP TO SEVERAL THOUSAND KILOMETER. IN PHASE I, E-TEK WILL PROVIDE AN OPTIMAL POLISHING AND ASSEMBLING TECHNIQUE TO CONSTRUCT FIBER OPTIC DOME OR CONICAL ARRAY USING THE SUBARRAY APPROACH. E-TEK WILL ALSO DEVELOP FIBER MICROLENS FABRICATION AND ANTI-REFLECTION COATING TECHNIQUES TO IMPROVE COUPLING EFFICIENCY AND REDUCE INTERNAL REFLECTION. LOW COST 1xN FIBER COUPLERS (N UP TO 200) PERFORMANCE WILL BE IMPROVED FOR MASTER LASER AND SLAVE LASERS INJECTION-LOCKING. THE PHASE I R&D RESULTS WILL DIRECTLY LEAD TO OPTICAL DOME PHASED-ARRAY FABRICATION, INTEGRATION, EVALUATION AND DEMONSTRATION FOR TARGET DETECTION.

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CONTRACT NUMBER:
J J PAN
TITLE:
HIGH MODULATION RATE OPTICAL TRANSMITTER
TOPIC# 40 OFFICE: RADC/XPX IDENT#: 31473

ANTENNA REMOTING, PHASED-ARRAY ANTENNA AND SIGNAL PROCESSING FOR COMMUNICATIONS, RADARS AND ELECTRONIC WARFARE REQUIRE FIBER OPTIC COMPONENTS/TRANSMITTER/RECEIVER OPERATING FREQUENCY UP TO 60 GHz. FIBER OPTIC TRANSMITTERS AND RECEIVER (Tx/Rx) HAVE BEEN DEMONSTRATED BY E-TEK UP TO 30 GHz. THE Tx/Rx OPERATING IN FREQUENCY RANGE OF 30-60 GHz SHALL HAVE HIGH SENSITIVITY, WIDE DYNAMIC RANGE, GOOD SNR, AND REQUIRING LOW RF DRIVING POWER. DURING PHASE I R&D, E-TEK WILL INVESTIGATE AND ANALYZE VARIOUS EOMS AND LASERS OPERATING IN 40-60 GHz REGION. SPECIAL PACKAGE TECHNIQUE WILL BE STUDIED IN 40-60 GHz RANGE TO MINIMIZE PARASITIC EFFECTS. DEVICES CHARACTERIZATION AND NONLINEARITY/NOISE IN REDUCTION ARE ALSO TO BE INVESTIGATED IN 40-60 GHz BAND. THE OPTICAL DEVICE AND TRANSMITTER DESIGNS WILL DIRECTLY LEAD TO PHASE II HARDWARE FABRICATION, EVALUATION AND DEMONSTRATION.

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E-TEK DYNAMICS INC
1885 LUNDY AVE
SAN JOSE, CA 95131
CONTRACT NUMBER:
J J PAN
TITLE:
CONFORMAL OPTICAL FOCUSING ELEMENTS FOR LASER COMMUNICATION
TOPIC# 41 OFFICE: RADC/XPX IDENT#: 31477

AIRCRAFT COMMUNICATIONS AND SPACECRAFT MULTI-ACCESS COMMUNICATIONS REQUIRE HIGH GAIN, CONFORMAL, WIDE FIELD-OF-VIEW (FOV) RECEIVING OPTION WITHOUT BULKY TELESCOPE. E-TEK WILL INVESTIGATE, DESIGN AND COMPARE THREE SOUND APPROACHES: a. CURVED BELT OR DOME OPTICAL PHASED ARRAY USING WAVEFRONT SENSING AND OPTICAL PHASE SHIFTERS; b. CURVED PHASED ARRAY USING ELECTRONIC PROCESSING, AND c. HOLOGRAPHIC FOCUSING ELEMENTS. THE BELT OR DOME ARRAY PROVIDES NUMEROUS ADVANTAGES AND MORE THAN 180 FOV. ONE OR TWO OPTICAL APPROACHES WILL BE SELECTED FOR PHASE II HARDWARE FABRICATION, EVALUATION AND DEMONSTRATION.

E-TEK DYNAMICS INC
1885 LUNDY AVE
SAN JOSE, CA 95131
CONTRACT NUMBER: F33615-89-C-1078
J J PAN
TITLE:
MINIATURE BROADBAND CIRCULATOR
TOPIC# 87 OFFICE: AFWAL/EL IDENT#: 32826

IN PHASE I, E-TEK WILL INVESTIGATE THREE SOUND DESIGN APPROACHES TO DEVELOP THE MINIATURE BROAD-BAND CIRCULATOR WITH PHYSICAL SIZE OF 0.16"x0.325"x0.75", FREQUENCY RANGE OF 6-18 GHz, SUBSTRATE THICKNESS OF 10 MILS, INSERTION LOSS OF LESS THAN 1 dB AND ISOLATION GREATER THAN 15 dB. THE FIRST APPROACH IS TO OPTIMIZE THE FIELDS, UNIFORMITY OF THE RESONATOR TO ACHIEVE A BROAD BANDWIDTH. THE SECOND APPROACH IS TO VARY THE RESONATOR'S SHAPE OR CONFIGURATION

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TO ACHIEVE A BROAD BANDWIDTH. THE THIRD APPROACH IS TO DEVELOP A WIDEBAND MINIATURE FOUR-PORT LANGE COUPLER-CIRCULATOR WITH E-TEK'S MANY YEARS OF EXPERIENCE AND KNOW-HOW IS DEVELOPING HIGH FREQUENCY, BROADBAND MICROSTRIP CIRCULATORS, PHASE I INVESTIGATION WILL DIRECTLY LEAD TO PHASE II HARDWARE IMPLEMENTATION, EVALUATION AND DEMONSTRATION.

EIC LABS INC
111 DOWNEY ST
NORWOOD, MA 02062
CONTRACT NUMBER: F08635-89-C-0349
MICHAEL M CARRABBA
TITLE:
A REAL-TIME HAZARDOUS CHEMICAL EMISSION RATE MONITORING INSTRUMEN
TOPIC# 59 OFFICE: AFESC/RDXP IDENT#: 31976

LEAKS OF HYPERGOLIC PROPELLANTS AS WELL AS OTHER HAZARDOUS CHEMICALS (E.G., AMONIA, CHLORINE, HYDROGEN FLUORIDE, AND HYDROGEN SULFIDE) CAN PRESENT SIGNIFICANT HAZARDS TO THE SAFETY OF CIVILIAN AND AIR FORCE PERSONNEL. IN THE CASE OF AN ACCIDENTAL RELEASE, THE TOXIC NATURE OF THESE MATERIALS REQUIRES THE ACCURATE KNOWLEDGE OF BOTH THE SOURCE AND DOWNWIND CONCENTRATIONS. THE GOAL OF THE PROPOSED WORK IS THE DEVELOPMENT OF A SENSITIVE, "REAL-TIME" MONITOR FOR THE MEASUREMENT OF EMISSIONS OF HYPERGOLIC AND HAZARDOUS CHEMICAL GASES AT BOTH THE SOURCE AND DOWNWIND LOCATIONS. THE SENSING TECHNIQUE IS BASED ON SURFACE ENHANCED RAMAN SPECTROSCOPY (SERS). THE SERS TECHNIQUE, WHICH CORRESPONDS TO THE VIBRATIONAL SPECTRUM OF A MOLECULAR ADSORBED ONTO SPECIFIC METAL OR METAL OXIDE SUBSTRATES, CAN BE USED FOR THE QUALITATIVE AND QUANTITATIVE ANALYSIS OF NUMEROUS COMPONENTS IN GASEOUS ENVIRONMENTS. THE GOAL OF THE PHASE I PROGRAM IS TO DEMONSTRATE THE FEASIBILITY OF DEVELOPING A RELIABLE SENSOR BASED ON SERS FOR THE "REAL-TIME" DETECTION OF HYPERGOLIC AND HAZARDOUS CHEMICALS. THE DESIGN AND TESTING OF ACTUAL INSTRUMENTS WILL BE UNDERTAKEN IN PHASE II.

EIC LABS INC
111 DOWNEY ST
NORWOOD, MA 02062
CONTRACT NUMBER: F41622-89-C-0015
MICHAEL M CARRABBA
TITLE:
A TRANSPORTABLE INSTRUMENT FOR REAL-TIME ON SITE ENVIRONMENTAL
MONITORING
TOPIC# 69 OFFICE: HSD/SORT IDENT#: 34740

SUBMITTED BY

THE OBJECTIVE OF THIS PROGRAM IS TO DEVELOP A UNIVERSAL, TRANSPORTABLE INSTRUMENT FOR REAL-TIME IDENTIFICATION AND MONITORING OF HAZARDOUS CHEMICALS, IN BOTH GASEOUS AND AQUEOUS ENVIRONMENTS, FOR AIR FORCE APPLICATIONS. THE PROPOSED INSTRUMENT WOULD BE BASED ON NEAR-INFRARED SURFACE ENHANCED RAMAN SPECTROSCOPY (NIR-SERS). THE ON-SITE, REAL-TIME ANALYSIS CAPABILITIES IN BOTH GASEOUS AND LIQUID ENVIRONMENTS OF THE INSTRUMENT WILL PROVE A SUBSTANTIAL IMPROVEMENT IN BOTH TIME AND COST OVER CONVENTIONAL MONITORING METHODS. THE NIR-SERS WILL BE ACCOMPLISHED WITH A NEW SPECTROMETER DESIGN BASED ON HADAMARD TRANSFORM MULTIPLEXING TECHNIQUE AND NEAR INFRARED EXCITATION USING A DIODE PUMPED Nd:YAG LASER. THE PHASE I OBJECTIVE IS TO DEMONSTRATE A PROTOTYPE NIR-HT-SERS INSTRUMENT AND ITS APPLICATION TO ENVIRONMENTAL MONITORING. PHASE II WOULD HAVE THE GOAL OF DEVELOPING AND FIELD TESTING A ROBUST, PORTABLE INSTRUMENTATION USING COMPACT SOLID STATE LASER SOURCES AND A FIBER OPTIC EXCITATION/COLLECTION SYSTEM.

EIDETICS INTERNATIONAL INC
3415 LOMITA BLVD
TORRANCE, CA 90505
CONTRACT NUMBER: F33657-89-C-2247
ROBERT C ETTINGER

TITLE:

INNOVATIVE DISPLAY CONCEPTS FOR FIELD OF VIEW EXPANSION IN AIR
COMBAT SIMULATORS

TOPIC# 162 OFFICE: ASD/XRX IDENT#: 32418

RECENT ACQUISITIONS OF A DOMED SIMULATION WITH BACKGROUND, LASER AND HIGH RESOLUTION TARGET DISPLAYS AND GRAPHICS WORKSTATIONS FOR MANNED ADVERSARIES BY AFWAL/FIGD ARE AIMED AT INCREASING THEIR CAPABILITY TO EVALUATE AND REFINE DESIGN REQUIREMENTS FOR TACTICAL AIRCRAFT. THE CURRENT EMPHASIS FOR THIS EQUIPMENT IS BEYOND-VISUAL-RANGE (BVR) COMBAT TO SUPPORT THE INTEGRATED COCKPIT AVIONICS FOR AIR SUPERIORITY (ICAAS) PROGRAM. THE MANNED ADVERSARY COCKPITS WILL ALLOW EVALUATIONS TO CONSIDER THE EFFECTS OF MULTIPLE TARGETS IN A BVR ENVIRONMENT. FURTHER STUDIES WILL NEED TO ADDRESS THE TRANSITION FROM BVR TO WITHIN-VISUAL-RANGE (WVR) COMBAT AND THE TRUE M ON N CLOSE-IN COMBAT OF A LARGE SCALE AIR BATTLE. THE OBJECTIVE OF THIS SBIR PHASE I

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EFFORT IS TO DEVELOP AN ENHANCED FIELD-OF-VIEW (FOV) VISUAL DISPLAY CAPABLE OF CONDUCTING CREDIBLE CLOSE-IN COMBAT FROM A SINGLE CRT SCREEN. THREE SEPARATE AND UNIQUE FOV EXPANSION TECHNIQUES WILL BE EVALUATED AND A RECOMMENDED DISPLAY CONCEPT IDENTIFIED. THIS SBIR I EFFORT WILL LEAD TO DISPLAYS FOR LOW COST, MANNED, INTERACTIVE CREW STATIONS TO SUPPLEMENT EXISTING AND NEW AFWAL/FIGD SIMULATIONS WITH CREDIBLE MULTIPLE PARTICIPANTS. THESE LOW COST, INTERACTIVE, CREW STATIONS WOULD ALLOW TRUE M OR N AIR BATTLE SIMULATIONS FROM BVR TO WVR CLOSE-IN MANEUVERING TO PROPERLY EVALUATE NEW TECHNOLOGY CONCEPTS AT AN AFFORDABLE COST.

EIDETICS INTERNATIONAL INC
3415 LOMITA BLVD
TORRANCE, CA 90505
CONTRACT NUMBER: F33657-89-C-2249
JAY W VAN PELT

TITLE:
INNOVATIVE TACTICS ENHANCEMENT TO THE ADVANCED AIR-TO-AIR SYSTEM
PERFORMANCE EVALUATION MODEL (AASPEN) PILOT DECISION LOGIC
TOPIC# 162 OFFICE: ASD/XRX IDENT#: 32419

THE ADVANCED AIR-TO-AIR SYSTEMS PERFORMANCE EVALUATION MODEL (AASPEN) IS A COMPREHENSIVE, DIGITAL, MULTI-AIRCRAFT ENGAGEMENT MODEL DEVELOPED BY THE BOEING MILITARY AIRCRAFT COMPANY FOR THE USAF. THIS MODEL EMPHASIZES BEYOND VISUAL RANGE (BVR) COMBAT. THE WITHIN-VISUAL-RANGE (WVR) OR CLOSE-IN COMBAT PORTION OF AASPEN IS A CARRY OVER FROM AN EARLIER MODEL, PACAM V. RESULTS OF STUDIES CONDUCTED BY EIDETICS INTERNATIONAL FOR ASD/XRM INDICATE THAT AASPEN DOES NOT MODEL MODERN CLOSE-IN COMBAT WELL. THE AASPEN CLOSE-IN COMBAT TACTICS LOGIC (WHICH CONTROLS THE AIRCRAFT ENGAGED IN COMBAT) RELIES ON TACTICS DEVELOPED FOR HIGH WING LOADED, MEDIUM THRUST-TO-WEIGHT AIRCRAFT. DURING AN ENGAGEMENT THE AASPEN AIRCRAFT MOVE QUICKLY TO THEIR "CORNER VELOCITY" TO MAXIMIZE THEIR TURN RATE EVEN THROTTLING BACK IF FASTER THAN THEIR "CORNER SPEED." THE RESULTING "DOGFLIGHTS" ARE DOMINATED BY SUSTAINED TURNING PERFORMANCE AT NEARLY CONSTANT ALTITUDE. MODERN FIGHTER AIRCRAFT WITH HIGH THRUST TO WEIGHT RATIOS AND LOW WIND LOADING SUCH AS THE F-14, F-15, F-16 AND F-18 RARELY BECOME ENGAGED IN SUSTAINED TURN FIGHTS. VERTICAL MANEUVERS AND SHORT, HARD TURNS WITH THE SPEED DROPPING BELOW "CORNER SPEED" AS

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REQUIRED, FOLLOWED BY RE-ACCELERATIONS, MORE CORRECTLY CHARACTERIZED MODERN FIGHTER COMBAT. THE OVERALL OBJECTIVE OF THIS SBIR EFFORT, BOTH PHASE I AND PHASE II, IS TO UPGRADE THE TACTICS LOGIC OF AASPEN TO BETTER REPRESENT CLOSE-IN COMBAT OF MODERN FIGHTERS. THE SPECIFIC OBJECTIVE OF THIS PHASE I EFFORT IS TO GATHER FRIENDLY AND ADVERSARY, SINGLE AND MULTIPLE SHIP TACTICS INFORMATION TO BE INCORPORATED IN THE AASPEN TACTICS LOGIC DURING A PHASE II EFFORT. THIS TACTICS INFORMATION WILL BE GATHERED FROM A REVIEW OF CURRENT TACTICS MANUALS AND DURING INTERVIEWS AT THE AIR FORCE AND NAVAL FIGHTER WEAPONS SCHOOLS AND FROM SIMULATED AIR-TO-AIR COMBAT RECORDED ON THE AIR COMBAT MANEUVERING INSTRUMENTATION (ACMI) AND TACTICAL AIR COMBAT TRAINING SYSTEM (TACTS) RANGES.

ELCEE COMPUTEK INC
398 NW 22ND AVE
BOCA RATON, FL 33486
CONTRACT NUMBER: F33615-89-C-3408
LINFU CHENG

TITLE:
KNOWLEDGE/GEOMETRY BASED MOBILE AUTONOMOUS ROBOT SIMULATION (KMAR
TOPIC# 117 OFFICE: AFWAL/FIOP IDENT#: 33690

WE PROPOSE TO STUDY THE FEASIBILITY OF KNOWLEDGE/GEOMETRY BASED MOBILE AUTONOMOUS ROBOT SIMULATION SYSTEM BASED ON SOLID (3D GEOMETRY) MODELER FOR OBSTACLES, A COMBINED VISIBILITY FREE-SPACE FOR ROBOT KNOWLEDGE, GOAL-FINDING EXPLORATION ALGORITHMS, AND FACILITIES TO SPECIFY THESE ALGORITHMS IN TERMS OF THOSE MODELING AND REPRESENTATION SCHEMES. A SOLID MODELER FACILITATES COMPLETE REPRESENTATION OF ROBOT ENVIRONMENT; VISIBILITY/FREE-SPACE GRAPHS CORRESPONDS TO WHAT THE ROBOT 'KNOWS'. THE SEPARATION OF A PRIORI KNOWN ENVIRONMENT FROM THE ROBOT'S ACCUMULATING KNOWLEDGE ENTAILS INDEPENDENT DEVELOPMENT AND USAGE OF OBJECT MODELS AND EXPLORATION ALGORITHMS. OBJECTS BASED ON PROVEN SOLID GEOMETRIC MODELING COMMON IN MECHANICAL CAD SYSTEMS, CAN REPRESENT MOST OBSTACLES OF DESIRED SHAPES AND COMPLEXITY. A COMMON TYPE OF SOLID MODEL USES SUCH PRIMITIVE SOLIDS AS BLOCKS, CYLINDER, CONES, AND SPHERES AND FORM COMPOSITE OBJECTS BY PERFORMING BOOLEAN OPERATIONS (INTERSECTION, UNION, AND DIFFERENCE) ON THEM. ANOTHER COMMON REPRESENTATION SCHEME IS BASED ON BOUNDARY REPRESENTATION OF ALL OBJECT SURFACES.

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OBJECTS WITH LINEAR AND QUADRIC SURFACES ARE EASILY REPRESENTED. THESE THUS ENCOMPASS ALL POLYHEDRA AND POLYGONS IN A TWO-DIMENSIONAL WORLD. VISIBILITY OF OBSTACLE FEATURES AND THE FREE SPACE BETWEEN OBSTACLES REPRESENT THE ROBOT'S KNOWS THROUGH USE OF ITS SENSORS AND SUITABLE EXPLORATION PROCESSES. VARIOUS NAVIGATION ALGORITHMS, PROCEDURAL OR NON-PROCEDURAL AI TECHNIQUES, CAN UTILIZE THESE SPATIAL KNOWLEDGE EFFECTIVELY. A GOAL-SEEKING EXPLORATION ALGORITHM WILL BE FURTHER EXPANDED TO ASCERTAIN THAT IT CAN BE APPLIED TO THE ROBOT ENVIRONMENT BASED ON SOLID MODELS.

ELECTRO-CHEM INC
400 W CUMMINGS PK
WOBURN, MA 01801
CONTRACT NUMBER: F04701-89-C-0070
DR WINOD JALAN
TITLE:
ELECTROCHEMICAL VAPOR-COMPRESSSION CYCLE FOR SPACECRAFT THERMAL
MANAGEMENT
TOPIC# 181 OFFICE: AFSTC/OLAB IDENT#: 34520

THE ELECTROCHEMICAL VAPOR-COMPRESSSION CYCLE (EVCC) IS AN INNOVATIVE APPLICATION PROPOSED TO MEET THE SPECIAL THERMAL MANAGEMENT OF MILITARY SPACECRAFT. THIS CONCEPT REPLACES THE MECHANICAL COMPRESSOR OF A REFRIGERATION SYSTEM WITH A HIGHLY EFFICIENT ELECTROCHEMICAL COMPRESSOR THAT IS COMPACT, LIGHT WEIGHT, NOISELESS, VIBRATION-FREE, AND HAS NO MOVING PARTS. THE EVCC IS DC POWERED AND CAN BE DIRECTLY INTEGRATED INTO SPACE POWER SYSTEMS. THE ELECTROACTIVE SPECIES ACTS AS THE REFRIGERANT IN A CONVENTIONAL REFRIGERATION CYCLE WHICH CAN PROVIDE THERMAL MANAGEMENT IN MILITARY SPACECRAFT. THE APPROACH TO DEMONSTRATING THE FEASIBILITY OF THIS CONCEPT INCLUDES MATERIALS IDENTIFICATION, CHARACTERIZATION, AND TESTING WHICH WILL ULTIMATELY LEAD TO CONSTRUCTION AND TESTING OF A PROTOTYPE. WHEN FULLY DEVELOPED, THE EVCC IS ANTICIPATED TO HAVE LOW COST, HIGH COEFFICIENT OF PERFORMANCE, MODULAR CONSTRUCTION, EFFICIENCY INDEPENDENT OF SIZE, AND FLEXIBILITY OF DESIGN.

ELECTRO-OPTEK CORP
3152 KASHIWA ST
TORRANCE, CA 90505
CONTRACT NUMBER:
WILLIAM S CHAN
TITLE:
REACTIVE ION-BEAM EPITAXY OF ULTRASTRUCTURE FOR HIGH-T(c)
SUPERCONDUCTOR FILMS
TOPIC# 48 OFFICE: RADC/XPX IDENT#: 31511

SUBMITTED BY

THIS EFFORT WILL INVESTIGATE THE CONTROLLED EPITAXY OF ULTRA-THIN, ALTERNATING LAYERS OF CuO AND BiSrCaO ON A BUFFERED Si SUBSTRATE, FORMING AN ULTRASTRUCTURE APPROXIMATING CLOSELY THE MULTILAYERED STRUCTURE OF THE BiSrCaCuO SUPERCONDUCTOR. THE HIGH-QUALITY AND HIGH-RATE OF EPITAXIAL GROWTH IS ACCOMPLISHED BY DIRECT REACTION OF THE IONIC SPECIES ON THE SUBSTRATE SURFACE. THIS REACTION IS ENHANCED BY A FOCUSED PLASMA OF HIGHLY REACTIVE ATOMIC OXYGEN GENERATED BY AN ELECTRON-CYCLOTRON-RESONANCE SOURCE. FAST RESPONSE COMPUTER-CONTROLLED SHUTTERS WILL BE USED TO PERFORM THE EPITAXY OF THE ALTERNATING LAYERS WITH SHARP INTERFACES. THE MAIN OBJECTIVE OF THIS RESEARCH IS TO DEVELOP A WELL-CONTROLLED, REACTIVE MOLECULAR BEAM EPITAXY (RMBE) PROCESS FOR GROWTH OF SINGLE CRYSTALLINE, SINGLE PHASE FILMS NECESSARY TO SUPPORT HIGH-T_c SUPERCONDUCTIVITY THROUGHOUT THE FILM STRUCTURE. THESE FILMS WILL BE DEVELOPED PRIMARILY FOR INFRARED DETECTION APPLICATIONS.

ELECTRO-OPTEK CORP
3152 KASHIWA ST
TORRANCE, CA 90505
CONTRACT NUMBER:
DR JIM SHIE
TITLE:
RADIATION-HARD VJFET DEVICES ON SOI SUBSTRATES
TOPIC# 219 OFFICE: BMO IDENT#: 32619

MANY ADVANCED MICROCIRCUITS USED IN MILITARY SYSTEMS HAVE TO BE HIGH SPEED, LOW NOISE AND RADIATION HARD, PARTICULARLY RADIATION HARD AGAINST NEUTRON IRRADIATION. A PROPOSAL IS MADE FOR THE DEVELOPMENT OF AN INNOVATIVE TECHNOLOGY FOR FABRICATING V-GROOVED JUNCTION-FIELD-EFFECT TRANSISTOR (VJFET) AND MICROCIRCUITS ON SILICON-ON-INSULATOR (SOI) WAFERS TO MEET THESE ADVANCED REQUIREMENTS. THIS TECHNOLOGY USES MICROMACHINING TO FABRICATE MICRO V-GROOVES TO SUPPORT THE FORMATION OF JFET DEVICES HAVING SUBMICRON GATE LENGTHS AND SELF-ALIGNED GATE CONFIGURATIONS, RESULTING IN VJFET STRUCTURES WITH TIGHTLY-CONTROLLED SUBMICRON DIMENSIONS NECESSARY FOR VERY HIGH-SPEED, LOW NOISE AND RADIATION-HARD APPLICATIONS. THE SOI WAFER WILL ELIMINATE LATCH-UP EFFECTS, REDUCE NEUTRON-CAPTURE VOLUME AND PROVIDE ELECTRICAL ISOLATION FOR VJFET MICROCIRCUIT

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FABRICATION. THE RESULTANT VJFET IS HIGHLY DESIRABLE FOR FABRICATING VERY HIGH-SPEED (20 GIGAHZ) MICROCIRCUITS THAT MUST SURVIVE HIGH RADIATION (NATURAL OR INDUCED) ENVIRONMENTS. THE AIM OF PHASE I IS TO ESTABLISH A MODEL FOR THE VJFET AND TO DEFINE THE PROCESSES AND REQUIREMENTS FOR FABRICATING THE DESIRED SUBMICRON STRUCTURES.

ELECTRO-RADIATION INC
39 PLYMOUTH ST
FAIRFIELD, NJ 07006
CONTRACT NUMBER: F33657-89-C-2252
MURRAY W ROSEN
TITLE:
RF/MICROWAVE FIBER OPTIC DELAY FOR COUNTERMEASURES SYSTEMS
TOPIC# 161 OFFICE: ASD/RWEE IDENT#: 32485

THE PROJECT DEFINES THE DESIGN OF COHERENT RF/MICROWAVE FIBER OPTIC DELAY CIRCUITS AND A MEMORY/DELAY DESIGN WHICH FUNCTIONALLY REPLACES THE DRFM WITH IMPROVED LINEAR PERFORMANCE. FIBER OPTIC TECHNOLOGY OFFERS THE CAPABILITY TO PROCESS SIGNALS AND GENERATE COHERENT ECM TECHNIQUES. FIBER OPTIC DESIGNS OFFER CAPABILITY AGAINST SIMULTANEOUS SIGNALS TAKING ADVANTAGE OF THE DELAY, BANDWIDTH, LINEARITY, AND LOSSES INHERENT IN THE TECHNOLOGY, WHERE HARDWARE CAN BE MADE RELATIVELY SMALL AND INEXPENSIVE. THE APPROACH MODULATES A HIGH SPEED LASER DIODE AT THE 1310 nm WAVELENGTH WITH THE RF/MICROWAVE SIGNAL, THE EMISSION COUPLES INTO SINGLE MODE OPTICAL FIBER DELAY LINES PROGRAMMED USING OPTIC SWITCH NETWORKS, AND THE SIGNAL IS RECOVERED USING A BROADBAND PHOTODIODE. THE DELAY CONFIGURATIONS CONSIDERED INCLUDE VARIABLE SERIAL DELAY, PARALLEL TARGET DELAY, AND RECIRCULATING MEMORY DELAY LOOPS. THE CAPABILITIES ARE COMBINED INTO A ROBUST ARCHITECTURE FOR ECM SYSTEMS. THE PROJECT EXAMINES ECM REQUIREMENTS AND DRFM PERFORMANCE; DEVELOPS ALTERNATE APPROACHES FOR ANALOG FIBER OPTIC MEMORY/DELAY; CONDUCTS RESEARCH AND TECHNOLOGY SURVEYS; PERFORMS DESIGN AND EVALUATION; CONDUCTS A RISK/PERFORMANCE TRADE-OFF; AND DEFINES A PHASE II PROTOTYPE DESIGN PLAN.

ELECTRONIC DECISIONS INC
1776 E WASHINGTON ST
URBANA, IL 61801
CONTRACT NUMBER: F08635-89-C-0372
DANIEL FLEISCH
TITLE:
ACT REALTIME PROCESSOR
TOPIC# 18 OFFICE: AD/PMR IDENT#: 31222

SUBMITTED BY

A NEW CLASS OF EXTREMELY FAST SINGLE-CHIP SIGNAL PROCESSORS BASED ON THE EMERGING TECHNOLOGY OF ACOUSTIC CHARGE TRANSPORT (ACT) HAS RECENTLY BECOME AVAILABLE THROUGH AN INTENSE DEVELOPMENT EFFORT BY DARPA AND THE U.S. AIR FORCE. ONE APPLICATION OF THIS NEW TECHNOLOGY IS THE MULTIPLEXING AND PROCESSING OF IR FOCAL PLANE SIGNALS FOR STARTING AND SCANNING ARRAYS. THE PROPOSED PROGRAM SEEKS TO DEVELOP AN ON-PLANE PROCESSOR BASED ON ACT TECHNOLOGY WHICH PERFORMS GAIN AND OFFSET COMPENSATION SPATIAL FILTERING, TEMPORAL FILTERING AND THRESHOLD SETTING PRIOR TO A/D CONVERSION. THESE FUNCTIONS MAY BE PERFORMED USING FOUR SINGLE-CHIP ACT PROCESSORS, EACH OF WHICH OCCUPIES 10 TO 100 SQUARE MILLIMETERS AND CONSUMES LESS THAN ONE-HALF WATT OF POWER. PHASE 1 OF THIS PROGRAM CONSISTS OF THE SYSTEM DESIGN OF THE ACT REALTIME PROCESSOR AS WELL AS A PROJECTION OF EXPECTED PERFORMANCE BASED ON EXISTING DATA OR NEW TESTS USING EXISTING DEVICES.

ELECTRONIC DECISIONS INC
1776 E WASHINGTON ST
URBANA, IL 61801
CONTRACT NUMBER:
DANIEL A FLEISCH
TITLE:
COVERT COMMUNICATIONS SYSTEM
TOPIC# 31 OFFICE: ESD/AVP IDENT#: 31594

THIS PROPOSAL IS FOR THE DESIGN OF A COVERT COMMUNICATIONS SYSTEM BASED ON ACOUSTIC CHARGE TRANSPORT (ACT) FILTER TECHNOLOGY. THIS SYSTEM IS COVERT IN THAT A NEARBY UNFRIENDLY RECEIVER WILL BE UNLIKELY TO DISCOVER THE PRESENCE OF THE TRANSMITTED SIGNAL, WHILE A MORE-DISTANT FRIENDLY RECEIVER WILL ONLY DETECTS THE SIGNAL, BUT ALSO MAINTAINS AN ADEQUATE SIGNAL-TO-NOISE RATIO. THE TECHNICAL APPROACH CHOSEN FOR THIS SYSTEM IS TO EMPLOY VERY LARGE PROCESSING GAIN IN THE RECEIVER SO THAT THE TRANSMITTED SIGNAL POWER DENSITY IS WELL BELOW THERMAL NOISE. ONE METHOD OF ACHIEVING RECEIVER PROCESSING GAIN IS TO ENCODE THE TRANSMITTED SIGNAL (VOICE OR DATA) WITH A CODE WHICH SPREADS THE SIGNAL ACROSS A WIDER BANDWIDTH THAN WOULD BE NEEDED TO SEND THE DESIRED INFORMATION. THE RESULTING "SPREAD SPECTRUM" IS TRANSMITTED TO A RECEIVER WHICH DECODES OR

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"COMPRESSES" THE SIGNAL INTO ITS ORIGINAL FORM; THE AMOUNT OF COMPRESSION DETERMINES THE PROCESSING GAIN. THE PROPOSED SYSTEM UTILIZES A CIRCULATING INTEGRATOR APPROACH TO ACHIEVE PROCESSING GAINS OF 45 TO 50 dB, WITH SYNCHRONIZATION TIMES OF LESS THAN 1 SECOND, AND TOTAL RECEIVER VOLUME APPROXIMATELY EQUAL TO THAT OF A CIGARETTE PACK.

ELECTRONIC DECISIONS INC

1776 E WASHINGTON ST

URBANA, IL 61801

CONTRACT NUMBER:

DANIEL FLEISCH

TITLE:

ACT MODULAR CHANNELIZER

TOPIC# 31 OFFICE: ESD/AVP

IDENT#: 31651

THIS PROPOSAL DESCRIBES A PROGRAM FOR THE DEVELOPMENT OF A FREQUENCY CHANNELIZER AND PROCESSOR FOR ESM, ECM, COMMUNICATIONS, OR SURVEILLANCE APPLICATIONS. THIS SYSTEM IS BASED ON THE EMERGING TECHNOLOGY OF ACOUSTIC CHARGE TRANSPORT (ACT) WHICH ALLOWS THE FUNCTIONS OF FILTERING, DELAY, DETECTION, AND SWITCHING TO BE PERFORMED ON A SINGLE GALLIUM-ARSENIDE CHIP. THE PROPOSED PHASE I PROGRAM SEEKS TO DEMONSTRATE THE FEASIBILITY AND PROJECT THE PERFORMANCE OF AN ACT MODULAR CHANNELIZER/PROCESSOR WHICH USES A SERIES OF MODULAR ELEMENTS OPERATING IN PARALLEL TO COVER A FREQUENCY RANGE OF UP TO 720 MHz WITH 3 MHz RESOLUTION. IN ADDITION TO CHANNELIZING THE SIGNALS, THIS SYSTEM ALSO DETECTS THE ACTIVITY IN EACH CHANNEL AND SENDS THE VIDEO OUTPUTS TO A CONTROLLER WHICH EXAMINES THE VIDEO OUTPUTS AND SELECTS THE DESIRED CHANNEL BY SETTING AN RF SWITCH. THE POWER OF ACT TECHNOLOGY IN THIS ARCHITECTURE IS THAT THE ORIGINAL INPUT SIGNAL IS PRESERVED FOR DOWNSTREAM ANALYSIS DURING THE DECISION-MAKING PROCESS, WHICH OFFERS THE SPEED OF ANALOG PROCESSING AND THE FLEXIBILITY OF DIGITAL PROGRAMMABILITY.

ENFITEK INC

2306 AVENUE Q

LUBBOCK, TX 79405

CONTRACT NUMBER: F40600-89-C-0008

DR A G ENGELHARDT

TITLE:

PLASMA DENSITY MEASUREMENT SYSTEM

TOPIC# 23 OFFICE: AEDC/PKP

IDENT#: 31349

SUBMITTED BY

ENFITEK PROPOSES TO ADAPT APPARATUS DEVELOPED AT THE UNIVERSITY OF INDIANA FOR THE MISSION REQUIREMENTS OF THE ARNOLD ENGINEERING DEVELOPMENT CENTER, TULLAHOMA, TENNESSEE FOR ELECTRON NUMBER DENSITY MEASUREMENTS. THE DEVICE USED THE PRINCIPLE OF THOMPSON SCATTERING OF LASER LIGHT FROM FREE ELECTRONS IN THE PLASMA. DENSITIES OF THE CORRECT ORDER ARE MEASURABLE NOW BUT WITH INADEQUATE SPATIAL RESOLUTION. WE WILL MODIFY THE INSTRUMENT TO MEET AIR FORCE REQUIREMENTS BY REDESIGNING THE OPTICAL SYSTEM.

ENTEK INC
1901 N BEAUREGARD ST - STE 208
ALEXANDRIA, VA 22311
CONTRACT NUMBER: F19628-89-C-0127
B J STRALSER
TITLE:
SPECIAL OPERATIONS COMMUNICATIONS SYSTEM (SPOCS)
TOPIC# 31 OFFICE: ESD/AVP IDENT#: 31632

MODERN TACTICAL AND STRATEGIC FORCES DEPEND HEAVILY ON THE RELIABILITY AND CAPABILITY OF THEIR SUPPORTING COMMAND, CONTROL AND COMMUNICATIONS SYSTEMS FOR SUCCESSFUL OPERATIONS. AS THE ELECTRONIC BATTLEFIELD HAS MATURED, IT HAS BECOME INCREASINGLY DIFFICULT TO FULFILL ALL THE CRITICAL REQUIREMENTS PLACED ON THE COMMUNICATIONS SYSTEM. IN THE PAST SEVERAL YEARS, LASERS, MILLIMETER WAVES AND VARIOUS FORMS OF PROPAGATION MODULATION AND SIGNAL ENCRYPTION HAVE BEEN DEVELOPED TO MEET THESE REQUIREMENTS. NONE HAVE BEEN 100% SUCCESSFUL. EARLY WORK WITH A NEUTRON PARTICLE BEAM, HOWEVER, INDICATES THAT THERE MAY BE A SINGLE SOLUTION TO FULFILLING THOSE CRITICAL REQUIREMENTS. THE SPECIAL OPERATIONS COMMUNICATION SYSTEM (SPOCS), USES A PULSE STREAM OF NEUTRONS FROM A NEUTRON GENERATOR AS A SECURE MEANS OF COMMUNICATIONS. THE TECHNIQUE APPLIES TO USES ON THE EARTH'S SURFACE AS WELL AS IN SPACE. THE NEUTRON WAS CHOSEN AS THE MEDIUM WITH WHICH TO TRANSMIT INFORMATION BECAUSE IT IS A NON-COMBINING NEUTRAL PARTICLE, AND AS SUCH, IS UNAFFECTED BY MAGNETIC FIELDS WHICH OCCUR DUE TO THE EARTH'S INFLUENCE, OR MAGNETIC FIELDS WHICH ARE GENERATED IN SPACE. IT IS ALSO UNAFFECTED BY WEATHER, SMOKE, BLAST, EMP EFFECTS, OR ELECTRONIC COUNTERMEASURES.

ES INDUSTRIES
8 S MAPLE AVE
MARLTON, NJ 08053
CONTRACT NUMBER: F40600-89-C-0012
DR WALTON CALDWELL
TITLE:
CONTINUOUS WATER MONITORING SYSTEM FOR PROCESS COOLING WATER
TOPIC# 30 OFFICE: AEDC/PKP IDENT#: 31378

SUBMITTED BY

THIS PROPOSAL DESCRIBES THE STEPS NECESSARY TO DEVELOP AN ONLINE GAS CHROMATOGRAPHIC SYSTEM CAPABLE OF CONTINUOUS MONITORING OF BOTH VOLATILE AND NON-VOLATILE ORGANIC CONTAMINANTS IN PROCESS COOLING WATER IN A 15 MINUTE CYCLE TIME. PHASE I WORK WOULD CONSIST OF THE DEVELOPMENT OF A SAMPLING SYSTEM AND COLUMNS REQUIRED TO SEPARATE SPECIFIED CONTAMINANTS. LIMITS OF DETECTION, ACCURACY AND PRECISION OF THE ANALYSIS SYSTEM WOULD BE DETERMINED. AN APPROPRIATE ALARM SYSTEM WOULD BE DEVELOPED BASED ON SPECIFIED LIMITS FOR EACH ANALYZED CONTAMINANT. A PHASE I REPORT COMPLETELY DESCRIBING THE RECOMMENDED SYSTEM AND PRESENTING THE RESULTS TO PROVE TO AEDC THAT THE SPECIFIED RESULTS CAN BE OBTAINED WITH THE SYSTEM WOULD BE AVAILABLE WITHIN 18 WEEKS.

EVANS C & ASSOCS
301 CHESAPEAKE DR
REDWOOD CITY, CA 94063
CONTRACT NUMBER: F33615-89-C-5652
DR MICHAEL H HERMAN
TITLE:
EPITAXIAL FILM BAND GAP/COMPOSITION MAPPING USING ELECTRON BEAM
ELECTROREFLECTANCE: OPTICAL CHARACTERIZATION OF HIGH X AlGaAs WAF
TOPIC# 125 OFFICE: AFWAL/MLK IDENT#: 33262

IN PHASE I, WE PROPOSE TO INVESTIGATE THE USE OF ELECTRON BEAM ELECTRO-REFLECTANCE (EBER) TO AUTOMATICALLY MAP THE BAND GAP OF HIGH x AlGaAs ($x > 0.38$) EPITAXIAL FILMS ON FULL, 3 INCH GaAs SUBSTRATES AT ROOM TEMPERATURE. THESE COMPOSITIONS OF AlGaAs ARE IMPORTANT FOR HIGH-EFFICIENCY GRINSCH LASERS AND OTHER APPLICATIONS, BUT AS THE CRYSTAL SWITCHES TO AN INDIRECT GAP ABOVE THIS x VALUE, TRADITIONAL OPTICAL METHODS SUCH AS PHOTOLUMINESCENCE (PL) FAIL. WE HAVE ALREADY BEEN SHOWN THAT HIGH x Al(x)Ga(1-x)As FILMS MAY BE SUCCESSFULLY TESTED BY EBER DURING EARLIER RESEARCH. THIS PHASE I WORK WILL INVESTIGATE THE APPLICABILITY OF EBER TO WAFER-SCALE ANALYSIS AND MAPPING OF THESE HIGH x FILMS. FOR THIS PURPOSE, WE WILL MEASURE THE $E(0)$ AND $E(1)$ FEATURES OF BOTH THICK (SEVERAL MICRONS) AND THIN (0.1 MICRON) MBE GROWN Al(x)Ga(1-x)As FILMS OF NOMINAL $x = 0.5, 0.6, 0.7, \text{ AND } 0.8$. OUR OBJECTIVE IS TO OBSERVE AND PARAMETRIZE THE OPTICAL MODULATED REFLECTANCE FEATURES OF AlGaAs FILMS IN THE

SUBMITTED BY

INDIRECT-GAP REGIME.

EXCEL TECHNOLOGY INC
140-20 KEYLAND CT
BOHEMIA, NY 11716
CONTRACT NUMBER: F33615-89-C-5638
DR RAMA RAO

TITLE:
HIGHLY SENSITIVE QUANTUM DETECTOR IN THE 10-50 MICRON REGION
FABRICATED WITH HIGH Tc BCSCO BY PLASMA ASSISTED LASER DEPOSITION
TOPIC# 127 OFFICE: AFWA/MLK IDENT#: 33328

IN THE PROPOSED PROGRAM, FOR THE FIRST TIME, FEASIBILITY OF DEVELOPING AND CHARACTERIZING A HIGHLY SENSITIVE AND HIGH SPEED QUANTUM DETECTOR IN THE 10-50 MICRO WAVELENGTH REGION USING A SUPERCONDUCTING SSS TYPE WEAK LINK OF Bi-Ca-Sr-Cu-O, IS EXAMINED. THE DETECTION PRINCIPAL IS BASED ON THE FACT THAT THE ABSORBED INFRARED RADIATION REDUCES THE ENERGY GAP OF THE SUPERCONDUCTOR, MODIFYING THE CURRENT--VOLTAGE CHARACTERISTICS OF JOSEPHSON JUNCTION WHICH CAN SERVE AS A USEFUL DETECTOR OUTPUT. RECENTLY, IN A PRELIMINARY EXPERIMENT, WE HAVE OBSERVED FOR THE FIRST TIME, NOT ONLY A SLOW BOLOMETRIC RESPONSE BUT ALSO A FAST NON-THERMAL QUANTUM RESPONSE DUE TO COOPER PAIR BREAKING AND QUASI-PARTICLES GENERATION IN YBaCuO FILM SUBJECTED TO PULSED 532 nm LASER. IN THE PRESENT WORK, PRECISELY CONTROLLED THIN FILM OF Bi-Ca-Sr-Cu-O WILL BE DEPOSITED ON A SUITABLE SUBSTRATE BY PLASMA ASSISTED LASER DEPOSITION USING 265 nm UV LASER AT 10 Hz. SUBSEQUENT TO DEPOSITION, SUPERCONDUCTING WEAK LINK SSS TYPE JOSEPHSON JUNCTION WILL BE FABRICATED BY PATTERNING THESE FILMS WITH 532 nm VISIBLE LASER AT 1 KHz. FOR DETECTION, INFRARED RADIATION FROM CO2 LASER AT 10.6 MICRON WILL BE MODULATED AND GUIDED THROUGH AN OPTICAL FIBER TO THE DETECTOR. IN THE PHASE I, NON-EQUILIBRIUM (QUANTUM) RESPONSE OF THE DETECTOR AT 10.6 MICRON AND THE TEMPERATURE DEPENDENCE OF THE RESPONSE WILL BE STUDIED. THE RESPONSIVITY OF THE DETECTOR IS ESTIMATED TO BE $\sim 10^4$ V/W, WHICH IS SEVERAL ORDERS OF MAGNITUDE HIGHER THAN PRESENTLY AVAILABLE QUANTUM DETECTORS. IN PHASE II, WAVELENGTH DEPENDENCE OF THE RESPONSE IN THE 10-50 MICRON REGION, HIGH FREQUENCY RESPONSE, AND THE TEMPERATURE DEPENDENCE OF THE RESPONSIVE TIME WILL BE INVESTIGATED.

SUBMITTED BY

EXTREL CORP
PO BOX 11512 - 240 ALPHA DR
PITTSBURGH, PA 15238
CONTRACT NUMBER: F40600-89-C-0013
SEKSAN DHEANDHANOO
TITLE:
CONTINUOUS WATER MONITORING SYSTEM
TOPIC# 30 OFFICE: AEDC/PKP IDENT#: 31379

THIS PROPOSAL IS FOR THE DESIGN, PROTOTYPE CONSTRUCTION AND TESTING OF MEMBRANE INTERFACES WHICH CAN BE USED WITH MASS SPECTROMETERS FOR CONTINUOUS WATER MONITORING. THIS IDEA IS BASED ON THE SELECTIVITY OF SEMI-PERMEABLE MEMBRANES. THE MEMBRANE INTERFACE IS A RELATIVELY SIMPLE AND INEXPENSIVE SEPARATION TECHNIQUES. THE CONTINUOUS WATER MONITORING SYSTEM WILL BE COMPOSED OF A QUADRUPOLE MASS SPECTROMETER AND SEMI-PERMEABLE MEMBRANE INTERFACE. THIS INSTRUMENT WILL ENABLE US TO ANALYZE WATER DIRECTLY WITHOUT ANY SAMPLE PREPARATION. THE CHEMICAL IMPURITIES IN THE WATER WILL PERMEATE THROUGH THE SEMI-PERMEABLE MEMBRANE AND BE IONIZED BY AN APPROPRIATE IONIZATION TECHNIQUE BEFORE BEING ANALYZED BY THE QUADRUPOLE MASS SPECTROMETER. THE DETECTION LIMIT OF THIS INSTRUMENT IS EXPECTED TO BE AS LOW AS 100 PARTS PER BILLION WITH A RESPONSE TIME OF LESS THAN ONE MINUTE. WE ENVISAGE THAT THIS SYSTEM WILL BE APPLICABLE NOT ONLY TO THE WATER MONITORING APPLICATION, BUT ALSO TO MEASUREMENT PROBLEMS THAT REQUIRE LOW LEVEL CHEMICAL ANALYSIS OF LIQUID SAMPLES IN REAL TIME, SUCH AS FERMENTATION PROCESSES.

FAAC PERCEPTRONICS INC
610 MASONS MILL BUSINESS PK
HUNTINGDON VALLEY, PA 19006
CONTRACT NUMBER: F33657-39-C-2253
ROGER J BANNET
TITLE:
INNOVATIVE INFRARED MISSILE COUNTERMEASURES
TOPIC# 162 OFFICE: ASD/XRX IDENT#: 38868

THIS PROPOSAL ADDRESSES THE PROBLEM OF PROTECTION OF U.S. AIR FORCE

SUBMITTED BY

AND OTHER DOD AIRCRAFT AGAINST HEAT-SEEKING, INFRARED GUIDED MISSILES. WHILE THERE ARE SEVERAL EXISTING APPROACHES ATTEMPTING TO SOLVE THIS PROBLEM, THEY ARE VARIOUSLY, LIMITED IN ROBUSTNESS, MULTI-SPECTRAL CAPABILITIES, RELIABILITY AND COST. THE APPROACH PROPOSED HEREIN WHICH EFFECT A LOW COST SOLUTION FOR ACQUISITION, AND LIFE-CYCLE (BOTH GROUP A AND GROUP B COSTS), LARGELY OVERCOMES THE LISTED LIMITATIONS IN PRESENT SYSTEMS. IT IS BASED ON COMBINING RESULTS FROM ACTUAL VIETNAM COMBAT EXPERIENCE WITH THOROUGH BACKGROUND IN MISSILE BEHAVIOR AND RECENT FAAC STUDIES UNDER THE LEMMING PROJECT.

FAILURE ANALYSIS ASSOCS
115 FLANDERS RD
WESTBOROUGH, MA 01581
CONTRACT NUMBER: F33615-89-C-5647
DONALD GALLER

TITLE:
ACCIDENT INVESTIGATION TECHNIQUES FOR AIRCRAFT ELECTRICAL/ELECTRO SYSTEMS USING METALLURGICAL AND OTHER PROPERTIES OF MATERIALS
TOPIC# 129 OFFICE: AFWAL/MLK IDENT#: 33391

IT IS PROPOSED THAT DATA BE COLLECTED TO ASSESS THE FEASIBILITY OF ADAPTING A VARIETY OF ELECTRICAL ACCIDENT INVESTIGATION TECHNIQUES TO AIRCRAFT ACCIDENT INVESTIGATION. SOME OF THE CANDIDATE TECHNIQUES INCLUDE: FILAMENT DEFORMATION AND FRACTURE IN FILAMENT LAMPS DUE TO IMPACT; DEMAGNETIZATION OF PERMANENT MAGNET MATERIALS SUBJECTED TO POST-ACCIDENT FIRE AND SHOCK; AND ANALYSIS OF CONDUCTOR ARCING TO DETERMINE CONDUCTION STATE AT THE TIME OF ARC DAMAGE. DATA WILL BE COLLECTED ON THE METALLURGICAL AND OTHER PROPERTIES OF ELECTRICAL AND ELECTRONIC MATERIALS. A MAJOR GOAL IS TO DEVELOP TECHNIQUES THAT CAN IDENTIFY PRE-ACCIDENT CONDITIONS OF ELECTRICAL AND ELECTRONIC EQUIPMENT DESPITE SEVERE POST-ACCIDENT DAMAGE.

FAR WEST SENSOR CORP
3265 ORANGE AVE
SIGNAL HILL, CA 90807
CONTRACT NUMBER: F08635-89-C-0390
CRAIG H OTIS

TITLE:
TEST TRACK POSITION-TIME MEASUREMENT SENSOR SYSTEM
TOPIC# 11 OFFICE: AD/PMR IDENT#: 31144

SUBMITTED BY

A FIBER OPTIC SYSTEM IS PROPOSED IN ORDER TO PROVIDE THE AIR FORCE HIGH SPEED TEST TRACK FACILITY AT HOLLOMAN AIR FORCE BASE IN NEW MEXICO WITH THE CAPABILITY TO ACCURATELY MEASURE THE VELOCITY OF ROCKET SLEDS IN THE SPEED REGIME OF 2000 TO 8000 FEET PER SECOND. THE ACCURACY OF THE PROPOSED SYSTEM IS 10 TIMES THAT REQUESTED BY THE SOLICITATION. THE DESIGN OF THE SENSORS IS SIMPLE, AND THE SYSTEM IS HIGHLY RESISTENT TO THE TEST TRACK AND DESERT ENVIRONMENT. THE PROPOSED PROGRAM CONSISTS OF DESIGN DEVELOPMENT, FABRICATION OF PROTOTYPE HARDWARE, AND A SET OF EXPERIMENTS AT THE TEST TRACK WITH THE PROTOTYPE HARDWARE.

FLAM & RUSSELL INC
PO BOX 444
HORSHAM, PA 19044
CONTRACT NUMBER:
JOHN F AUBIN
TITLE:
SOUNDING ROCKET TELEMETRY/TRACKING SYSTEM
TOPIC# 232 OFFICE: BMO/MYSC IDENT#: 32724

AN OUTLINE FOR THE DESIGN OF A TRANSPORTABLE HIGH SPEED TELEMETRY TRACKING SYSTEM IS DESCRIBED. THE TRANSPORTABLE SYSTEM RECEIVES S-BAND TELEMETRY DATA, DETERMINES THE ACTUAL TRAJECTORY, PROVIDES UPLINK CONTROL OF PAYLOADS, AND PROVIDES FLIGHT TERMINATION CAPABILITY. TWO SYSTEMS ARE REQUIRED TO SATISFY THE RANGE SAFETY REQUIREMENTS FOR REDUNDANCY. EACH SYSTEM CONSISTS OF AN ANTENNA MOUNTED TO A TWO-AXIS-PEDESTAL. THE DATA IS PASSED TO RECORDING AND DATA ANALYSIS EQUIPMENT MOUNTED IN AN EQUIPMENT SHELTER. A SUITABLE COMPUTER PROVIDES SLANT RANGE, ROCKET TRAJECTORY, AND PROJECTED IMPACT ZONES FOR RANGE SAFETY. SYSTEM REQUIREMENTS AND ACCURACIES ARE DETERMINED AS PART OF THIS EFFORT.

FLOW RESEARCH INC
21414 - 68TH AVE S
KENT, WA 98032
CONTRACT NUMBER: F33615-89-C-2932
DR SURESH MENON
TITLE:
DEVELOPMENT OF A MATHEMATICAL CODE TO PREDICT THERMAL DEGRADATION OF FUEL AND DEPOSIT FORMATION IN A FUEL SYSTEM
TOPIC# 149 OFFICE: AFWAL/POMP IDENT#: 33207

SUBMITTED BY

IT HAS BEEN OBSERVED IN BOTH SMALL-SCALE EXPERIMENTS AND FULL-SCALE FUEL SYSTEM SIMULATORS THAT JET FUELS, WHEN HEATED, UNDERGO CHEMICAL REACTIONS THAT EVENTUALLY RESULT IN SEDIMENT/DEPOSIT FORMATION. THUS, THE THERMAL STABILITY OF JET FUELS HAS THE DELETERIOUS EFFECT OF CAUSING FUEL SYSTEM MALFUNCTIONS. THIS SITUATION IS ALSO POSSIBLE IN SUPERSONIC AIRCRAFT, WHERE AN INCREASE IN THE METAL SKIN TEMPERATURE DUE TO AERODYNAMIC HEATING CAN, IN TURN, INCREASE THE TEMPERATURE OF UNINSULATED FUEL TANKS, LEADING TO DEPOSIT FORMATION. ALTHOUGH A GREAT DEAL OF EXPERIMENTAL DATA HAS BEEN OBTAINED, THE EXACT MECHANISMS OF THE DEGRADATION REACTION AND THE CONSEQUENT DEPOSIT FORMATION PROCESS ARE STILL LARGELY UNKNOWN. THIS IS PRIMARILY DUE TO THE FACT THAT THE DEGRADATION PROCESS IS INFLUENCED BY MANY FACTORS, SOME OF WHICH CANNOT BE DETERMINED, VARIED OR CONTROLLED IN AN EXPERIMENT. THUS, THERE IS A NEED FOR A MATHEMATICAL MODEL THAT CAN BE USED TO PREDICT THE FUEL DEPOSITION PROCESS BY COMBINING THE EFFECTS OF THE FLUID FLOW AND HEAT TRANSFER PROCESSES AND THE FUEL DEGRADATION REACTIONS. IN THIS PHASE I STUDY, A SIMPLE MATHEMATICAL MODEL WILL BE DEVELOPED USING AVAILABLE INFORMATION ON THE VARIOUS UNIT PROCESSES INVOLVED IN THE DEPOSIT FORMATION PROCESS. SAMPLE PROBLEMS BASED ON EXISTING EXPERIMENTAL DATA WILL BE SOLVED USING THIS MODEL, AND THE RESULTS WILL BE VALIDATED WITH AVAILABLE EXPERIMENTAL DATA.

FLOW RESEARCH INC
21414 - 68TH AVE S
KENT, WA 98032
CONTRACT NUMBER: F33615-89-C-3407
DR PETER H-T LIU

TITLE:
NUMERICAL DETERMINATION OF AERODYNAMIC COEFFICIENTS USING A GAS
HYDRAULIC ANALOGY WATER TABLE
TOPIC# 106 OFFICE: AFWAL/FIOP IDENT#: 33579

FLOW RESEARCH, INC. (FLOW), PROPOSES TO DEVELOP A SCANNING LASER-SHEET TECHNIQUE AS A SENSING AND TOPOGRAPHIC MAPPING DISPLAY SYSTEM FOR THE MEASUREMENT OF WATER SURFACE DISPLACEMENT. THE PROPOSED TECHNIQUE IS AN EXTENSION OF PROVEN OPTICAL METHODS DEVELOPED AT FLOW FOR MEASURING THE DISPLACEMENT OF CAPILLARY AND

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BREAKING WAVES. THIS TECHNIQUE IS ESSENTIAL FOR CARRYING OUT THE SHALLOW-WATER HYDRAULIC ANALOGY OF COMPRESSIBLE AERODYNAMIC PHENOMENA, WHICH ARE OTHERWISE TOO COMPLICATED TO BE INVESTIGATED BY NUMERICAL MODELING AND WIND-TUNNEL TESTING. THE PHENOMENON OF SPECIFIC INTEREST OF DOD IS THE SEPARATION OF AN ESCAPE CAPSULE FROM AN AEROSPACE VEHICLE. THE HYDRAULIC ANALOGY WOULD PROVIDE AN INEXPENSIVE OPPORTUNITY TO INVESTIGATE ESCAPE SYSTEM SEPARATION EFFECTS IN TERMS OF MODIFIED AERODYNAMIC COEFFICIENTS FROM LOW SPEEDS TO ABOUT MACH 7. DURING PHASE I, THE FEASIBILITY OF THE PROPOSED SYSTEM, WHICH WILL CONSIST OF OFF-THE-SHELF COMPONENTS, WILL BE DEMONSTRATED THROUGH A SERIES OF EXPERIMENTS CONDUCTED IN A LABORATORY MODEL OF A WATER TABLE INSTALLED IN A TOW TANK. EMPHASIS WILL BE PLACED ON DEMONSTRATING THE SYSTEM'S ABILITY TO SENSE AND DISPLAY THE SURFACE DISPLACEMENT INDUCED BY A TOWED HYDRAULIC MODEL OF THE AEROSPACE VEHICLE.

FLUID PHYSICS IND
4265 MANCHESTER AVE
ENCINITAS, CA 92024
CONTRACT NUMBER:
RICHARD M TRACI
TITLE:
HYPERSONIC RAREFIED FLOW SIMULATOR
TOPIC# 218 OFFICE: BMO/MYSC IDENT#: 32612

THE ABILITY TO ACCURATELY PREDICT HEAT AND AERODYNAMIC FORCE LOADING ON HYPERSONIC REENTRY VEHICLES IN NON-CONTINUUM RAREFIED FLOW REGIMES REQUIRES SIMULATION OF THE MOLECULAR NATURE OF THE FLOW ENVIRONMENT. FLUID PHYSICS INDUSTRIES AND OUR SAIC CONSULTANTS PROPOSE TO DEVELOP A COMPUTATIONALLY EFFICIENT AND FAST SIMULATION TOOL WHICH INCLUDES SELF-CONSISTENT PLASMA PHENOMENA, RADIATION, SPATIAL DOMAIN DECOMPOSITION WITH ADAPTIVE GRIDDING FOR TRANSITION, AND FREE MOLECULAR FLOW REGIMES. THE STUDY WILL DEVELOP APPROPRIATE ALGORITHMS WHICH ARE REQUIRED FOR DETAILED SIMULATIONS OF ARBITRARY 3D RV GEOMETRIES AT ARBITRARY ORIENTATIONS TO THE FLOW.

FLUOROCHEM INC
680 S AYON AVE
AZUSA, CA 91702
CONTRACT NUMBER: F33615-89-C-5630
THOMAS ARCHIBALD
TITLE:
NEW HIGH PERFORMANCE POLYMERS
TOPIC# 120 OFFICE: AFWAL/MLK IDENT#: 33441

SUBMITTED BY

NOVEL TECHNIQUES FOR PREPARING RIGID-ROD POLYMERS CONTAINING CAGE MOLECULES WILL BE EXPLORED. NEW MONOMERS WILL BE SYNTHESIZED AND PROPERTIES OF THE RESULTING POLYMERS WILL BE STUDIED.

FOSTER-MILLER INC
350 SECOND AVE
WALTHAM, MA 02254
CONTRACT NUMBER:
LAWRENCE H DOMASH
TITLE:
ORGANIC NONLINEAR OPTICAL LIQUIDS FOR DEVICE APPLICATIONS
TOPIC# 200 OFFICE: AFWL/PRC IDENT#: 31850

LIQUIDS WITH THE NONLINEAR OPTICAL PROPERTY OF INTENSITY DEPENDENT REFRACTIVE INDEX AT PICOSECOND SPEEDS TOGETHER WITH SUCH LINEAR OPTICAL PROPERTIES AS LOW ABSORPTION AND ADJUSTABLE INDEX ARE DESIRED FOR A NUMBER OF PRACTICAL DEVICE APPLICATIONS SUCH AS OPTICAL SWITCHING AND LASER HARDENING. FOSTER-MILLER IS ENGAGED IN RESEARCH TO DEVELOP A HIGH SPEED ALL-OPTICAL SWITCH FOR FIBER NETWORKS USING SUCH LIQUIDS. THE PROPOSED PHASE I RESEARCH WILL EXPLORE AND SCREEN A NEW CLASS OF ORGANIC HIGH-BETA/SOLVENT SYSTEMS IN WHICH SECOND ORDER NONLINEARITIES ARE CASCADED TO YIELD EFFECTIVE THIRD-ORDER PROPERTIES. RESULTING LIQUIDS ARE PREDICTED WHICH MAY HAVE INTENSITY DEPENDENT REFRACTIVE INDEX COEFFICIENTS EQUAL TO THE LARGEST KNOWN SOLID POLYMERS, OR 100X LARGER THAN CARBON DISULPHIDE, THE CURRENT STANDARD. ELEMENTS OF RESEARCH PROPOSED FOR PHASE I AND II INCLUDE LABORATORY SCREENING, MEASUREMENTS OF CHEMICAL, LINEAR AND NONLINEAR OPTICAL PROPERTIES, AND MOLECULAR MODELING BY COMPUTER.

FOSTER-MILLER INC
350 SECOND AVE
WALTHAM, MA 02254
CONTRACT NUMBER: F08635-89-C-0345
DR HARRIS GOLD
TITLE:
IN-PLACE ELECTRICALLY-HEATED REGENERATION OF VAPOR-PHASE ACTUATED CARBON
TOPIC# 57 OFFICE: AFESC/RDXP IDENT#: 31960

SUBMITTED BY

AIR STRIPPING IS AN ESTABLISHED METHOD OF REMOVING A WIDE VARIETY OF VOLATILE ORGANIC CONTAMINANTS FROM GROUNDWATER. UTILIZATION OF THIS PROCESS REMOVES THE PRIORITY POLLUTANT FROM THE LIQUID STREAM AND DISCHARGES THE POLLUTANT INTO THE AIR STREAM. VAPOR PHASE ABSORPTION ON GRANULAR ACTIVATED CARBON (GAC) HAS PROVEN SUCCESSFUL IN TREATING THE AIR STREAM, BUT CONVENTIONAL REGENERATION METHODS ARE EXPENSIVE, REQUIRE TRANSFER OF THE CARBON, AND DEGRADE THE CARBON. THE OBJECTIVE OF THE PROPOSED PROGRAM IS TO DETERMINE THE FEASIBILITY OF USING ELECTRICALLY-HEATED PROCESSES FOR THE IN-PLACE REGENERATION OF VAPOR-PHASE GAC. TWO PROCESSES WILL BE CONSIDERED, NAMELY ELECTRIC RESISTANCE HEATING, USING THE CARBON ITSELF AS THE RESISTANCE, AND MICROWAVE HEATING. LABORATORY-SCALE EXPERIMENTS WILL BE CARRIED OUT TO DETERMINE THE OPTIMUM TEMPERATURE AT WHICH THE CARBON CAN BE EFFICIENTLY REGENERATED. BASED ON THESE RESULTS, PROCESS FLOW DIAGRAMS FOR AN INTEGRATED AIR STRIPPING, VAPOR-PHASE GAC ADSORPTION, AND REGENERATION PROCESS WILL BE DEVELOPED AND ESTIMATES MADE OF THE CAPITAL AND OPERATING COSTS OF THE INTEGRATED SYSTEM. THE BEST INTEGRATED SYSTEM WOULD BE RECOMMENDED FOR FURTHER PILOT SCALE TESTING IN PHASE II.

FOSTER-MILLER INC
350 SECOND AVE
WALTHAM, MA 02254
CONTRACT NUMBER: F33615-89-C-1086
RICHARD W LUSIGNEA
TITLE:
MULTICHIP INTERCONNECT SUBSTRATES
TOPIC# 85 OFFICE: AFWAL/AAOP IDENT#: 32798

IN THE PHASE I PROGRAM FOSTER-MILLER WILL DEVELOP AN INNOVATIVE APPROACH TO PACKAGING CHIP-ON-BOARD MULTICHIP MODULES USING CONTROLLED COEFFICIENT OF THERMAL EXPANSION (CTE), HIGH THERMAL CONDUCTIVITY SUBSTRATES AND TAILORED DIELECTRIC FILM LAYERS FOR INTERCONNECTION. OUR APPROACH WILL OVERCOME FOUR OF THE MAJOR PROBLEMS FOR HIGH DENSITY INTERCONNECTION: REMOVAL OF HEAT, HERMETICITY, THERMAL EXPANSION AND UNIFORM THICKNESS DIELECTRIC LAYERS. WE WILL USE A NEW HIGH PERFORMANCE POLYMER FILM MADE FROM POLY BENZOBISTHIAZOLE (PBZT) OR POLY BENZOBISOXAZOLE (PBO) IN

SUBMITTED BY

CONJUNCTION WITH NEW SILICON-ON-SILICON MULTICHIP MODULES. THIS APPROACH WILL PERMIT A HIGH MODULARITY IN DESIGN, AND WILL ACHIEVE AN INTERCONNECTION DENSITY NOW ONLY POSSIBLE FOR SEMICONDUCTOR CIRCUITS.

FOSTER-MILLER INC
350 SECOND AVE
WALTHAM, MA 02254
CONTRACT NUMBER: F33615-89-C-5636
RICHARD W LUSIGNEA
TITLE:
HIGH COMPRESSIVE STRENGTH PBO MICROCOMPOSITE FIBERS
TOPIC# 120 OFFICE: AFWAL/MLK IDENT#: 33444

PBO ORDERED POLYMER FIBERS CURRENTLY SHOW LOW COMPRESSIVE STRENGTH AS A RESULT OF MICROFIBRILLAR BUCKLING. FOSTER-MILLER PROPOSES TO SOLVE THIS PROBLEM BY PROCESSING PBO FIBERS INTO MICROCOMPOSITES, WHERE SPACES BETWEEN MICROFIBRILS ARE FILLED WITH SPECIALLY-SELECTED SECONDARY PHASE MATERIALS. PBO MICROCOMPOSITE FIBERS WILL EXCEED 200 KSI COMPRESSIVE STRENGTH FOR TWO REASONS: FIRST, PBO MICROFIBRILS WILL BE SUPPORTED AGAINST BUCKLING BY ENCAPSULATION WITHIN A MATRIX OF SECONDARY PHASE POLYMER RESIN. SECOND, PBO FIBERS WILL BECOME COATED DURING THE PROCESS WITH THIN SURFACE FILMS OF SECONDARY PHASE THAT SHRINK DURING HEAT-TREATMENT, PLACING THE FIBERS INTO RADIAL COMPRESSION AND INCREASING THEIR RESISTANCE TO BUCKLING. SECONDARY PHASE SURFACES OF PBO MICROCOMPOSITE FIBERS WILL INTERACT STRONGLY WITH THERMOPLASTIC MATRICES, PROTECT AGAINST ABRASION AND RESIST MOISTURE INCURSION AS A RESULT OF THEIR SPECIALLY-TAILORED CHEMISTRY. PHASE I OF THIS PROGRAM WILL DEMONSTRATE FEASIBILITY AND COMPARE THE EFFECTIVENESS OF SOL-GEL GLASS AND THERMOPLASTIC POLYIMIDE SECONDARY PHASES. IN PHASE II, WE WILL OPTIMIZE THE PROCESS AND EVALUATE PBO MICROCOMPOSITE FIBERS IN THERMOPLASTIC COMPOSITES.

FOSTER-MILLER INC
350 SECOND AVE
WALTHAM, MA 02254
CONTRACT NUMBER:
UDAY KASHALIKAR
TITLE:
GRAPHITE REINFORCED TITANIUM ALUMINIDES FOR THE AEROSPACE PLANE STRUCTURES
TOPIC# 248 OFFICE: AFSC/NAT IDENT#: 37987

SUBMITTED BY

WE PROPOSE TO DEVELOP A HIGH PERFORMANCE GRAPHITE FIBER-REINFORCED TITANIUM ALUMINIDE COMPOSITE MATERIAL, WELL-SUITED FOR AEROSPACE PLANE STRUCTURAL APPLICATIONS. ADVANTAGES OF GRAPHITE FIBERS OVER SiC AS REINFORCEMENT FOR INTERMETALLIC COMPOUNDS INCLUDE: HIGHER STRENGTH, STIFFNESS (USING SPECIALTY GRAPHITE FIBERS); SMALLER FILAMENT DIAMETER - ALLOWING THINNER WALLS AND MORE COMPLEX SHAPES; LOWER COST. THESE ADVANTAGES OF Gr FIBERS CAN BE EXPLOITED IN THE NATIONAL AEROSPACE PLANE (NASP) PROGRAM AFTER DEMONSTRATION OF SUCCESSFUL FABRICATION OF Gr REINFORCED INTERMETALLICS. DURING PHASE I, THE PRINCIPAL PROCESSING RELATED PROBLEMS FOR Gr/TiAl SYSTEMS WILL BE ALLEVIATED THROUGH THE FOLLOWING TECHNIQUES: FIBER SURFACE REACTION WITH INTERMETALLIC MATRIX - THROUGH PROPRIETARY COATINGS. CTE MISMATCH BETWEEN FIBER AND MATRIX PHASES - USING "COMPLIANT" FIBER COATINGS. POOR FLOW CHARACTERISTICS OF INTERMETALLIC MATRIX (AT REASONABLE TEMPERATURE) - THROUGH INCLUSION OF A PHASE WITH A LOW MELTING POINT. DURING PHASE II, A THOROUGH PARAMETRIC STUDY WILL BE CONDUCTED INVESTIGATING THE EFFECT OF PROCESSING CONDITIONS ON IMC QUALITY AND MECHANICAL PROPERTIES. ALSO, SPECIMENS WITH ULTRATHIN WALL SECTIONS ($t=0.005$ in.) WILL BE FABRICATED AND EVALUATED AGAINST CURRENT HIGH TEMPERATURE MATERIALS. DEMONSTRATING THE SUPERIORITY OF THIS MATERIAL OVER CURRENT TECHNOLOGY WILL ESTABLISH A FIRM BASIS FOR A COMMERCIALY SUPPORTED PHASE III PROGRAM.

FRONTIER TECHNOLOGY INC
530 E MONTECITO ST - STE 105
SANTA BARBARA, CA 93103
CONTRACT NUMBER: F33657-89-C-2277
EDWARD P JORDAN

TITLE:
COMPLEMENTARY OPERATIONS CONCEPTS AND REQUIREMENTS FOR THE NEXT
MULTI-ROLE FIGHTER
TOPIC# 162 OFFICE: ASD/XRX IDENT#: 32468

BY ABOUT 2003, DELIVERIES OF A NEW MULTI-ROLE FIGHTER TO REPLACE THE F-16 WILL BE NEEDED. IT WILL REQUIRE MUCH SUPERIOR COMBAT CAPABILITIES AND SURVIVABILITY TO THE F-16, BUT MUST COST NO MORE. ONE APPROACH TO IMPROVE COST EFFECTIVENESS IS THROUGH "COMPLEMENTARY"

SUBMITTED BY

OPERATIONS BETWEEN THE MULTI-ROLE AIRCRAFT AND SPECIALIZED AIRCRAFT, WHICH MAY BE ENABLED BY NEW "INTERMITTING" DATA LINK TECHNOLOGIES. FRONTIER PROPOSES TO INITIATE DEVELOPMENT PLANNING FOR THE "COMPLEMENTARY MULTI-ROLE FIGHTER" (CMRF) BY CONDUCTING AN ANALYSIS OF MISSION AND SYSTEM REQUIREMENTS, IN CONJUNCTION WITH SPECIAL STUDIES FOCUSED ON "WATERBED" TOPICS. THE FIRST OF THESE WILL BE THE OPERATIONAL UTILITY AND TECHNICAL FEASIBILITY OF INTERNETTED, COMPLEMENTARY COMBAT OPERATIONS BETWEEN THE CMRF AND OTHER AIR VEHICLES. OTHER SPECIAL TOPICS WILL INCLUDE COST REQUIREMENTS, PRODUCTION TIMING, SURVIVABILITY, MULTI-ROLE TRAINING, BASING/SUPPORT CONCEPTS (INCLUDING RUNWAY REQUIREMENTS), SUPERMANEUVERABILITY UTILITY, FORCE MIX, ETC.

FRONTIER TECHNOLOGY INC
4141 COLONEL GLENN HWY - STE 140
BEAVERCREEK, OH 45431
CONTRACT NUMBER: F33615-89-C-3610
RON BRAET

TITLE:

METHODOLOGY DEVELOPMENT FOR VERIFICATION OF FLIGHT CRITICAL SYSTEM SOFTWARE

TOPIC# 113 OFFICE: AFWAL/FIOP IDENT#: 33661

THE OVERALL OBJECTIVE OF THIS PROGRAM IS TO DEVELOP AND DEMONSTRATE AN INTEGRATED VERIFICATION METHODOLOGY WHICH FOCUSES ON HIGHLY COUPLED FLIGHT CRITICAL SYSTEMS SOFTWARE. THE APPLICATIONS OF ADVANCED CONTROL ON INTEGRATION TECHNOLOGIES ARE BRING ABOUT THE DEVELOPMENT OF ON-BOARD SYSTEMS THAT ARE DESIGNED TO ENHANCE COMBAT EFFECTIVENESS AND SURVIVABILITY IN THE EVER INCREASING HOSTILE COMBAT ENVIRONMENTS. FLIGHT CRITICAL SYSTEMS INCLUDING INTEGRATED FLIGHT AND PROPULSION CONTROL, INTEGRATED FLIGHT AND FIRE CONTROL, SELF-REPAIRING FLIGHT CONTROL, VEHICLE MANAGEMENT, PILOT-VEHICLE INTERFACE, AND FLIGHT VEHICLE SENSORS ARE BEING CONTROLLED AND INTEGRATED IN SOFTWARE. THIS PROPOSAL EFFORT IS DESIGNED TO DEVELOP AND DEMONSTRATE A VERIFICATION METHODOLOGY WHICH WILL PROVIDE AN EFFECTIVE AND EFFICIENT SOFTWARE VERIFICATION ENVIRONMENT CONTAINING METHODS, DISCIPLINES, TOOLS AND CONTROLS NEEDED FOR DEVELOPMENT AND VERIFICATION OF HIGHLY RELIABLE, FAULT TOLERANT FLIGHT CRITICAL SOFTWARE.

SUBMITTED BY

FRONTIER TECHNOLOGY INC
530 E MONTECITO ST - STE 105
SANTA BARBARA, CA 93103
CONTRACT NUMBER: F04701-89-C-0063
ROBERT G UTTLEY
TITLE:
INNOVATIVE SPACE SYSTEMS SURVIVABILITY CONCEPTS (METHODOLOGY FOR
DETERMINING SATELLITE SURVIVABILITY REQUIREMENTS FOR COMBAT SUPPO
TOPIC# 178 OFFICE: AFSTC/OLAB IDENT#: 34459

PRESENT AND FUTURE U.S. SPACE SYSTEMS WILL SUPPORT STRATEGIC AND
COMBAT FORCES BY PROVIDING SURVEILLANCE, COMMUNICATIONS, NAVIGATION
AID, WEATHER DATA, ETC. WELL-FOUNDED QUANTITATIVE ASSESSMENTS OF HOW
COMBAT FORCE EFFECTIVENESS DECREASES AS SATELLITES ARE LOST ARE
GENERALLY LACKING. PHASE I OF THIS STUDY WILL PROVIDE AND ILLUSTRATE
A METHODOLOGY FOR DERIVING SUCH RELATIONSHIPS, ACCOUNTING FOR THE
COLLECTION AND FUSION OF SPACE- AND NON-SPACE-GENERATED DATA, AND
COMMUNICATIONS VIA NON-SPACE AS WELL AS SPACE NETWORKS. PHASE II
WILL IMPLEMENT THE METHODOLOGY FOR CURRENT AND PLANNED SPACE SYSTEMS
VS. PROJECTED SU THREATS. IT WILL COMPARE THE RESULTS TO THE LEVELS
OF SUPPORT NEEDED FOR VARIOUS COMBAT MISSIONS AND THE LENGTH OF TIME
SUCH SUPPORT IS NEEDED FOR EACH MISSION. MEANS OF IMPROVING
SURVIVABILITY ENOUGH TO REMOVE DEFICIENCIES WILL BE PROPOSED, MAKING
MAXIMUM USE OF THE PREVIOUS EXISTING STUDIES OF VARIOUS APPROACHES
TO SURVIVABILITY ENHANCEMENT.

FRONTIER TECHNOLOGY INC
530 E MONTECITO ST - STE 105
SANTA BARBARA, CA 93103
CONTRACT NUMBER: F41622-89-C-0010
JONATHAN SOUTHARD
TITLE:
OPERATIONAL AIR COMMAND SIMULATION TECHNOLOGIES: ATAF/TACC
PLANNING AND OPERATIONS GAME
TOPIC# 68 OFFICE: HSD/SORT IDENT#: 34710

THERE IS A NEED FOR TECHNOLOGIES TO DEVELOP EASY-TO-USE SIMULATION

SUBMITTED BY

GAMES WITH WHICH HIGH- AND INTERMEDIATE-ECHELON TACTICAL AIR COMMANDERS AND THEIR STAFFS CAN DEVELOP INSIGHTS AND UNDERSTANDING OF CAMPAIGN DYNAMICS AND DECISION PROBLEMS. MOREOVER, THERE IS A NEED FOR TECHNOLOGIES TO EVALUATE THE BENEFIT FROM SUCH GAMES. THESE TECHNOLOGIES CAN BE DEVELOPED BY COMBINING TECHNIQUES FROM THE COMMERCIAL WARGAMING INDUSTRY WITH ANALYTIC COMBAT MODELS. TECHNOLOGIES WILL BE DEVELOPED FOR THE PROPER CHOICE OF SIMULATION DETAIL (FIDELITY), FOR STRUCTURING THE EDUCATION PRODUCT TO BE USED TO REALIZE GRADUATED LEARNING OBJECTIVES, FOR ENSURING THAT THE PARTICIPANT LEARNS BROADLY APPLICABLE WAR-FIGHTING LESSONS, AND FOR EVALUATING A SIMULATION GAME'S EDUCATIONAL BENEFIT. IN PHASE I, WE WILL DEVELOP AND DOCUMENT THE CRITICAL DESIGN TECHNOLOGIES, AND DESIGN THE BASIC FRAMEWORK OF A GAME FOR FURTHER DEVELOPMENT AND DEMONSTRATION. WE WILL ALSO DEVELOP A PLAN TO DEMONSTRATE METHODS OF EVALUATING THE TRAINING BENEFIT FROM SUCH A GAME. IN PHASE II A WORKING DEMONSTRATION GAME, RUNNING ON A PC, WILL BE IMPLEMENTED. IT WILL BE USED TO DEMONSTRATE THE METHOD OF EVALUATING TRAINING BENEFITS THROUGH EXPERIMENT, AS WELL AS TO DEMONSTRATE THE EFFICACY OF THE DESIGN TECHNOLOGIES.

FROST ENGINEERING DEVELOPMENT CORP
PO BOX 1294 - 3900 S KALAMATH
ENGLEWOOD, CO 80150
CONTRACT NUMBER: F41622-89-C-0006
HORACE M VARNER

TITLE:

AN IMPROVED UPPER TORSO HAULBACK AND INERTIA REEL SYSTEM FOR
EJECTION SEATS

TOPIC# 68 OFFICE: HSD/SORT IDENT#: 34665

UPPER TORSO HAULBACK MUST BE COMPLETED RAPIDLY TO ASSURE TIMELY EJECTION UNDER ADVERSE CONDITIONS YET THE HAULBACK MOTION SHOULD NOT INJURE THE PILOT. DESIGN OF A HAULBACK SYSTEM SHOULD INCLUDE CONSIDERATION OF THE BIODYNAMICS OF THE HUMAN BODY AND ASSOCIATED RESTRAINT HARNESS, THE KINEMATICS OF THE HAULBACK DEVICE, AND THE THERMODYNAMICS OF THE GAS GENERATOR. THE PROPOSED PROGRAM CONSISTS OF BIODYNAMIC AND KINEMATIC ANALYSIS BY A LEADING EXPERT IN HAULBACK AT THE UNIVERSITY OF DAYTON RESEARCH INSTITUTE, THERMODYNAMIC CONSULTING FROM THE NAVAL ORDNANCE STATION, AND MECHANICAL DESIGN BY

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FROST ENGINEERING TO CREATE AN OPTIMIZED HAULBACK SYSTEM BASED UPON RECENT ADVANCES IN RESTRAINT HARNESS IN COMBINATION WITH THE HUMAN BODY. THE RESULT WILL BE (1) A METHOD FOR DESIGNING UPPER TORSO HAULBACK SYSTEMS IN THE FUTURE, AND (2) A SYSTEM DESIGN APPLICABLE TO AN ADVANCED FIGHTER AIRCRAFT EJECTION SEAT. THE DESIGN WILL CONSIST OF LAYOUTS, DRAWINGS, AND SKETCHES BASED UPON THE VARIOUS ANALYSES. HARDWARE FABRICATION AND TEST WOULD OCCUR IN A PHASE II PROGRAM.

GEMINI COMPUTERS INC (ICS DIVISION)

PO BOX 222417

CARMEL, CA 93922

CONTRACT NUMBER:

DR ROGER SCHELL

TITLE:

EMBEDDED SECURE DATA BASE MANAGEMENT SYSTEM (ESDBMS)

TOPIC# 31 OFFICE: ESD/AVP IDENT#: 31593

THE USE OF COMMERCIAL DATA BASE MANAGEMENT SYSTEM (DBMS) FOR REAL-TIME COMMAND, CONTROL, AND COMMUNICATIONS (C3) SYSTEMS IS OFTEN TECHNICALLY FEASIBILITY. COMMERCIAL DBMSs ARE OFTEN CLOSELY TIED TO GENERAL-PURPOSE OPERATING SYSTEMS NOT SUITED FOR REAL-TIME APPLICATIONS. COMMERCIAL DBMSs ALSO DO NOT SUPPORT MULTILEVEL APPLICATIONS (I.E., ACCESS TO OPERATIONAL DATA OF VARIOUS SENSITIVITIES BY OPERATORS WITH DIFFERENT CLEARANCES). THE TECHNICAL STATE-OF-THE-ART NOW ALLOWS BOTH OF THESE DEFICIENCIES TO BE ADDRESSED. THE THEORETICAL CONCEPTS NEEDED HAVE BEEN DEMONSTRATED AS PART OF THE SEAVIEW PROJECT, SHOWING THAT A HIGHLY-ASSURED SYSTEM WITH DBMS FUNCTIONALITY CAN BE IMPLEMENTED AS AN UNTRUSTED DBMS EXECUTING ON A HIGHLY-TRUSTED SECURITY KERNEL, WITH ADEQUATE PERFORMANCE. FOR THE PROPOSED PROJECT, CALLED THE EMBEDDED SECURE DBMS, WE PROPOSE TO PORT A HIGH-PERFORMANCE DBMS (VIZ., ORACLE OR EQUIVALENT) TO GEMSOS IN SUCH A WAY AS TO ADEQUATELY SUPPORT REAL-TIME, EMBEDDED MULTILEVEL APPLICATIONS. THIS PROPOSAL IS SYNERGISTIC WITH AN ONGOING PRODUCT DEVELOPMENT EFFORT TO PROVIDE A MULTILEVEL SECURE VERSION OF ORACLE IN THE CONTEXT OF A GENERAL-PURPOSE OPERATING SYSTEM. THE ESDBMS WILL BE FOCUSED PRIMARILY UPON THE ISSUE OF DESIGNING AND DEVELOPING A RUN-TIME EXECUTIVE WHICH SUPPORTS THE MULTILEVEL VERSION OF ORACLE AND ALLOWS HIGH-PRIORITY TRANSACTIONS TO BE PROCESSED IN REAL-TIME REGARDLESS OF SYSTEM LOAD.

SUBMITTED BY

GENERAL PLASMA INC
12 THOMPSON RD
EAST WINDSOR, CT 06088
CONTRACT NUMBER:
RAYMOND G ROY

TITLE:
LOW-COST DEPOSITION OF HIGH TEMPERATURE SUPERCONDUCTOR FOR AVIONI
AND OTHER SCREENING APPLICATIONS
TOPIC# 51 OFFICE: RADC/XPX IDENT#: 31527

THE OBJECTIVE OF THE PROPOSED PROGRAM (PHASE I) IS TO DEVELOP THE PROCESS OF PLASMA FLAME DEPOSITION OF HIGH TEMPERATURE SUPERCONDUCTING MATERIALS FOR USE IN SCREENING AND ELECTROMAGNETIC CAVITY APPLICATIONS. IN ORDER TO REDUCE POST-DEPOSITION ANNEALING TIME AND EXPOSURE OF HIGH TEMPERATURE, A NOVEL ANNEALING PROCESS WILL BE EMPLOYED. THIS PROCESS INVOLVES THE USE OF AN ACTIVE SPECIES OF MOLECULAR OXYGEN, SPECIFICALLY DELTA SINGLET OXYGEN, AT CONCENTRATIONS OF UP TO 80%. IT IS ANTICIPATED THAT THE PLANNED REDUCTION IN TIME AT TEMPERATURE OF THE ANNEALING PROCESS WILL FAVORABLY LIMIT INTERACTION BETWEEN THE SUBSTRATE AND THE DEPOSITED HIGH TEMPERATURE SUPERCONDUCTOR. ADDITIONALLY, A PLASMA DEPOSITION/FABRICATION PROCESS FOR HOLLOW STRUCTURES WILL BE DEVELOPED - INVOLVING THE USE OF SACRIFICIAL MANDRELS. IT IS EXPECTED THAT THE TECHNOLOGY DEVELOPED DURING PHASE I OF THIS PROGRAM WILL BE APPLICABLE TO WORK WITH MOST OXIDE SUPERCONDUCTORS CURRENTLY UNDER DEVELOPMENT BY OTHER INVESTIGATORS.

GENERAL SCIENCES INC
655 S GRAVERS RD
PLYMOUTH MEETING, PA 19462
CONTRACT NUMBER:
DR PETER D ZAVITSANOS

TITLE:
AN RCS SIGNATURE REDUCTION CONCEPT
TOPIC# 209 OFFICE: BMO/MYSC IDENT#: 32552

NEW COMPOUND COMPOSITIONS HAVE BEEN IDENTIFIED BY GSI WHICH HAVE A

SUBMITTED BY

HIGH PROBABILITY OF IMPROVING THE PENETRATION CAPABILITIES OF STRATEGIC SYSTEMS. THESE NEW MATERIALS, HOWEVER, NEED TO BE CHARACTERIZED ON THE BASIS OF MICROWAVE INTERACTION AND ABLATION. THE PROPOSED PROGRAM WILL EXAMINE LEVEL OF EFFECTIVENESS AS A FUNCTION OF MATERIAL COMPOSITION AND PROPERTIES WHICH CONTROL IMPORTANT ASPECTS OF RV AND DECOY PERFORMANCE; EXPERIMENTAL AS WELL AS ANALYTICAL TECHNIQUES WILL BE USED.

GENERAL TECHNOLOGY

2560 PRESCOTT RD
HAVERTOWN, PA 19083

CONTRACT NUMBER: F33615-89-C-2929

JOSEPH P CERINI

TITLE:

DEVELOPMENT OF IMPROVED HIGH TEMPERATURE SOLID LUBRICANT CONCEPTS

TOPIC# 151 OFFICE: AFWAL/POMP IDENT#: 33213

SOLID LUBRICANTION HAS BEEN ACCEPTED AS A UNIQUE METHOD OF IMPROVING BEARING LIFE UNDER EXTREME CONDITIONS OF TEMPERATURE, LOAD, AND SPEED. THE CHALCOGENIDES (COMPLEX SULFUR CONTAINING COMPOUNDS) HAVE LONG BEEN IDENTIFIED AS SOLID LUBRICANTS (MOLYBDENUM DISULFIDE IS A DICHALCOGENIDE) THAT PROVIDE SATISFACTORY PERFORMANCE LIFE FOR ROLLING BEARINGS. THE COMPLEX METAL CHALCOGENIDES HAVE SHOWN GOOD PERFORMANCE AS A SOLID LUBRICANT FOR CERAMIC ROLLING BEARINGS IN HIGH TEMPERATURE BEARING TESTS. TO BENEFIT FROM THE APPLICATION OF THE SOLID LUBRICANT TECHNOLOGY AN UNDERSTANDING OF THE RELATIONSHIP BETWEEN PROPERTIES OF THE CHALCOGENIDES AND THE SUBSTRATE (BEARING) MATERIALS ALONG WITH THE IN-SERVICE ENVIRONMENT IS ESSENTIAL. THIS PHASE I PROJECT WILL INVESTIGATE THE PROPERTIES OF THE COMPLEX METAL CHALCOGNIDES TO CHARACTERIZE THEM AS THEY INTERACT WITH THE CERAMIC AND SUPER ALLOYS USED IN THE HIGH THRUST, WIDE TEMPERATURE RANGE OF THE ADVANCED ENGINE. THIS RESEARCH WILL INVESTIGATE THE PROPERTIES OF THE COMPLEX CHALCOGENIDES IN TEMPERATURES OF -65 DEG F (COLD SOAK TEST) AND 1500 DEG F (WEAR LIFE PERFORMANCE TEST). THE RESULTS WILL ESTABLISH AN IMPORTANT DATA BASE FOR THE EFFECTIVE LUBRICATION OF CERAMIC AND SUPER ALLOY COMPONENTS PROVIDING LONG TERM OPERATION UNDER WIDE SPECTRUM OF OPERATING CONDITIONS WHICH REPRESENTS AN IMPORTANT GOAL AND A BASIC REQUIREMENT FOR THE ADVANCED LIMITED-LIFE SMALL TURBINE ENGINE.

SUBMITTED BY

GEO-CENTERS INC
7 WELLS AVE
NEWTON CENTRE, MA 02159
CONTRACT NUMBER: F04701-89-C-0053
PATRICIA A TAFFE
TITLE:
PERSONAL HYDRAZINE VAPOR DOSIMETER
TOPIC# 171 OFFICE: AFSTC/OLAB IDENT#: 34365

IN SUPPORT OF THE AIR FORCE SPACE DIVISION OPERATIONS, GEO-CENTERS, INC. PROPOSES THE DEVELOPMENT OF A UNIQUE DOSIMETER INCORPORATING BOTH A PASSIVE COLORMETRIC ELEMENT AND AN OPTICAL SENSOR. THE DOSIMETER ALLOWS CONTINUOUS REAL TIME PASSIVE MONITORING WHILE THE OPTICAL SENSOR ALLOWS THE INCORPORATION OF AN AUDIO ALARM SYSTEM. GEO-CENTERS, INC. PROPOSES A PHASE I EFFORT TO DESIGN AND DEMONSTRATE IN THE LABORATORY AN OPTICAL SENSOR CAPABLE OF DETECTING HYDRAZINE AND ITS DERIVATIVES, MONOMETHYLHYDRAZINE (MMH) AND UNSYMMETRICAL DIMETHYLHYDRAZINE (UDMH), USING A PROVEN CHEMICAL INDICATION SYSTEM. SPECIFICALLY, GEO-CENTERS, INC. WILL CONSTRUCT AND EVALUATE OPTICAL SENSORS AND DESIGN A COMPOSITE BADGE CONSISTING OF BOTH A VISUAL INDICATION SYSTEM AND AN OPTICAL SENSOR ALARM SYSTEM ACCEPTABLE FOR PHASE II DEVELOPMENT AND FIELD EVALUATION.

GOFFMAN M ASSOCS
3 DELLVIEW DR
EDISON, NJ 08820
CONTRACT NUMBER: F08635-89-C-0374
XIN Di WU
TITLE:
PREPARATION OF EPITAXIAL AND GRAIN-BOUNDARY-FREE HIGH T(c)
SUPERCONDUCTING THIN FILMS FOR FAST AND SENSITIVE INFRARED DETECT
TOPIC# 8 OFFICE: AD/PMR IDENT#: 31115

THE OBJECTIVE OF THIS WORK IS TO PREPARE EPITAXIAL AND GRAIN-BOUNDARY-FREE HIGH Tc Y0Ba-Cu OXIDE SUPERCONDUCTING THIN FILMS FOR THE APPLICATIONS OF INFRARED DETECTIONS. OPTICAL RESPONSES HAVE

SUBMITTED BY

BEEN MEASURED ON THE GRANULAR HIGH T_c SUPERCONDUCTING THIN FILMS. THE FASTEST RESPONSE TIME AND THE HIGHEST DETECTIVITY WERE 20 ns AND $10(8) \text{ cm-Hz}(1/2)/W$, WHICH ARE FAR BELOW THE REQUIRED NUMBERS FOR ANY PRACTICAL APPLICATIONS. WE ANTICIPATE THE FABRICATION OF SUPERCONDUCTING THIN FILMS WITHOUT ANY GRAIN BOUNDARIES BUT WITH A LARGE NUMBER OF LOCAL DEFECTS. THE ACHIEVEMENT OF THESE GOALS WILL DEMONSTRATE THAT THESE FILMS CAN USED FOR FAST AND SENSITIVE DETECTIONS FROM NEAR INFRARED TO FAR INFRARED WAVELENGTHS. THIS WILL LEAD TO THE BIRTH OF A SUPER HIGH SPEED AND SUPER HIGH SENSITIVITY SEMICONDUCTING THIN FILM INFRARED DETECTOR WHICH WILL FIND WIDE APPLICATIONS IN THE AREAS OF MILITARY, SCIENTIFIC AND MEDICAL RESEARCH AS WELL AS INDUSTRY.

GROTON ASSOCS INC
PO BOX 1070 - 266 NASHUA RD
GROTON, MA 01450
CONTRACT NUMBER:
STEPHEN A BOLDUC
TITLE:
EXPERT SYSTEM FOR SOFTWARE ENGINEERING CAPABILITY ENHANCEMENT
TOPIC# 31 OFFICE: ESD/AVP IDENT#: 31611

THIS PROPOSAL WILL INVESTIGATE THE FEASIBILITY OF THE DEVELOPMENT AND USE OF AN "EXPERT" SYSTEM TO PRESCRIBE REMEDIAL ACTIONS WHICH WILL IMPROVE THE SOFTWARE ENGINEERING CAPABILITY OF A SOFTWARE DEVELOPMENT ORGANIZATION. USING THE SOFTWARE ENGINEERING INSTITUTE'S A METHOD FOR ASSESSING THE SOFTWARE ENGINEERING CAPABILITY OF CONTRACTORS AS A BASELINE SET OF METRICS AND AS DIAGNOSTIC INPUT DATA TO THE SYSTEM, AN AUTOMATED ANALYSIS WOULD BE ACCOMPLISHED WHEREBY SPECIFIC REMEDIAL RECOMMENDATIONS WILL BE GENERATED SO AS TO IMPROVE THE SOFTWARE DEVELOPMENT ORGANIZATION'S SOFTWARE ENGINEERING CAPABILITY AS DEFINED BY THE SOFTWARE ENGINEERING INSTITUTE'S METHODOLOGY.

GS INC
PO BOX 4026 - BVL STA
ANDOVER, MA 01810
CONTRACT NUMBER: F19628-89-C-0192
GEORGE PLOUSSIOS
TITLE:
ELECTRONICALLY TUNED HF ANTENNA
TOPIC# 31 OFFICE: ESD/AVP IDENT#: 31623

SUBMITTED BY

A VERY EFFICIENT ELECTRONICALLY TUNABLE HELICAL ANTENNA COVERING HF BAND WITH 2 ELEMENTS HAS BEEN POSTULATED. A UNIQUE PIN DIODE TUNING NETWORK ALLOWS THE DESIGN OF AN ANTENNA THAT IS AT LEAST 10 DB HIGHER IN EFFICIENCY THAN ANTENNAS OF COMPARABLE SIZE AND PROVIDE USEC SWITCHING SPEEDS. SOME OF THE ANTENNA CHARACTERISTICS HAVE BEEN DEMONSTRATED IN PREVIOUS WORK AT VHF. THE PHASE I EFFORT IS INTENDED TO VERIFY CRITICAL CHARACTERISTICS THAT HAVE NOT TO DATE BEEN DEMONSTRATED. THESE CHARACTERISTICS INCLUDE HIGH POWER OPERATION (E.G. 400 WATTS CW), NETWORK CHARACTERISTICS AT HF, COUPLING BETWEEN ANTENNAS IN A CO-SITE CONFIGURATION, AND FAILURE MODE ANALYSIS. THE PHASE I EFFORT WILL INCLUDE ANALYTICAL MODELING OF THE ANTENNA PLUS FABRICATION OF A TEST CONFIGURATION THAT WILL BE TESTED TO DEMONSTRATE THE ABOVE CHARACTERISTICS.

GT-TECH INC
5 MEADOW MIST CT
REISTERSTOWN, MD 21136
CONTRACT NUMBER: F33615-89-C-1079
EDWARD H GERMAN JR
TITLE:
INTEGRATED INFORMATION SIGNAL PROCESSING
TOPIC# 84 OFFICE: AFWAL/AAOP IDENT#: 32770

PRESENT MILITARY AND AIRCRAFT RADIOS SPAN NUMEROUS SPECIAL FUNCTIONS AND NEEDS. MODERN DEVICE TECHNOLOGY (HIGH SPEED DIGITAL FFT'S AND SAW/ACT ANALOG CHIRP FOURIER TRANSFORMERS) HAS OPENED AVENUES FOR SIGNIFICANT ADVANCES IN INTEGRATED SIGNAL PROCESSING CAPABILITIES IN MILITARY RADIOS FOR USE BY THE AIR FORCE. THROUGH USE OF THIS DEVICE TECHNOLOGY, AN LPI/AJ CNI INTEGRATED RADIO CONCEPT, IS PROPOSED FOR DEVELOPMENT, BASED UPON THE USE OF TRANSFORM DOMAIN PROCESSING. TRANSFORM DOMAIN TECHNIQUES ALLOW NATURAL COMBINING OF MULTI-CHANNEL SYNCHRONOUS/ASYNCHRONOUS OPERATION, FREQUENCY HOPPING AND DISCRETE SEQUENCE SPREADING ENCODING, LPI FUNCTIONS INCLUDING CONTROL OF THE TRANSMITTED SPECTRUM, AND NETWORKING INTO A SINGLE RADIO. AS NAVIGATION AND IDENTIFICATION FUNCTIONS CAN BE BASED UPON WIDEBAND SPREADING SEQUENCES, THESE FUNCTIONS ARE INHERENT IN SYSTEM OPERATION. NOT ONLY WILL THE PROPOSED CONCEPT BE CAPABLE OF THE CNI FUNCTIONS, BUT IT IS CAPABLE OF INTEROPERABILITY WITH PRESENT

SMALL BUSINESS INNOVATION RESEARCH (SBIR) PROGRAM - PHASE 1 PAGE 364
BY SERVICE
FISCAL YEAR 1989
AF

SUBMITTED BY

COMMUNICATIONS SYSTEMS (JTIDS, GPS, AND OPERATING IN PRESENT AND FORESEEABLE MILITARY AND CIVILIAN NETWORKS. ELECTRONIC SURVEILLANCE MONITORING OF THE EXTERNAL ELECTROMAGNETIC ENVIRONMENT IS ALSO INHERENT IN THE SYSTEM DUE TO THE "BUILT-IN" FOURIER TRANSFORMERS.

GUPTA P K INC
117 SOUTHBURY ROAD
CLIFTON PARK, NY 12065
CONTRACT NUMBER: F33615-89-C-5648
DR PRADEEP K GUPTA
TITLE:
MODELING OF STRESSES IN COATED SOLIDS
TOPIC# 121 OFFICE: AFWAL/MLK IDENT#: 33463

A FINITE ELEMENT APPROACH TO MODELING OF STRESSES IN COATED ELASTIC SOLIDS IS PROPOSED. CONCENTRATED CONTACT PROBLEMS, SUBJECTED TO NORMAL, SHEAR AND THERMAL LOADINGS, SHALL BE FIRST CONSIDERED IN PLANE STRAIN CONFIGURATION. THE FINITE ELEMENT RESULTS SHALL BE VALIDATED AGAINST SOLUTIONS AVAILABLE FROM OTHER PROVEN ANALYTICAL TECHNIQUES; THUS, TECHNICAL FEASIBILITY OF THE OVERALL APPROACH SHALL BE PROVEN. A PARAMETRIC EVALUATION OF STRESSES IN THE COATING, AND THE SHEAR AND TENSION CONDITIONS AT THE COATING/SUBSTRATE INTERFACE SHALL BE CARRIED OUT AS A FUNCTION OF COATING THICKNESS AND MATERIAL PROPERTIES TO DEMONSTRATE PRACTICAL SIGNIFICANCE OF THE MODEL FOR DEVELOPMENT OF ACTUAL DESIGNS. AFTER SUCH PROVEN TECHNICAL FEASIBILITY AND PRACTICAL SIGNIFICANCE OF THE MODEL, POTENTIAL OF THE FINITE ELEMENT APPROACH FOR MODELING COMPLEX GEOMETRIES AND ADVERSE MECHANICAL AND THERMAL LOADING ENVIRONMENTS, SHALL BE DEMONSTRATED BY MODELING A THREE DIMENSIONAL ELLIPTICAL CONTACT. SUCH AN IMPLEMENTATION, WITHIN THE WORK SCOPE OF THE PROPOSED PHASE I EFFORT, SHALL PROVIDE THE REQUIRED ANALYTICAL FOUNDATION FOR THE DEVELOPMENT OF A MORE COMPLEX THREE DIMENSIONAL FINITE ELEMENT MODEL, IN PHASE II.

HARRIS GROUP INC
1801 ROBERT FULTON DR - STE 200
RESTON, VA 22091
CONTRACT NUMBER: F08635-89-C-0386
C DAN KOHLHAAS
TITLE:
AN INVESTIGATION OF THE APPLICATION OF NEURAL NETWORK TECHNOLOGY TO DAMAGE ASSESSMENT
TOPIC# 56 OFFICE: AFESC/RDXP IDENT#: 31915

SUBMITTED BY

A NEED EXISTS FOR PROVIDING TIMELY DAMAGE ASSESSMENT INFORMATION TO THE KEY DECISION MAKERS ON A TYPICAL AIRBASE DURING AN ATTACK OR NATURAL DISASTER. AT PRESENT, THE DIFFICULTY OF PROVIDING ACCURATE AND TIMELY INFORMATION HINDERS DECISION MAKING DURING A CRISIS. REAL-TIME DAMAGE ASSESSMENT MAY BE POSSIBLE THROUGH THE APPLICATION OF NEURAL NETWORK TECHNOLOGY. FOR A DAMAGE ASSESSMENT SYSTEM TO BE SUCCESSFUL IT MUST PERFORM THREE KEY FUNCTIONS: RECOGNITION AND IDENTIFICATION, CATEGORIZATION, AND LOCATION. IN THIS PROPOSAL A SYSTEM CONSISTING OF A DIGITAL COMPUTER HOSTING A NEURAL NETWORK WITH SIMULATED SENSORS WILL BE USED TO INVESTIGATE THE CAPABILITIES OF THE SYSTEM TO PERFORM THE THREE FUNCTIONS. THE MAIN THRUST OF THIS EFFORT IS TO SHOW THAT THESE FUNCTIONS CAN BE ACCOMPLISHED ON REAL-TIME AND WITH SUFFICIENT PRECISION AND RELIABILITY TO MAKE REMOTE SENSING DAMAGE ASSESSMENT POSSIBLE.

HAZTEC INC
23 PINE ST
LEBANON, NH 03766
CONTRACT NUMBER: F08635-89-C-0344
CLAYTON R MORLOCK
TITLE:
MANAGEMENT METHODOLOGY FOR A LARGE NETWORK OF UNDERGROUND STORAGE TANKS - PHASE I: EXTERNAL MONITORING WITH IN SITU SENSORS
TOPIC# 56 OFFICE: AFESC/RDXP IDENT#: 31942

A COST EFFECTIVE METHODOLOGY TO MANAGE A LARGE NETWORK OF UNDERGROUND STORAGE TANKS, SUCH AS WHAT EXISTS AT A MAJOR AIR FORCE FACILITY, WILL BE INVESTIGATED. A VERSATILE, IN GROUND, LEAK DETECTION SYSTEM UTILIZING IN SITU SENSORS AND AN INSTALLATION METHOD OF PUSHING PREFABRICATED MONITORING POINTS INTO THE SOIL WILL BE DEVELOPED. THE METHODOLOGY DEvised IS EXPECTED TO REPLACE COSTLY MONITOR WELL INSTALLATION AND LABORATORY ANALYSIS CURRENTLY USED FOR SUBSURFACE CONTAMINANT MONITORING. TECHNIQUES TO EXPLOIT THE LARGE AMOUNT OF NEW SENSORS SUITABLE FOR IN SITU USE WILL BE INVESTIGATED AND DOCUMENTED SO THAT THE FULL ADVANTAGE OF THESE NEW SENSORS CAN BE REALIZED. FIBER OPTIC CHEMICAL SENSORS WILL BE USED IN THE PILOT STUDY. THESE SENSORS READINGS WILL BE COMPARED WITH CONVENTIONAL WELL SAMPLE AND ANALYSIS PROCEDURES. FIELD PERFORMANCE OF SENSORS

SUBMITTED BY

INSTALLED IN BOTH MONITOR WELLS AND PUSHED INSTALLATIONS WILL BE DOCUMENTED. PHASE II RESEARCH WILL INTEGRATE EXTERNAL MONITORING METHODS WITH OTHER TECHNOLOGIES TO DESIGN A COMPLETE SYSTEM FOR MANAGEMENT OF A LARGE NETWORK OF UNDERGROUND STORAGE TANKS.

HIGH TECHNOLOGY CORP

28 RESEARCH DR
HAMPTON, VA 23666

CONTRACT NUMBER:

DR MUJEEB R MALIK

TITLE:

NUMERICAL AND ANALYTICAL STUDIES OF LAMINAR TO TURBULENCE TRANSITION
TOPIC# 236 OFFICE: AFOSR/XOT IDENT#: 34271

IT IS PROPOSED HERE TO STUDY NONLINEAR DEVELOPMENT OF GORTLER AND CROSSFLOW VORTICES AND INVESTIGATE VARIOUS WAVE-INTERACTION MECHANISMS OPERATIVE IN TWO AND THREE-DIMENSIONAL BOUNDARY LAYERS. THE PROPOSED WORK WILL NUMERICALLY SIMULATE TRANSITION IN A THREE-DIMENSIONAL BOUNDARY LAYER. THE OBJECTIVE OF THE RESEARCH IS TO FURTHER THE UNDERSTANDING OF LAMINAR/TURBULENT TRANSITION MECHANISMS AND GORTLER/TS AND CROSSFLOW/TS INTERACTION. WE WILL INVESTIGATE NUMERICALLY AND THEORETICALLY WHAT IMPACT THESE WAVE-INTERACTIONS MIGHT HAVE ON PRESENT DAY TRANSITION PREDICTION METHODOLOGY BASED UPON LINEAR STABILITY THEORY AND WILL SUGGEST IMPROVEMENTS IN THE PREDICTION TECHNIQUES. TRANSITION PREDICTION IS OF IMMENSE PRACTICAL SIGNIFICANCE AND UNDERSTANDING OF THE TRANSITION PROCESS IS ALSO OF RELEVANCE IN FURTHERING THE KNOWLEDGE OF TURBULENCE. TO ACHIEVE OUR GOAL, WE USE STATE OF THE ART SPECTRAL TECHNIQUES FOR NUMERICAL SIMULATION AND EVALUATE THEORIES BASED UPON TRIPLE-DECK APPROACH, METHOD OF MULTIPLE-SCALES AND FLOQUET ANALYSIS.

HITECH PRODUCTS INC

PO BOX 790 - 100 PARK ST/UNIT 12

AYER, MA 01432

CONTRACT NUMBER: F33615-89-C-3211

STEPHEN P WNUK JR

TITLE:

ATTACHMENT TECHNIQUES FOR HIGH TEMPERATURE STRAIN
TOPIC# 119 OFFICE: AFWAL/FIOP IDENT#: 33700

SUBMITTED BY

HITECH PRODUCTS PROPOSES RESEARCH, DEVELOPMENT, AND TESTING REQUIRED TO CHARACTERIZE STRAIN GAGE ATTACHEMENT TECHNIQUES ON METALLIC AND COMPOSITE STRUCTURAL MATERIALS IN ELEVATED TEMPERATURE ENVIRONMENTS. THIS PROGRAM WILL BUILD ON EXISTING KNOWLEDGE OF ATTACHEMENT TECHNIQUES ACQUIRED THROUGH NUMEROUS DEVELOPMENT PROJECTS WITH AEROSPACE AND ROCK INDUSTRIES. SPECIFICALLY, WE INTEND TO EVALUATE CERAMIC CEMENT, FLAME SPRAY, SPUTTER COATINGS, WELDING, BRAZING, AND METALLIZING TECHNIQUES FOR ATTACHING RESISTIVE AND CAPACITIVE SENSORS TO MATERIALS INCLUDING TITANIUM ALUMINIDES, NICKEL ALUMINIDES, CERAMIC MATRIX COMPOSITES, AND METAL MATRIX COMPOSITES. SPECIFIC SENSORS SELECTED FOR EVALUATION WILL MINIMALLY INCLUDE SPECIAL ALLOY WIRE GAGES (Pd-Cr, Fe-Cr-Al, ETC), BOEING AND GPD CAPACITIVE GAGES, AND OTHER GAGES (I.E. CLIP GAGES) AS APPROPRIATE. EVALUATION OF SPUTTER PRE-COATS AND SIMPLE SPUTTERED GAGES ON ABOVE MATERIAL SYSTEMS WILL ALSO BE CONDUCTED. OUR FINAL OBJECTIVE WILL BE PROTOTYPE INSTALLATIONS DEMONSTRATING FEASIBILITY/COMPATABILITY OF THE ATTACHEMENT METHOD WITH VARIOUS TEST MATERIALS.

HNC INC
5501 OBERLIN DR
SAN DIEGO, CA 92121
CONTRACT NUMBER: F33657-89-C-2266
TODD GUTSCHOW
TITLE:
ADAPTIVE NEURAL NETWORK BEAM-FORMING SYSTEM FOR LARGE ANTENNA ARRAYS
TOPIC# 163 OFFICE: ASD/XXR IDENT#: 32357

A NEURAL NETWORK BASED APPROACH TO ADAPTIVE ANTENNA CONTROL IS PRESENTED. THIS APPROACH PROVIDES AN ADAPTIVE AND AUTOMATIC TECHNIQUE FOR STEERING BEAMS IN LARGE ANTENNA ARRAYS. THE FINAL DISTRIBUTION OF BEAMS APPROXIMATES THE ANGULAR EMITTER SIGNAL PROBABILITY DENSITY FUNCTION. THIS TECHNIQUE MAY BE APPLICABLE TO COMPLEX ARRAY GEOMETRIES SUCH AS CONFORMAL ARRAYS AND "SMART SKINS". THE DESIGN OF THE ADAPTIVE CONTROL TECHNIQUE USES HYBRIDS INSTEAD OF PHASE SHIFTERS. THIS ENHANCES THE POSSIBILITY OF FABRICATING SUCH A CONTROLLER USING MMIC TECHNOLOGY.

HNC INC
5501 OBERLIN DR
SAN DIEGO, CA 92121
CONTRACT NUMBER: F33615-89-C-3607
GEOFFREY J HUETER
TITLE:
IN-FLIGHT ADAPTIVE CONTROL USING NEURAL NETWORKS
TOPIC# 108 OFFICE: AFWA/FIOP IDENT#: 33617

SUBMITTED BY

REAL-TIME FLIGHT CONTROL IS OFTEN IMPLEMENTED USING CONTROL SYSTEMS AND PRE-PROGRAMMED CONTROLLER SOFTWARE TAILORED TO A SINGLE APPLICATION. HNC, INC. PROPOSES TO BUILD AN ADAPTIVE NEURAL NETWORK CONTROLLER WHICH DOES NOT NEED TO BE PROGRAMMED BUT RATHER CREATES AN INTERNAL REPRESENTATION OF THE CONTROL LAW AS A RESPONSE TO THE ACTION OF THE SYSTEM BEING CONTROLLED OR A SIMULATION THEREOF. HNC, WITH THE COOPERATION OF UNITED TECHNOLOGIES CORPORATION, PROPOSES TO DEMONSTRATE THE OPERATION OF AN ADAPTIVE NEURAL NETWORK FLIGHT CONTROLLER. PHASE I WILL CONVER THE EXTENSION OF HNC/UTC'S CURRENT NEURAL NETWORK CONTROLLER TO INCLUDE IN-FLIGHT RE-CONFIGURATION, AS WELL AS A DEFINITION OF THE HARDWARE REQUIREMENTS AND CORRESPONDING ARCHITECTURE FOR A REAL-TIME SYSTEM. PHASE II WOULD INVOLVE DEMONSTRATING THE CONTROLLER IN REAL-TIME FOR AN AIRFRAME TO BE SELECTED BY AFWAL AND DESIGNING A DEPLOYABLE CONTROLLER. A THIRD PHASE OF THE PROGRAM WOULD BE DIRECTED TOWARD THE PRODUCTION AND FLIGHT TEST OF THE PROTOTYPE NEURAL NETWORK CONTROLLER.

HOLOMETRIX INC (ELECTRO-OPTICS DIV)

99 ERIE ST

CAMBRIDGE, MA 02139

CONTRACT NUMBER:

DR P GREGORY DeBARYSHE

TITLE:

SYSTEM FOR MACRO AND MICRO AIRFIELD PAVEMENT DAMAGE ASSESSMENT

TOPIC# 67 OFFICE: AFESC/RDXP IDENT#: 32067

DUE TO THE EXTREMELY DYNAMIC NATURE OF THE AIR-LAND BATTLE, IT IS PARTICULARLY IMPORTANT TO HAVE TIMELY RECOVERY FROM AIRFIELD DAMAGE. TIMELINESS IS THE RESULT OF A NUMBER OF FACTORS, INCLUDING THE ABILITY TO RAPIDLY AND ACCURATELY ASSESS DAMAGE, AS WELL AS TO ASSIST IN REPAIR OF DAMAGE BY PROVIDING IN SITU MEASUREMENTS ON INDIVIDUAL REPAIR SEGMENTS. AT PRESENT, DATA REQUIRED FOR ASSESSMENT OF PAVEMENT DAMAGE (TYPICALLY THE LOCATIONS AND SIZES OF CRATERS, HEAVES, SPALLS OR OTHER FEATURES THAT PREVENT THE NORMAL USE OF THE AFFECTED RUNWAY) MUST BE ACQUIRED AND PROCESSED VIA AERIAL PHOTOGRAPHY OR BY OTHER MANUAL METHODS. BOTH OF THE ABOVE METHODS, HOWEVER, LACK THE MOST-NEEDED FEATURES OF TIMELINESS, ACCURACY, AND OPERATOR SAFETY. IN ORDER TO LOCATE A "BEST-CASE" MINIMUM OPERATING

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STRIP (MOS), DATA MUST IDEALLY BE OF A THREE-DIMENSIONAL NATURE, PROVIDING AN ACCURATE INDICATION OF THE VOLUME AND LOCATIONS OF VARIOUS AIRSTRIP DEFORMITIES, FOR INPUT TO NEURAL NETWORK OR OTHER PROCESSING METHODS. A NEW APPROACH TO DAMAGE ASSESSMENT, INVOLVING PULSED LASER DISTANCE MEASUREMENT, WILL BE STUDIED. THE STUDY PERFORMED WILL RESULT IN A BASELINE SPECIFICATION FOR A HIGHLY ACCURATE DAMAGE SURVEY SYSTEM FOR PRACTICAL USE IN RAPID AIRFIELD RECOVERY.

HUGHES ASSOCS INC
2730 UNIVERSITY BLVD W - STE 902
WHEATON, MD 20902
CONTRACT NUMBER: F08635-89-C-0381
DR LEONARD A JONAS
TITLE:
ENERGY FIELDS FOR FIRE EXTINGUISHMENT
TOPIC# 66 OFFICE: AFESC/RDXP IDENT#: 32060

THE OBJECTIVE OF THIS PROPOSAL IS TO IDENTIFY THE ADJUSTMENT OF FLAMES BY ENERGY FIELDS TO CAUSE OR TO INCREASE THE POTENTIAL FOR FIRE EXTINGUISHMENT, AND TO DETERMINE THE ENERGY FIELD WHICH PROVIDES OPTIMAL EFFECTS.

HUMAN FACTORS SOLUTIONS
4617 GEMSTONE TERRACE
ROCKVILLE, MD 20852
CONTRACT NUMBER: F19628-89-C-0099
PAMELA T MYERS
TITLE:
COMMMAND CONTROL AND COMMUNICATIONS SYSTEMS AND SUBSYSTEMS-FUTURE
NORTH AMERICAN AIR TRAFFIC CONTROL SYNERGY
TOPIC# 31 OFFICE: ESD/AVP IDENT#: 31599

THE NATIONAL AIRSPACE SYSTEM (NAS) PLAN AND THE CANADIAN AIRSPACE SYSTEM (CAS) PLAN CONTAIN MODERNIZATION PROJECTS AFFECTING MOST ELEMENTS OF THE NORTH AMERICAN AIRSPACE SYSTEM AND HAVE POTENTIALLY SIGNIFICANT IMPACTS ON SYSTEM USERS. FURTHER, THE AIRSPACE SYSTEMS

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OF THE U.S. AND CANADA HAVE CONSIDERABLE POINTS OF INTERDEPENDENCY AND INTERRELATIONSHIP. AS BEFITTED THEIR INDEPENDENT NATIONAL INTERESTS, EACH COUNTRY DEVELOPED THEIR MODERNIZATION REQUIREMENTS IN RELATIVE ISOLATION FROM ONE ANOTHER. FURTHER, THE RESPECTIVE DEFENSE AGENCIES OF THESE COUNTRIES HAVE BEEN ONLY MINIMALLY INVOLVED WITH MODERNIZATION PLANS AND NOT IN A STRUCTURED ORGANIZATIONAL MANNER. THE MILITARY IS VITALLY INTERESTED IN THE OPERATION, PLANNING, AND POTENTIAL LONG-RANGE INTERFACE WITH NAS AND CAS PLAN PROJECTS. INDIVIDUAL DEFENSE AGENCIES HAVE A CRITICAL INTEREST IN ENSURING ADEQUATE COMMAND, CONTROL, AND COMMUNICATIONS INFRASTRUCTURE AND INTERFACE FOR THE DEFENSE MISSIONS IN NORTH AMERICA. THE OBJECTIVES OF THE PROPOSAL ARE TO: (1) ESTABLISH THE POINTS OF INTEROPERABILITY TO FACILITATE EXCHANGE OF LESSONS LEARNED, POSSIBLE OUTYEAR TECHNOLOGICAL APPLICATIONS, AND RESEARCH AND DEVELOPMENT GAINS; AND (2) DETERMINE THE MAJOR INTERFACE ISSUES BETWEEN CANADA AND THE UNITED STATES FROM A TECHNOLOGICAL AND AN ORGANIZATIONAL PERSPECTIVE.

HUMAN MACHINE INTERFACES INC
PO BOX 22446
KNOXVILLE, TN 37933
CONTRACT NUMBER: F41622-89-C-0013
DR JOHN V DRAPER

TITLE:
EXPERT SYSTEM FOR SETTING FORCE REFLECTION LEVELS DURING
TELEOPERATION
TOPIC# 68 OFFICE: HSD/SORT IDENT#: 34722

THIS PROPOSAL DESCRIBES THE FIRST PHASE OF A PROJECT WHICH WILL DEVELOP AN EXPERT SYSTEM CAPABLE OF SELECTING OPTIMAL FORCE REFLECTION LEVELS IN REAL-TIME DURING TELEOPERATION. THERE ARE THREE GOALS FOR PHASE I: 1) DELINEATION OF TASK SITUATIONS IN WHICH FORCE-FEEDBACK IS HELPFUL; 2) DEVELOPMENT OF EXPERIMENTAL METHODS FOR TESTING THE EFFECT OF DIFFERENT FEEDBACK LEVELS ON RATE OF LEARNING, ASYMPTOTIC PERFORMANCE LEVEL, ABILITY TO TRANSFER TRAINING TO NEW TASKS, AND RATE OF SKILL DECAY; AND 3) INITIATION OF PILOT EXPERIMENTS TO DETERMINE THE APPROPRIATE FORCE REFLECTION LEVELS FOR MORE EXTENSIVE RESEARCH. PHASE I WILL PROVIDE A BASIS FOR STUDYING THE ROLE OF FORCE REFLECTION IN COMPLEX TASKS WHICH DEMAND A VARIETY OF MANIPULATIVE SKILLS, IN DEVELOPING AND MAINTAINING OPERATOR SKILL,

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AND THE IMPACT OF MANIPULATOR SYSTEM CHARACTERISTICS. THE PROPOSED PROJECT WILL PROVIDE EXPERIMENTAL RESULTS CONCERNING THE IMPACT OF FORCE REFLECTION ON TELEOPERATION. IT WILL IDENTIFY WHICH TASKS BENEFIT FROM FORCE REFLECTION, ALLOWING EQUIPMENT DESIGNERS TO MODIFY EQUIPMENT TO OPTIMIZE TELEOPERATION. THIS WILL LEAD TO BETTER SYSTEM PERFORMANCE, LOWER OPERATOR FATIGUE, AND SAFER OPERATION.

HUNG M INC
1522 DEER HURST LN
ROCHESTER HILLS, MI 48063
CONTRACT NUMBER: F33615-89-C-3405
DR S K CHENG
TITLE:
LANDING GEAR COMPONENT DESIGN VERIFICATION AND DURABILITY
DETERMINATION
TOPIC# 103 OFFICE: AFWAL/FIOP IDENT#: 33566

THIS PROPOSAL AIMS TO EXPLORE A NOVEL OPTICAL APPROACH FOR FULL-FIELD STRAIN MEASUREMENT AND DESIGN VERIFICATION OF LOAD-RESISTING MEMBERS SUCH AS LANDING GEAR COMPONENTS. THIS NEW TECHNIQUE, REFERRED TO AS SHEAROGRAPHY, IS EQUIVALENT TO A FULL-FIELD STRAIN GAGE PERMITTING MEASUREMENT OF STRAIN DISTRIBUTION OVER A LARGE AREA. THE TECHNIQUE DOES NOT REQUIRE INSTALLING GAGES, AND IT IS FAST, PRECISE AND NON-CONTACTING. UNLIKE HOLOGRAPHIC INTERFEROMETRY, SHEAROGRAPHY DOES NOT REQUIRE SPECIAL VIBRATION ISOLATION, AND THEREFORE IT IS APPLICABLE IN A FIELD/PRODUCTION ENVIRONMENT. THE PROPOSED INVESTIGATION WILL FOCUS ON A FEASIBILITY STUDY.

IAP RESEARCH INC
2763 CULVER AVE
DAYTON, OH 45429
CONTRACT NUMBER: F33615-89-C-2941
DONALD E JOHNSON
TITLE:
HIGH-SPEED SUPERCONDUCTING SWITCH
TOPIC# 141 OFFICE: AFWAL/POMP IDENT#: 33075

WE PROPOSE TO DEVELOP A HIGH-SPEED, COMPACT SUPERCONDUCTING SWITCH

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THAT EXPLOITS UNIQUE PROPERTIES OF THE NEW HT(c) MATERIALS. IN PHASE I WE WILL BUILD AND TEST A SMALL SWITCH TO DEMONSTRATE THE SWITCH TO CONTROL MECHANISM. IN PHASE II WE WILL DEMONSTRATE THE SWITCH IN A CIRCUIT APPLICATION AND DEVELOP PACKAGING CONCEPTS.

IMAGING SCIENCE TECHNOLOGIES
PO BOX 8175 - 1425 SEMINOLE/S #310
CHARLOTTESVILLE, VA 22906
CONTRACT NUMBER:
MICHAEL D LOCKHART
TITLE:
UN-COOLED LWIR IMAGING SYSTEM
TOPIC# 217 OFFICE: BMO/MYSC IDENT#: 32599

THE DOD REQUIRES SENSORS CAPABLE OF OPERATING AT 20 MICROMETERS TO DETECT LOW TEMPERATURE OBJECTS, E.G. MISSILES. THE CONTRACTOR REPRESENTS IT HAS UNIQUE PATENTED TECHNOLOGY FOR AN UN-COOLED IR SENSOR & IMAGING SYSTEM WITH NEAR MERCURY CADMIUM TELLURIDE (MCT) PERFORMANCE IN THE 10 MICRON REGION AT FAR LESS COST THAN MCT. THE TECHNOLOGY IS PHOTONIC, NOT THERMAL AND RELIES ON THE OPTICAL PROPERTIES OF A PHOTODICHROIC MATERIAL AFFORDING SUB-MICROSECOND RANGE RESPONSE TIMES. THE CONTRACTOR BELIEVES THIS IS THE ONLY TECHNOLOGY WHICH DIRECTLY CONVERTS AN IR SIGNAL INTO A VISIBLE ONE WITHOUT ELECTRONIC CIRCUITRY. THE IMAGING SUBSTRATE IS A CONTINUOUS THIN FILM THAT ACTS AS BOTH SENSOR & DISPLAY. INITIAL MATERIAL STUDIES HAVE ACHIEVED AN MRT OF 0.1 DEG C OVER 19 DEG C RANGE. THE CONTRACTOR WILL INVESTIGATE THE FEASIBILITY OF A PHOTODICHROIC THIN FILM POLYMER ABSORBING 20 MICROMETER IR PHOTONS. THIS COULD RESULT IN A LOW-COST, UN-COOLED LWIR IMAGING SYSTEM.

IMATRON INC
389 OYSTER POINT BLVD
S SAN FRANCISCO, CA 94080
CONTRACT NUMBER:
FREDRICK L RODER
TITLE:
DEVELOPMENT OF A REAL-TIME CT CAPABILITY FOR ROCKET MOTOR TEST AND DISPLAY
TOPIC# 229 OFFICE: BMO/MYSC IDENT#: 32710

SUBMITTED BY

IMATRON HAS DEVELOPED AN ELECTRON-BEAM CT SCANNER CAPABLE OF IMAGING OBJECTS UP TO 48 cm IN DIAMETER AT AN ACQUISITION RATE OF 17 IMAGES PER SECOND IN EACH OF TWO ADJACENT PLANES AT A RESOLUTION OF 4 LINE PAIRS PER cm, AND AT AN ACQUISITION RATE OF 9 IMAGES PER SECOND IN A SINGLE PLANE AT A RESOLUTION OF 7 LINE PAIRS PER cm. THE SCANNING TIMES IN THESE TWO MODES ARE 50 AND 100 ms, RESPECTIVELY. THE TECHNOLOGY EMBODIED IN THIS ELECTRON-BEAM SCANNER MAY BE ADAPTED TO SCAN SOLID-PROPELLANT ROCKET MOTORS DURING TEST FIRING. IN PHASE I, IMATRON WILL ESTABLISH THE PERFORMANCE PARAMETERS REQUIRED FOR THE MEANINGFUL DYNAMIC SCANNING OF ROCKET MOTORS, PREPARE A CONCEPTUAL DESIGN FOR A SCANNER SATISFYING THESE REQUIREMENTS, AND PERFORM A DEMONSTRATION EXPERIMENT USING MATERIALS OF INTEREST TO ROCKET MOTOR DEVELOPERS.

IMPLANT SCIENCES CORP
35 CHERRY HILL DR
DANVERS, MA 01923
CONTRACT NUMBER: F33615-89-C-2942
DR A J ARMINI
TITLE:
WEAR MEASUREMENT OF CERAMIC COMPONENTS IN GAS TURBINES
TOPIC# 153 OFFICE: AFWAL/POMP IDENT#: 33229

THE MEASUREMENT OF WEAR DEBRIS FROM CERAMIC COMPONENTS IN HIGH TEMPERATURE GAS TURBINES CANNOT BE DONE USING CONVENTIONAL MAGNETIC TECHNIQUES. A METHOD IS PROPOSED USING THE THIN LAYER ACTIVATION TECHNIQUE TO IMPLANT A RADIOTRACER IN THE CERAMIC FOR EXTERNAL MONITORING. THE TECHNIQUE DOES NOT NEED INDEPENDENT CALIBRATION AND CAN MEASURE WEAR ON BOTH METAL AND CERAMIC COMPONENTS SIMULTANEOUSLY EVEN WHILE THE TURBINE IS OPERATING. THE TECHNIQUE IS LOW COST AND CAN MEASURE WEAR ON CERAMICS TO A PRECISION OF 1 MILLIONTH OF AN INCH. THE METHOD CAN ALSO BE USED FOR ROUTINE MAINTENANCE IN OPERATIONAL SQUADRONS.

IMT INC
1355 PICCARD DR - STE 350
ROCKVILLE, MD 20850
CONTRACT NUMBER: F08635-89-C-0110
YAAKOV YERUSHAIMI
TITLE:
PROPOSAL FOR BURSTER LAYER RESEARCH
TOPIC# 56 OFFICE: AFESC/RDXP IDENT#: 31950

SUBMITTED BY

THE PROPOSED PHASE I SBIR PROJECT WILL INCLUDE RESEARCH AND DEVELOPMENT OF BURSTER LAYERS DESIGNED TO WITHSTAND DIRECT HITS OF CONVENTIONAL WEAPONS, LEADING TO DEVELOPMENT OF OPTIONAL BURSTER LAYER CONFIGURATIONS WITH POTENTIAL COMMERCIAL APPLICATIONS. THE PHASE I EFFORT WILL INCLUDE AN EXTENSIVE SURVEY OF THE STATE OF THE ART IN THE FIELD OF BURSTER LAYERS, ESPECIALLY THE EXPERIENCE PRACTICALLY GAINED IN ISRAEL SINCE 1968 AND IN OTHER COUNTRIES, THE ANALYSIS OF THE PENETRATION OF DIFFERENT CONVENTIONAL WEAPONS INTO ALL TYPES OF BURSTER LAYERS, THE PARAMETRIC ANALYSIS AND COMPARISON OF DIFFERENT CONFIGURATIONS OF BURSTER LAYERS, AND THE IDENTIFICATION OF ALTERNATIVE SOLUTIONS FOR FURTHER DEVELOPMENT IN PHASE II.

INNO-TECH ENTERPRISES INC
77 RAYNOR AVE
RONKONKOMA, NY 11779
CONTRACT NUMBER: F19628-89-C-0108
Y TRAEGER
TITLE:
MAXIMUM ENTROPY ALGORITHM FOR TRACK FUSION
TOPIC# 34 OFFICE: ESD/AVP IDENT#: 31689

THE PROBLEM ADDRESSED IS THE FUSION OF MULTISENSOR TRACKS, INCLUDING ATTRIBUTES, OBTAINED IN AN AIRBORNE MULTITHREAT ENVIRONMENT ON A SINGLE PLATFORM. FUSION IS REQUIRED TO ENHANCE SENSOR SUITE CAPABILITY, SIMPLIFY CLUTTERED DISPLAYS AND REDUCE OPERATOR WORK LOAD. SENSOR TRACKS AND THEIR ATTRIBUTES ARE THE GIVEN INPUTS. THIS EFFORT COVERS THE PRELIMINARY DEVELOPMENT OF A TRACK FUSION ALGORITHM BASED ON THE MAXIMUM ENTROPY METHOD (MEM) FORMALISM. RELATIVE ENTROPY IS USED COMBINING BOTH A PRIORI INFORMATION FROM PREVIOUS TIME STEPS AND NEW SENSOR DATA AT THE CURRENT TIME STEP. THE ALGORITHM CONCEPT IS PRESENTED WITH EMPHASIS ON THE ASSOCIATION PROBLEM AND IS BRIEFLY COMPARED TO AN ALGORITHM BY BOWMAN AND GROSS (1985).

INTEGRAL SYSTEMS INC
5000 PHILADELPHIA WY - STE A
LANHAM, MD 20706
CONTRACT NUMBER: F04701-89-C-0061
WILLIAM C STRATTON
TITLE:
A DISTRIBUTED OPEN ARCHITECTURE FOR SATELLITE GROUND SYSTEMS
TOPIC# 177 OFFICE: AFSTC/OLAB IDENT#: 34423

SUBMITTED BY

A NEW CONCEPT IS PRESENTED FOR SATELLITE GROUND SYSTEMS, UTILIZING INDUSTRY STANDARD HARDWARE AND SOFTWARE IN A DISTRIBUTED ENVIRONMENT. A SURVEY OF VENDOR COMPONENTS IS PROPOSED TO ESTABLISH THE POTENTIAL PERFORMANCE CHARACTERISTICS OF THE PROPOSED ARCHITECTURE. A STRAWMAN DESIGN EFFORT IS PROPOSED TO IDENTIFY THE BENEFITS OF THE ARCHITECTURE FOR VARIOUS CLASSES OF AIR FORCE SATELLITE PROGRAMS. NOVEL USER INTERFACE METHODOLOGIES ARE PRESENTED TO ENHANCE OPERATIONS EFFICIENCY IN THE DISTRIBUTED ENVIRONMENT. A PHASED IMPLEMENTATION APPROACH FOR THE PROPOSED ARCHITECTURE IS PRESENTED FOR A SPECIFIC AIR FORCE SATELLITE PROGRAM--THE DEFENSE METEOROLOGICAL SATELLITE PROGRAM (DMSP).

INTEGRATED ACCELERATOR TECHNOLOGIES

7602 PARK PROMENADE - #1124

WINTER PARK, FL 32792

CONTRACT NUMBER: F04611-89-C-0041

DELBERT J LARSON

TITLE:

AN ELECTRON COOLER FOR PORTABLE LOW ENERGY ANTIPROTON RINGS

TOPIC# 192 OFFICE: AFAL/TSTR IDENT#: 38864

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 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 CRITICAL COMPONENT OF SUCH A PORTABLE SOURCE, AN ELECTRON COOLER. ELECTRON COOLING OF ANTIPROTONS WILL ALLOW OPERATION OF A SMALL PORTABLE ANTIPROTON STORAGE RING BY ELIMINATING THE BEAM LOSSES CAUSED BY INTRABEAM SCATTERING, MULTIPLE SCATTERING, AND LONG LIFETIME RESONANT BEAM EMITTANCE GROWTH.

INTEGRATED PARALLEL TECHNOLOGY

PO BOX 908 - 51 E CAMPBELL AVE

CAMPBELL, CA 95009

CONTRACT NUMBER: F08635-89-C-0369

CALVIN A BUZZELL

TITLE:

THE WIZBAND CHIP: APPLICATION-SPECIFIC INTEGRATED CIRCUITS FOR

WEAPONS EFFECTS ASSESSMENTS

TOPIC# 10 OFFICE: AD/PMR IDENT#: 31208

SUBMITTED BY

A STUDY AND HARDWARE PROTOTYPE IS PROPOSED TO EVALUATE POTENTIAL COST SAVINGS, IF ANY, THAT MAY BE REALIZED IN COMPUTER RESOURCES EXPENDED IN RUNNING COMPUTER CODES STANDARD WITHIN DoD USING ASICs. THE STUDY WILL INCLUDE A HARDWARE PROTOTYPE OF A SPECIFIC WEAPONS EFFECTS CODE. REPRESENTATIVE METHODS OF AN EXISTING AERIAL TARGET VULNERABILITY MODEL WILL BE TESTED IN HARDWARE AND COMPARED TO SOFTWARE BENCHMARKS ON EXISTING COMPUTERS. A SPECIFIC EXAMPLE OF A MATURE FORTRAN CODE IMPLEMENTED IN HARDWARE WILL BE TESTED IN A BREADBOARD IN PHASE I. THE WIZBAND CODE OF THE USAF SHAZAM ENDGAME MODEL IS OFFERED AS THE PROTOTYPE EXAMPLE.

INTEGRATED SYSTEMS INC
2500 MISSION COLLEGE BLVD
SANTA CLARA, CA 95054
CONTRACT NUMBER: F08635-89-C-0389
DR MINJEA TAHK

TITLE:
ROBUST AUTOPILOT DESIGN METHODOLOGY SUITABLE FOR COMPUTER-AIDED
IMPLEMENTATION
TOPIC# 1 OFFICE: AD PMR IDENT#: 31028

DEVELOPMENT OF A NEW AND REVOLUTIONARY AUTOPILOT DESIGN METHODOLOGY IS PROPOSED THAT WILL BE SIMPLE TO USE AND PROVIDES UNPRECEDENTED LEVELS OF ROBUTNESS AND PERFORMANCE. THE PROPOSED AUTOPILOT DESIGN METHODOLOGY IS BASED UPON FEEDBACK LINEARIZATION, WHEREIN TIME-DOMAIN PLANT INVERSION IS ACCOMPLISHED CONTINUOUSLY BY FEEDBACK OF STATE VARIABLES THAT APPEAR IN THE REDUCED-ORDER EQUATIONS OF MOTION. INTEGRATED SYSTEMS INC. (ISI) HAS INVESTED IN-HOUSE RESOURCES TO DEMONSTRATE SOME ROBUTNESS AND PERFORMANCE BENEFITS OF THE FEEDBACK LINEARIZATION SCHEME. THE OBSERVED ROBUTNESS TO LARGE ERRORS IN AERODYNAMIC CHARACTERISTICS WAS UNPRECEDENTED AS WELL AS UNEXPECTED. WE PROPOSE TO DEVELOP A THEORY THAT EXPLAINS THE OBSERVED ROBUTNESS, AND TO PERFORM ANALYSES USING THIS THEORY THAT WILL DEFINE THAT PARAMETER SPACES THAT ARE CONSISTENT WITH GOOD ROBUSTNESS AND HIGH PERFORMANCE. IN ADDITION, WE WILL DEVELOP ESTIMATION SCHEMES FOR FEEDBACK VARIABLES THAT MAY BE IN-CONVENIENT TO MEASURE, ADDRESS DESIGN ISSUES ASSOCIATED WITH ACTUATOR SATURATION, AND EVALUATE PERFORMANCE IN THE PRESENCE OF MEASUREMENT NOISE AND ERRORS.

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INTEGRATED SYSTEMS INC
2500 MISSION COLLEGE
SANTA CLARA, CA 95054
CONTRACT NUMBER:
M MICHAEL BRIGGS
TITLE:
LOW-COST MODULAR SECONDARY-INJECTION THRUST VECTOR CONTROL FOR
SOUNDING ROCKETS
TOPIC# 230 OFFICE: BMO/MYSC IDENT#: 32720

ADDITION OF TVC COULD EASILY DOUBLE THE COST OF SOUNDING ROCKETS UNLESS DESIGN FEATURES THAT LIMIT COST GROWTH ARE INCORPORATED. ALSO, THE DESIGN OF THE TVC SUBSYSTEM MUST BE MODULAR AND SELF-CONTAINED SO THAT THE DEVICE CAN BE CONFIGURED FOR INSTALLATION ON 13 OR MORE SOUNDING ROCKET BOOSTERS. INTEGRATED SYSTEMS INC. (ISI) PROPOSED TO DEVELOP A MODULAR, LOW-COST THRUST VECTOR CONTROL AND GUIDANCE SUBSYSTEM FOR SOUNDING ROCKETS BASED UPON USE OF SECONDARY-INJECTION OF HOT GAS AS THE SOLE MEANS OF ACTUATION. MODULAR THRUSTERS DEVELOPED FOR USE ON SDI EXO AND ENDOATMOSPHERIC INTERCEPTORS WILL BE ADOPTED AS THE SECONDARY-INJECTION ACTUATORS. THRUSTER SIZES WILL BE SELECTED TO PROVIDE 2 -3 DEG OF THRUST VECTOR CONTROL SINCE ONLY A SMALL AMOUNT OF CONTROL MARGIN OVER THE ALIGNMENT UNCERTAINTIES (+ OR - 0.5 DEG MAX) IS NECESSARY TO PROVIDE EFFECTIVE CONTROL AND GUIDANCE IN THE PRESENCE OF ATMOSPHERIC DISTURBANCES. THE PROPOSED TVC DESIGN WILL PROVIDE PITCH, YAW, AND ROLL CONTROL. GUIDANCE OF THE SOUNDING ROCKETS WILL BE ACCOMPLISHED BY FEEDBACK CONTROL OF BODY ATTITUDE OR RATE, EITHER OF WHICH CAN BE SCHEDULED TO CONTROL THE FLIGHT PATH. RATE-CONTROL WILL PROVIDE ACCURATE BALLISTIC TRAJECTORIES, WHEREAS ATTITUDE REFERENCE FROM THE PAYLOAD OR ADDITIONAL SENSORS CAN SUPPORT PITCH, YAW, AND ROLL CONTROL AND GUIDANCE.

INTEGRATED TRANSACTION SYSTEMS
3325 IRVING AVE S
MINNEAPOLIS, MN 55408
CONTRACT NUMBER:
THOMAS RAEUCHLE
TITLE:
PROGRAM DEVELOPMENT TOOLKIT FOR PERSISTENT DISTRIBUTED APPLICATIO
TOPIC# 31 OFFICE: ESD/AVP IDENT#: 31653

SUBMITTED BY

THE OVERALL GOAL OF THIS PROJECT IS TO IMPROVE PROGRAMMER PRODUCTIVITY AND TO REDUCE THE COST OF DEVELOPING PERSISTENT DISTRIBUTED APPLICATIONS. THE APPROACH PROPOSED IS TO RESEARCH AND DEVELOP A TOOLKIT FOR PERSISTENT DISTRIBUTED PROGRAMMING WHICH (1) PROVIDES LANGUAGE SUPPORT FOR EXPRESSING PERSISTENCE AND DISTRIBUTION OF APPLICATIONS (2) SUPPLIES MECHANISMS IMPLEMENTING PERSISTENCE AND PROGRAM DISTRIBUTION AS LANGUAGE LIBRARIES, AND (3) PROVIDES TYPE SAFETY FEATURES FOR STORING AND COMMUNICATING TYPED DATA.

INTER-SCIENCE INC
105 JORDAN RD
TROY, NY 12180
CONTRACT NUMBER: F40600-89-C-0007
DR JAMES CASTRACANE
TITLE:
HIGH SPATIAL RESOLUTION THOMSON SCATTERING SYSTEM FOR PLASMA DENSITY MEASUREMENTS
TOPIC# 23 OFFICE: AEDC/PKP IDENT#: 31351

IN THE ANALYSIS OF PLASMA PHENOMENA, DETAILED KNOWLEDGE OF THE PARAMETERS INCLUDING LOCAL ELECTRON DENSITIES PROVIDES THE KEY TO UNDERSTANDING THE BEHAVIOR AND INFLUENCE OF PLASMAS IN EXPERIMENTS. ONE TECHNIQUE TO GAIN THIS INFORMATION WHICH HAS ACHIEVED CENTRAL IMPORTANCE IS LASER THOMSON SCATTERING. THE MAIN ADVANTAGES OF THIS METHOD ARE THAT IT IS NON-INVASIVE, ACCURATE AND CAN ACHIEVE SPATIAL PRECISION. HOWEVER, IN MOST INSTANCES THIS SPATIAL INFORMATION MUST BE OBTAINED ON A SHOT BY SHOT BASIS THEREBY ELIMINATING THE USE OF THE DIAGNOSTIC FOR TRANSIENT PROFILE MEASUREMENTS. WE PROPOSE TO DESIGN A COMPACT THOMSON SYSTEM TO MEASURE SPATIAL PROFILES OF THE ELECTRON DENSITY WITH HIGH RESOLUTION BASED ON THE USE OF A MULTI-ELEMENT DETECTION SYSTEM AND RAPID DATA PROCESSING. BY EXTENDING THE THOMSON TECHNIQUE TO THIS SPECIFIC APPLICATION, MORE REFINED KNOWLEDGE OF THE PLASMAS IN ARC HEATERS AND NEAR HYPERVELOCITY OBJECTS RESULTS. THE OBJECTIVE OF THE PHASE I PROGRAM IS TO DESIGN THE OPTIMUM OPTICAL CONFIGURATION AND RESULTING PROTOTYPE SYSTEM.

INTERSPEC INC
1100 E HECTOR ST
CONSHOCKEN, PA 19428
CONTRACT NUMBER:
DR KENNETH ABEND
TITLE:
INTEGRATED DESIGN OF SMART PHASED ARRAY SYSTEMS
TOPIC# 43 OFFICE: RADC/XPX IDENT#: 31489

SUBMITTED BY

THE OBJECTIVE OF THIS PROJECT IS TO DEFINE THE DESIGN PRINCIPLES OF A SMART PHASED ARRAY RADAR SYSTEM WHICH INTEGRATES THE FOLLOWING FUNCTIONS (i) DIGITAL BEAMFORMING, (ii) SELF-MONITORING OF ARRAY PERFORMANCE, (iii) AUTOMATIC DETECTION AND CORRECTION OF COMMON AND CORRECTABLE ELEMENT FAILURES, AND (iv) RAPID (MICROSECOND) JAMMER NULLING. SELF-MONITORING AND FAILURE COMPENSATION WILL BE PERFORMED USING THE MEASURED DATA AND WILL NOT REQUIRE ANY EXTRA HARDWARE AT THE ARRAY ELEMENTS. RAPID JAMMER NULLING WILL BE PERFORMED USING FAST ALGORITHMS SUCH AS THE INVERTED GRAM SCHMIDT ORTHOGONALIZATION VIA THE HUNG-TURNER-KULLSTRAM ALGORITHM. THE ALGORITHMS WILL BE IMPLEMENTED USING A MULTIPROCESSOR NETWORK WITH THE BULK OF THE PROCESSING BEING PERFORMED AT THE ELEMENT LEVEL. THIS MULTIPROCESSOR NETWORK DESIGN WILL (i) ATTEMPT TO MINIMIZE INTRA PROCESSOR COMMUNICATIONS, AND (ii) BE UPGRADED SO THAT IT CAN BE USED TO PERFORM MORE SOPHISTICATED TASKS SUCH AS TRACKING AND TARGET DISCRIMINATION.

INTERSPEC INC
1100 E HECTOR ST
CONSHOHOCKEN, PA 19428
CONTRACT NUMBER:
DR E HESHAM ATTIA

TITLE:
SELF-SURVEY OF DISTRIBUTED THINNED PHASED ARRAYS
TOPIC# 45 OFFICE: RADC/XPX IDENT#: 31499

WE PROPOSE TO CONDUCT A STUDY LEADING TO THE EXPERIMENTAL COMPARISON OF THE PERFORMANCE OF SELF-SURVEY TECHNIQUES WITH ADAPTIVE BEAMFORMING IN ORDER TO COHERE LARGE AND DISTRIBUTED PHASED ARRAYS. PHASE I WILL (1) ANALYTICALLY COMPARE THE TWO APPROACHES, (2) ASSESS EQUIPMENT REQUIREMENTS, (3) ANALYZE PHASE ERRORS, (4) EVALUATE PREDICTED PERFORMANCE, AND (5) DESIGN AN EXPERIMENT TO COMPARATIVELY DEMONSTRATE THE TWO APPROACHES TO COHERING THE ARRAY. THE PROPOSED EXPERIMENT (TO BE PERFORMED UNDER PHASE II OF THIS PROGRAM) WILL UTILIZE EQUIPMENT BEING BUILT BY INTERSPEC UNDER A CURRENT PHASE II SBIR CONTRACT TO RADC/EEA, HANSCOM. THE EXPERIMENT REQUIRES MINIMAL HARDWARE CHANGES. A NUMBER OF OFF-THE-SHELF LASER SURVEYING INSTRUMENTS (A MINIMUM OF ONE AND A MAXIMUM OF THREE) SHALL BE ADDED

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TO THE EXISTING 3-ELEMENT DISTRIBUTED ARRAY RADAR. THE EXPERIMENT SHALL QUANTIFY REQUIREMENTS FOR COHERING A LARGE OR DISTRIBUTED ARRAY RADAR USING (1) SELF-SURVEY ALONE, (2) ADAPTIVE-BEAMFORMING ALONE, AND (3) A HYBRID SELF-SURVEY/ADAPTIVE BEAMFORMING TECHNIQUE. THE NEW HYBRID TECHNIQUE, TO BE DEVELOPED UNDER THIS PHASE I EFFORT, USES A COARSE SELF-SURVEY SYSTEM TO ESTABLISH APPROXIMATE ELEMENT POSITIONS AND IMPROVES THE ESTIMATES ADAPTIVELY USING CLUTTER RETURNS. THEN ADAPTIVE BEAMFORMING IS APPLIED. THE ROBUST BEAM PRODUCED BY ADAPTIVE BEAMFORMING CAN BE SCANNED OVER WIDE ANGULAR REGIONS A MINIMAL SELF-SURVEY SYSTEM.

IRVINE SENSORS CORP
3001 REDHILL AVE - BLDG 3/STE 208
COSTA MESA, CA 92626
CONTRACT NUMBER: F08635-89-C-0377
DAVID E LUDWIG

TITLE:

APPLICATION OF HYMOSS SIGNAL PROCESSING CIRCUITRY TO SENSOR FUZED SUBMUNITIONS

TOPIC# 1 OFFICE: AD/PMR IDENT#: 31030

IRVINE SENSORS CORPORATION (ISC) PROPOSES TO DEVELOP AN INNOVATIVE INTEGRATED CIRCUIT (IC) WHICH WILL PROVIDE A HIGHER PERFORMANCE PASSIVE GUIDANCE SYSTEM FOR A VARIETY OF MISSILES AND PROJECTILES, SUCH AS SKEET AND SENSOR FUZED SUBMUNITIONS. CURRENT SYSTEMS OF THIS TYPE UTILIZE ONLY A FEW INFRARED DETECTOR ELEMENTS IN ORDER TO MINIMIZE THE NUMBER OF ELECTRICAL LEADS WHICH MUST EXIST THROUGH THE CRYOGENIC DEWAR WALL, SINCE MULTIPLEXING IS TYPICALLY DONE OFF-FOCAL PLANE. THE NUMBER OF DETECTOR ELEMENTS IS ALSO LIMITED BY DATA RATE, POWER, AND WEIGHT LIMITATIONS. THE INNOVATIVE ISC PROPOSES IS AN IC WHICH WILL PROVIDE LONGER RANGE ACQUISITION CAPABILITIES FOR NON-IMAGING SEEKERS FOR A VARIETY OF PROJECTILE MISSIONS BY PROVIDING ON-FOCAL PLANE SIGNAL PROCESSING CIRCUITRY FOR UP TO 32 DETECTOR ELEMENTS. THIS WILL INCLUDE SUITABLE TRADE-OFFS IN DEWAR SIZE, COST, AND THERMAL INTEGRITY. THIS WILL BE POSSIBLE BECAUSE ISC'S PROPOSED CIRCUITRY CAN PROVIDE ALL REQUIRED CONTROL ELECTRONICS ON THE FOCAL PLANE, AS WELL AS PER-CHANNEL AMPLIFICATION, FILTERING, ANALOG-TO-DIGITAL CONVERSION, AND MULTIPLEXING. ALL THIS SIGNAL PRE-PROCESSING WILL BE ACCOMPLISHED WITHIN THE VOLUME AND POWER

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CONSTRAINTS OF THE MINIATURE DEWAR ASSEMBLIES UTILIZED IN SKEET-TYPE PROJECTILES. ISC'S PHASE I PROGRAM WILL CONDUCT THE PRELIMINARY DESIGN AND ANALYTICAL VERIFICATION OF THE CIRCUIT, INCLUDING SIZE AND POWER BUDGETS. IN PHASE II, ISC WILL FINALIZE THE IC DESIGN, FABRICATE, AND ELECTRO-OPTICALLY CHARACTERIZED TEST ICS.

IRVINE SENSORS CORP
3001 REDHILL AVE - BLDG 3/STE 208
COSTA MESA, CA 92626
CONTRACT NUMBER: F08635-89-C-0388
DAVID E LUDWIG
TITLE:
HIGH-SPEED HIGH-DENSITY VIDEO DATA MEMORY SYSTEM
TOPIC# 2 OFFICE: AD/PMR IDENT#: 31065

IRVINE SENSORS CORPORATION (ISC) PROPOSES TO APPLY ITS 3-D PACKAGING TECHNIQUE IN DEVELOPING A SOLID STATE, HIGH-SPEED, HIGH-DENSITY MEMORY SYSTEM. THIS SOLID STATE MEMORY SYSTEM WILL BE CAPABLE OF STORING DATA FROM THE MOST ADVANCED IMAGERS AND FIT WELL WITHIN THE 200 CUBIC INCH VOLUME REQUIREMENT. THE SYSTEM WILL BE CONFIGURED TO BE AS GENERIC AS POSSIBLE. SINCE THE MEMORY SYSTEM IS SOLID STATE AND HAS NO MOVING PARTS, IT CAN WITHSTAND THE MOST SEVERE OF ENVIRONMENTS. THE SYSTEM CAN ALSO BE CONFIGURED WITH DIFFERENT MEMORY IC TECHNOLOGIES (SRAM, DRAM, EEPROM, FERROELECTRIC) TO BEST FIT THE SPECIFIC APPLICATION REQUIREMENTS. THE PRESENTLY DEMONSTRATED ISC 3-D PACKING DENSITY IS ABOUT ONE FOURTH OF THAT REQUIRED FOR THE VIDEO DATA MEMORY APPLICATION, UTILIZING 32 LAYER MODULES WITH 400 MICRON THICK LAYERS. THE PROPOSED INNOVATION IS TO REDUCE LAYER THICKNESS TO 100 MICRONS, EMPLOYING TECHNIQUES PREVIOUSLY DEMONSTRATED IN IR DETECTOR READOUT MODULE APPLICATIONS. THE PROPOSED PHASE I PROGRAM WILL DETERMINE THE OPTIMAL MODULE ARCHITECTURE FOR VIDEO DATA MEMORIES, AND THE PHASE II PROGRAM WILL PERFORM HARDWARE DEMONSTRATIONS OF COMPATIBLE MEMORY MODULES.

IRVINE SENSORS CORP
3001 REDHILL AVE - BLDG 3/STE 208
COSTA MESA, CA 92626
CONTRACT NUMBER: F33615-89-C-1111
DAVID E LUDWIG
TITLE:
APPLICATION OF 3-D FPA MODULES WITH DYNAMIC STARE TO AERIAL ELECTRO-OPTICAL SENSING
TOPIC# 90 OFFICE: AFWAL/AAOP IDENT#: 32841

SUBMITTED BY

IRVINE SENSORS CORPORATION (ISC) PROPOSES TO EXAMINE TWO MAJOR EO AVIONICS SYSTEMS PROBLEMS WHICH ARE ADDRESSED BY THREE-DIMENSIONAL (3-D) FPAs WITH DYNAMIC STARE: 1) THE EXTREMELY POWERFUL, STRUCTURED, AND DYNAMIC BACKGROUND CLUTTER WHICH MAKES TARGET DETECTION NEARLY IMPOSSIBLE; AND 2) THE LARGE FIELD-OF-REGARD WHICH MUST BE VIEWED WITH GREAT RESOLUTION WHILE KEEPING REVISIT TIMES SHORT AND DATA RATES LOW. THE INNOVATION PROPOSED IS AN FPA SYSTEM WHICH WILL PROVIDE THE CAPABILITY TO EXTRACT TARGETS BASED BOTH UPON SPATIAL SIGNATURES AND MOTION RELATIVE TO THE BACKGROUND BY COMBINING SPATIAL (INTRAFRAME) AND TEMPORAL (INTERFRAME) PROCESSING ON THE FOCAL PLANE. THIS ALLOWS ALL WIDE BANDWIDTH, HIGH PRECISION PROCESSING TO BE PERFORMED IN PARALLEL IN THE 3-D FOCAL PLANE MODULE PRIOR TO MULTIPLEXING, THUS REDUCING THE DATA RATES AND COMPUTATIONAL LOADS OF THE OFF-FOCAL PLANE PROCESSOR TO MANAGEABLE VALUES. ISC'S PROPOSED PHASE I PROGRAM WILL: 1) INVESTIGATE THE BOUNDARIES OF PERFORMANCE FOR THE 3-D FPA/DYNAMIC STARE APPLICATION TO AN EO AVIONICS SYSTEM; AND 2) DEMONSTRATE PERFORMANCE WITH COMPUTER EMULATION AGAINST ACTUAL IR CLUTTER SCENES FROM SETS OF AIRBORNE SCENARIOS. IN PHASE II, A BREADBOARD SENSOR WILL BE CONSTRUCTED AND USED TO DEMONSTRATE THE PERFORMANCE PREDICTED IN PHASE I.

IRVINE SENSORS CORP
3001 REDHILL AVE - BLDG 3/STE 208
COSTA MESA, CA 92626
CONTRACT NUMBER: F33615-89-C-1089
DAVID E LUDWIG
TITLE:
HIGH PERFORMANCE STARING THREAT WARNING RECEIVER WITH OPTICAL
FILTERING
TOPIC# 95 OFFICE: AFWAL/AAOP IDENT#: 32902

IRVINE SENSORS CORPORATION (ISC) PROPOSES TO DEMONSTRATE THE DATA RATE REDUCTION AND CLUTTER SUPPRESSION CAPABILITIES IN THREAT WARNING (TW) APPLICATIONS WHICH CAN BE ACHIEVED UTILIZING MASSIVELY-PARALLEL PREPROCESSING TECHNIQUES IMPLEMENTED EFFICIENTLY UTILIZING ISC'S THREE-DIMENSIONAL (3-D) PACKAGING TECHNIQUES. THE PHASE I PROGRAM WILL ADDRESS THE ISSUES CREATED BY UTILIZING STARING INFRARED MOSAIC ARRAYS FOR WIDE FIELD OF REGARD TW SENSORS, INCLUDING HIGH DATA

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RATES, CLUTTER REJECTION, THE EFFECTIVENESS OF OPTICAL FILTERING TECHNIQUES, AND DOWNSTREAM PROCESSING OVERLOAD. ISC'S PROPOSED ANALYSIS DURING PHASE I WILL INCLUDE A STUDY TO DETERMINE THE OPTIMAL PARTITIONING OF SIGNAL PROCESSING ELECTRONICS, ON- VERSUS OFF-FOCAL PLANE. THE ANALYTICAL RESULTS WILL ALSO PROVIDE A BASELINE SEQUENCE FOR THE VARIOUS SPECTRAL, TEMPORAL, AND SPATIAL FILTERING ELEMENTS WHICH WILL BE INCLUDED IN THE DEMONSTRATION UNIT. THE PHASE II FEASIBILITY DEMONSTRATION (FD) WILL CONSIST OF AN ACOUSTO-OPTIC TUNABLE FILTER (AOTF) FOR SPECTRAL FILTERING, COUPLED WITH A 3-D SIGNAL PROCESSING MODULE PROVIDING SPATIAL FILTERING AND AN OFF-FPA DYNAMIC STARE ALGORITHM FOR TEMPORAL FILTERING. THE FD WILL BE STRUCTURED TO ALLOW ASSESSMENT OF THE RELATIVE EFFICIENCIES OF DIFFERENT SEQUENCES FOR THE SIGNAL PROCESSING FUNCTIONS.

IRVINE SENSORS CORP
3001 REDHILL AVE - BLDG 3/STE 208
COSTA MESA, CA 92626
CONTRACT NUMBER: F04701-89-C-0069
RONALD J INDIN
TITLE:
AUTONOMOUS TARGET SELECTION FOR ASAT/DSAT INTERCEPTORS
TOPIC# 181 OFFICE: AFSTC/OLAB IDENT#: 34526

A NUMBER OF LIGHTWEIGHT INTERCEPTOR TECHNOLOGIES HAVE BEEN DEVELOPED IN SDIO KEW PROGRAM AND BY DARPA UNDER THE STRATEGIC COMPUTER INITIATIVE PROGRAM. OF THESE TECHNOLOGIES, 3-D FPA ELECTRONICS AND 3-D COMPUTERS ARE PIVOTAL. THESE PACKAGING TECHNOLOGIES ARE NOW BEING IMPLEMENTED BY IRVINE SENSORS CORPORATION (ISC) INTO NARROW FIELD OF VIEW SPACE AND GROUND BASED INTERCEPTORS WHICH HAVE THE ADVANTAGE OF UTILIZING SURVEILLANCE PLATFORM SENSORS WHICH LIMIT THE REQUIRED FIELD OF VIEW TO A FEW DEGREES. IN CONTRAST, HOWEVER, ASAT/DSAT SYSTEMS REQUIRE THE EXTREME INNOVATION OF STAYING LIGHTWEIGHT WHILE ACQUIRING, TRACKING, AND KILLING TARGETS WITHIN THE 5 TO 10 DEG UNCERTAINTY BASKET PRESENTED IN ATTACKING TARGETS AUTONOMOUSLY AT THEIR PERIGREE POINTS. THIS PROPOSAL ADDRESSES THE INNOVATION REQUIRED TO INTEGRATE ADVANCED ANALOG AND DIGITAL PARALLEL PROCESSING CIRCUITRY AND FOCAL PLANE ARRAYS (FPA) WHILE REMAINING WITHIN THE SENSOR CONSTRAINTS OF AN ASAT/DSAT SYSTEM. ISC'S PHASE I FEASIBILITY STUDY WILL DETERMINE THE SYSTEM LIMITS ON ASAT/DSAT

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INTERCEPTOR SEEKERS INCLUDING VOLUME, WEIGHT AND POWER. A PRELIMINARY DESIGN OF A TEST IC DEMONSTRATION WILL ALSO BE COMPLETED DURING PHASE I. THE TEST IC DEMONSTRATION UNIT WILL BE FABRICATED AND TESTED DURING PHASE II.

IRVINE TECHNOLOGY GP INC

9 ST MAXIME

LAGUNA NIGUEL, CA 92677

CONTRACT NUMBER:

RONALD E OGLEVIE

TITLE:

MICROCOMPUTER-BASED EARTH-TO-ORBIT TRAJECTORY OPTIMIZATION PROGRA

TOPIC# 146 OFFICE: AFWAL/POMP IDENT#: 33161

THE PRIMARY OBJECTIVE IS THE DEVELOPMENT OF AN EARTH-TO-ORBIT TRAJECTORY OPTIMIZATION PROGRAM CAPABLE OF ACCOMMODATING AIR BREATHING PROPULSION AND SUITABLE FOR PRELIMINARY DESIGN ANALYSIS. RAPID EXECUTION AND EASE-OF-USE ARE REQUIRED. A DUAL MODE APPROACH IS PROPOSED WITH THE FOLLOWING FEATURES: RAPID OPTIMIZATION MODE - PROVIDES ROBUST AND USER-FRIENDLY OPERATION FOR PRELIMINARY DESIGN TRADES AND ANALYSES. PRECISION MODE - UTILIZES RAPID MODE TO OBTAIN INITIAL GUESSES FOR FAST AND ROBUST CONVERGENCE. SERVES AS TRUTH MODEL FOR VERIFICATION OF RAPID MODE. DUAL MODE OPERATION - SYNERGISTICALLY ALLEVIATES SHORTCOMINGS OF INDIVIDUAL MODES. THE RAPID OPTIMIZATION MODE IS DELIVERED IN PHASE I. RESULTS FROM PRELIMINARY SIMULATION OF THE RAPID MODE ARE PROMISING. THE AT MICROCOMPUTER CAPACITY IS ADEQUATE WITH PRUDENT DESIGN. THE PROGRAM OFFERS SUBSTANTIAL IMPROVEMENT IN PRODUCTIVITY OVER CURRENT PERFORMANCE OPTIMIZATION PROGRAMS.

KAMBEA INDUSTRIES

1130 RONDA DR

MANHATTAN BEACH, CA 90266

CONTRACT NUMBER: F33657-89-C-2248

KAM L WONG

TITLE:

RELIABILITY PREDICTION MODELS FOR MILITARY AVIONICS

TOPIC# 158 OFFICE: ASD/AE& IDENT#: 32510

SUBMITTED BY

THE ABILITY TO ACCURATELY PREDICT THE PROBABILITY OF EQUIPMENT SUCCESSFUL OPERATION BEFORE ITS ACTUAL USE WOULD ENHANCE THE AIR FORCE'S DECISION STRATEGY. DOCUMENTED INVESTIGATIONS SHOWED THAT THE EXISTING RELIABILITY PREDICTION MODELS FALL SHORT OF PROVIDING THE REQUIRED PREDICTION ACCURACY AND A BETTER MODEL IS NEEDED. THE KEY PROBLEMS IN THE EXISTING MODELS LIE IN THEIR EXCLUSION OF CRITICAL FACTORS. FOR EXAMPLE, THE REAL VIBRATIONAL CONDITION OF A UNIT IN A FIGHTER COULD BE VERY DIFFERENT FROM THE AVERAGE CONDITION ASSUMED UNDER THE GENERAL CONDITION CALLED OUT IN MIL-HDBK-217. AIRCRAFT USAGE COULD GREATLY VARY THE THERMAL CYCLING RATE OF AVIONICS, BUT THERMAL CYCLING IS NOT EXPLICITLY TREATED. BESIDES THE REAL ENVIRONMENTS, SELECTION OF PART SUPPLIERS, SYSTEM AGING, ENVIRONMENTAL STRESS SCREENING, AND PARTS RELIABILITY IMPROVEMENT IN CALENDAR TIME ARE ALSO NOT EXPLICITLY TREATED. THE PROPOSED RESEARCH FOR DEVELOPING A CREDIBLE RELIABILITY PREDICTION MODEL IS TO EXPAND THE PRESENT PART STRESS METHOD OF ESTIMATING FAILURE RATES TO INCLUDE ALL OF THE CRITICAL FACIORS AS THEY RELATE TO THE ACTUAL FAILURE MECHANISMS AND APPLIED STRESSES. AN ALGORITHM WILL ALSO BE DEVELOPED TO MERGE THE FAILURE RATES TO COVER MULTI-CONDITION MISSIONS I.E. COVERING STORAGE, SHIPPING, FLIGHT, ETC. IN ONE MISSION RELIABILITY ESTIMATE.

KDT INDUSTRIES INC
PO BOX 1787
AUSTIN, TX 78767
CONTRACT NUMBER: F33615-89-C-5733
CURT BILBY
TITLE:
UNIFIED LIFE CYCLE ENGINEERING DESIGN SYSTEM
TOPIC# 132 OFFICE: AFWAL/MLK IDENT#: 33714

KDT INDUSTRIES, INC., IN CONJUNCTION WITH THE UNIVERSITY OF TEXAS AT AUSTIN, PROPOSES A RESEARCH PROGRAM LEADING TO THE DEVELOPMENT OF AN INNOVATIVE ANALYSIS TOOL FOR THE DESIGN OF MECHANICAL PARTS. THE PROPOSED SYSTEM INVOLVES INTEGRATION OF EXISTING AND NEWLY DEVELOPED TOOLS IN THE AREAS OF FEATURE-BASED SOLID MODELING, COMPUTER-AIDED DESIGN, COMPUTER-AIDED MANUFACTURING, FINITE ELEMENT ANALYSIS, AND EXPERT SYSTEMS. THE RESEARCH WILL FOCUS ON THE LIFE-CYCLE DESIGN

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ISSUES RELATING TO SYSTEM OPTIMIZATION SUCH AS COST AND PERFORMANCE. THE RESULTING SYSTEM WILL CONCURRENTLY ADDRESS AND INTEGRATE THE DESIGN, MANUFACTURING, OPERATIONAL AND SUPPORT PHASES OF A PARTICULAR CLASS OF MECHANICAL PARTS. THIS RESEARCH WILL LEAD TO A SYSTEM THAT WILL SUPPORT AIR FORCE AND OTHER GOVERNMENT AGENCIES BY AIDING DESIGN AND SYSTEM ENGINEERS. BY UTILIZING EXISTING AS WELL AS NEWLY DEVELOPED TOOLS, THE PROPOSED SYSTEM WILL LEVERAGE EXISTING RESOURCES, THUS DECREASING THE LIFE-CYCLE COST OF LIFE-CYCLE ANALYSIS SYSTEMS. IN PHASE I, A LIMITED SYSTEM CONCEPT WILL BE DEVELOPED THAT ADDRESSES A SPECIFIC PART OR SYSTEM OF PARTS THAT HAS MANY AIR FORCE APPLICATIONS.

KLEIN ASSOCS INC
PO BOX 264 - 800 LIVERMORE ST
YELLOW SPRINGS, OH 45387
CONTRACT NUMBER: F41622-89-C-00009
DR GARY A KLEIN

TITLE:
USING CASE-BASED REASONING TO ESTIMATE MANPOWER PERSONNEL TRAININ
AND SAFETY REQUIREMENTS
TOPIC# 68 OFFICE: HSD/SORT IDENT#: 34706

THE OBJECTIVE IS TO DEVELOP A KNOWLEDGE-BASED ASSISTANT FOR ESTIMATING MANPOWER, PERSONNEL, TRAINING, AND SAFETY REQUIREMENTS FOR NEW SYSTEMS AND SUBSYSTEMS. A CASE-BASED REASONING (CBR) APPROACH TO KNOWLEDGE ELICITATION IS PROPOSED AS A SENSITIVE AND EFFECTIVE STRATEGY TO DERIVE AND REPRESENT CRITICAL KNOWLEDGE. PHASE I WILL DEMONSTRATE THE FEASIBILITY OF A CBR APPROACH THAT USES MPT&S DATA FROM PREVIOUS SYSTEMS AS THE BASIS FOR PREDICTIONS. STANDARD ARTIFICIAL INTELLIGENCE (AI) APPROACHES TO MPT&S ESTIMATION RUN INTO THE DIFFICULT OF HAVING TO MODEL THE COMPLEXITIES OF THE HARDWARE/SOFTWARE ELEMENTS ALONG WITH THE COMPLEXITIES OF THE HUMAN FACTORS. A CASE-BASED REASONING STRATEGY AVOIDS THIS PROBLEM BY RELYING ON MATCHES TO SIMILAR PROJECTS, ELIMINATING THE NEED TO REPRESENT WORLD KNOWLEDGE.

KNOWLEDGE BASED SYSTEMS INC
100 W BROOKSIDE
BRYAN, TX 77801
CONTRACT NUMBER:
SUE WELLS

TITLE:
COMPUTER BASED TESTING AND TRAINING IN INTELLIGENT SYSTEMS
TOPIC# 73 OFFICE: HSD/SORT IDENT#: 34756

SUBMITTED BY

THE GOAL OF THIS PROJECT IS TO DEVELOP A METHODOLOGY FOR SPECIFICATION OF STUDENT'S MODELS THAT WILL BOTH ALLOW ACCURATE ASSESSMENT OF A STUDENT'S CAPABILITIES IN A PARTICULAR DOMAIN AS WELL AS PROVIDING A KNOWLEDGE REPRESENTATION FRAME WORK FOR AN AUTHORING SYSTEM. TRAINING SITUATIONS ARE SPECIALIZED FORMS OF DISCOURSE SITUATIONS INVOLVING THE TRANSFER OF PROBLEM SOLVING INFORMATION BETWEEN THE SITUATED AGENTS. KBSI PROPOSES THE USE OF SITUATION SEMANTICS MODELS OF DISCOURSE SITUATIONS AS THE BASIS FOR MODELS OF INFORMATION TRANSFER BETWEEN THE SITUATED AGENTS (E.G. STUDENT AND INFORMATION TRANSFER SYSTEM (ITS)).

KNOWLEDGE BASED SYSTEMS INC
100 W BROOKSIDE
BRYAN, TX 77801
CONTRACT NUMBER: F41622-89-C-0018
PATRICIA G FRIEL

TITLE:
FORM FEATURE BASED DESIGN KNOWLEDGE REPRESENTATION FOR ULCE
TOPIC# 75 OFFICE: HSD/SORT IDENT#: 34759

IN LARGE, LONG LIFE, COMPLEX PRODUCTS SUCH AS MODERN WEAPONS SYSTEMS THE ORIGINAL DESIGN TEAM IS LONG SINCE GONE WHEN THE PRODUCT EXHIBITS THE DESIGN PROBLEMS. THE ONLY WAY TO PROVIDE THE NEW DESIGN TEAM WITH VISIBILITY INTO THE CORRELATION BETWEEN THE DESIGN DECISIONS AND THEIR IMPLICATIONS IS TO PROVIDE A MEANS OF CAPTURE OF THE DESIGN RATIONALE AND THE CORRELATE THIS RATIONAL TO THE EFFECTS. THIS PROJECT FOCUSES ON THE DEVELOPMENT OF A DESIGN KNOWLEDGE MANAGEMENT SYSTEM (DKMS) CONCEPTUAL DESIGN WITH VARIOUS FORM FEATURE CAPABILITIES TO ALLOW FOR THE: 1) INTEGRATION OF A NUMBER OF "DESIGN DECISION SUPPORT TOOLS"; 2) DEVELOPMENT OF "DESIGNER" SYSTEMS WHICH AUTOMATICALLY MAKE THE DESIRED DESIGN TRADEOFF DECISIONS; 3) REDUCE THE TIME FOR CONCEPT ENTRY PARTICULARLY THE ENTRY OF FORM FEATURE GEOMETRY DATA AND THE GENERATION OF DESIGN TRADEOFF MODEL INPUT DATA DERIVED FROM THAT PRODUCT GEOMETRY; 4) DELIVERY OF QUALITATIVE ASSESSMENTS OF DESIGN OPTIONS BY PROVIDING THE ABILITY TO ASSOCIATIVELY INDEX HISTORICAL KNOWLEDGE STRUCTURE AROUND FORM FEATURE INTERPRETATION OF THE EVOLVING PRODUCT GEOMETRY.

KNOWLEDGE SYSTEMS CONCEPTS INC
262 LIBERTY PLAZA
ROME, NY 13440
CONTRACT NUMBER:
JOHN M DECKER

TITLE:
NATURAL LANGUAGE UNDERSTANDING FOR MESSAGE DISSEMINATION
TOPIC# 53 OFFICE: RADG/XPX IDENT#: 31552

SUBMITTED BY

THE OBJECT OF THIS RESEARCH IS TO NOMINATE NATURAL LANGUAGE PROCESSING (NLP) AND NATURAL LANGUAGE UNDERSTANDING (NLU) TECHNIQUES TO DETERMINE THEIR FEASIBILITY TO SUPPORT A MESSAGE DISSEMINATION COMPONENT OF AN AUTOMATED MESSAGE HANDLING FUNCTION. THE WORK PROPOSED WILL (1) IDENTIFY MESSAGE DISSEMINATION COMPONENT PROCESSING NODES WHERE SELECTED NLP/NLU TECHNIQUES CAN PRODUCE IMPROVEMENTS; (2) NOMINATE NLP/NLU TECHNIQUES FOR EACH PROCESSING NODE; (3) DETERMINE OPTIMAL NLP/NLU TECHNIQUES; AND (4) DEVELOP AN ARCHITECTURE FOR A PROTOTYPE THAT EXHIBITS THE FEASIBILITY OF NLP/NLU-DRIVEN IMPROVEMENTS TO THE MESSAGE DISSEMINATION PROCESS.

KORSCH OPTICS INC
10111 BLUFF DR
HUNTSVILLE, AL 35803
CONTRACT NUMBER:
DR DIETRICH KORSCH
TITLE:
PHASED ARRAY IMAGING TELESCOPE
TOPIC# 204 OFFICE: AFWL/PRC IDENT#: 31873

OPTICAL DESIGNS OF TWO CONCEPTS FOR WIDE FIELD, HIGH RESOLUTION PHASED ARRAY IMAGING TELESCOPES WILL BE DEVELOPED AND ANALYZED. THE RESULTS WILL THEN BE COMPARED TO FIND THE SUPERIOR CONCEPT. THE FIRST CONCEPT RESEMBLES CLOSELY THE SYSTEMS PROPOSED IN THE PAST FOR ASTRONOMICAL SPACE TELESCOPES. IT CONSISTS OF AN ARRAY OF AFOCAL SUBTELESCOPES WHOSE EXISTING BEAMS ARE OPTICALLY COMBINED TO FORM A UNITED IMAGE WITH A THEORETICAL RESOLUTION APPROACHING THE DIFFRACTION LIMIT OF AN APERTURE DIAMETER THAT IS EQUAL TO THE LONGEST DISTANCE BETWEEN THE TELESCOPES. IN DIFFERENCE TO THE PREVIOUS SYSTEMS THE NEW SYSTEM MUST OPERATE OVER A WIDE FIELD OF VIEW WHICH ADDS A SIGNIFICANT DEGREE OF COMPLEXITY TO THE DESIGN OF BOTH, THE SUBTELESCOPES AND THE COMBINING TELESCOPE. THE DEVELOPMENT OF SUITABLE TELESCOPE DESIGNS WILL, THEREFORE, BE THE MOST IMPORTANT PART OF THE PROPOSED EFFORT. THE SECOND IDEA IS BASED UPON THE CONCEPT OF A LARGE TELESCOPE WITH A PARTIALLY FILLED APERTURE. THE FACT THAT ALL OPTICAL COMPONENTS ARE COAXIAL SIMPLIFIES THE CONCEPT, AND GREATLY INCREASES THE CORRECTIBILITY. DIFFICULTIES ARE EXPECTED IN THE AREAS OF ALIGNMENT AND SURFACE GENERATION.

SUBMITTED BY

KTAADN INC
1340 CENTRE ST - STE 202
NEWTON, MA 02159
CONTRACT NUMBER:
JAMES S DRAPER
TITLE:
USE OF NEURAL NETWORKS FOR IDENTIFYING TARGETS IN RADAR CLUTTER
TOPIC# 31 OFFICE: ESD/AVP IDENT#: 31644

AIRCRAFT RECOGNITION PROCESSORS BASED ON NEURAL NETWORKS WHICH CAN BE LARGELY TRAINED 'ON THE GROUND' WITH 'TWEAKING' AT ALTITUDE ARE ENVISIONED. TWO RADAR SYSTEM STRATEGIES ARE DESCRIBED BOTH UTILIZING A MULTI-WAVELENGTH ..., RADAR TO OBTAIN PART OF THE ASPECK ANGLE, 0, DEPENDENCE OF THE AIRCRAFT CROSS-SECTIONS, THE FIRST STRATEGY IS A NETWORK FOR RECOGNIZING THE 0 DEPENDENCE OF IT WILL EVALUATE RESTRICTED COULOMB ENERGY (RCE) AND BACKPROPAGATION (BP) AIRCRAFT RECOGNITION NETWORKS. TRAINING IMPOSES CALCULATED AND MEASURED ... PATTERNS ON NETWORK INPUTS WHILE MODIFYING LINK VALUES AND ENFORCING IDENTIFICATION OF THE AIRCRAFT AT THE OUTPUT NODES. RECOGNITION, WITH FIXED LINK WEIGHTS, IMPOSES FRAGMENTARY, NOISY RADAR ... PATTERNS ON THE NETWORK INPUT NODES WHILE OBSERVING OUTPUT NODE ACTIVATIONS. TRIAL NETWORKS WILL BE BUILT AND EVALUATED. THE SECOND STRATEGY IS AN INVERSE SYNTHETIC APERATURE RADAR (ISAR) USING NETWORKS TO ADAPT TO THE AIRCRAFT PATH AND COHERENTLY PROCESS THE TARGET RETURN TO ACHIEVE THE RESOLUTION OF A SYNTHETIC APERTURE. THE RESULTING IMAGE WOULD BE PROCESSED IN RECOGNITION NETWORKS AS IN THE FIRST STRATEGY. THE THEORETICAL REQUIREMENTS OF ISAR NETWORKS WILL BE STUDIED.

L2 TECHNOLOGIES INC
4707 WINNETKA CT NE
ALBUQUERQUE, NM 87111
CONTRACT NUMBER: F08635-89-C-0415
DR JUE-YU LIU
TITLE:
DEVELOP A CONSERVATIVE REZONING PROCEDURE FOR DYNA2D
TOPIC# 9 OFFICE: AD/PMR IDENT#: 31134

SUBMITTED BY

CURRENT NUMERICAL COMPUTATIONAL METHODS USED TO PERFORM WARHEAD DESIGN AND ANALYSIS ARE COMMONLY BASED ON THE EULERIAN FINITE DIFFERENCE METHOD. THE EULERIAN METHOD IS USED TO ALLOW THE MATERIAL TO BE ADVECTED THROUGH A MESH, AND THE FINITE DIFFERENCE METHOD IS USED TO PROVIDE A NATURAL WAY TO EXPLICITLY ACCOUNT FOR THE MATERIAL FLUX FROM A DONOR CELL INTO NEIGHBORING RECEIVER CELLS THROUGH THE CONVENIENCE OF ORDERED MESH INDICES (I, J, K). THE EULERIAN FINITE DIFFERENCE METHOD IS ADEQUATE, HOWEVER, IN ITS ABILITY TO TREAT COMPLICATED MESH GEOMETRIES, IRREGULAR BOUNDARIES, AND VARIATIONS IN BOTH MESH SIZE AND CELL SHAPE. AS A RESULT, THE EULERIAN FINITE DIFFERENCE METHOD CAN NOT BE ECONOMICALLY USED FOR SOLVING GENERAL THREE-DIMENSIONAL PROBLEMS. THE LAGRANGIAN FINITE ELEMENT METHOD, ON THE OTHER HAND, IS VERY ADAPTIVE AT HANDLING COMPLICATED GEOMETRIES WHILE REDUCING THE NUMBER OF ELEMENTS WITHOUT COMPROMISING THE NUMERICAL ACCURACY. THE LAGRANGIAN FINITE ELEMENT METHOD IS, HOWEVER, INCOMPETENT IN SOLVING PROBLEMS WITH SEVERE MATERIAL/MESH DEFORMATION. THE REZONING AND DEZONING PROCEDURES CAN BE EFFECTIVELY USED TO OVERCOME THE SEVERE MESH DEFORMATION PROBLEM OCCURRING IN THE LAGRANGIAN FINITE ELEMENT METHOD IF THE MESH DISCRETIZATION ONLY CONTAINS A SMALL NUMBER OF REGIONS WITH SEVERE MESH DEFORMATION. THE LAGRANGIAN FINITE ELEMENT METHOD WITH REZONE AND DEZONE CAPABILITIES APPEARS TO HAVE THE ADVANTAGE OVER THE EULERIAN FINITE DIFFERENCE METHOD FOR SOLVING IMPACT DYNAMICS PROVIDED THE PROCEDURES TO PERFORM THE REZONE AND DEZONE ARE CONSERVATIVE. IN PHASE I WE WILL DEVELOP A CONSERVATIVE REZONING PROCEDURE TO REPLACE THE NON-CONSERVATIVE REZONING PROCEDURE CURRENTLY USED IN DYNA2D.

LASER-GENICS CORP
PO BOX 611330
SAN JOSE, CA 95161
CONTRACT NUMBER:
DR RICHARD SCHLECHT
TITLE:
HYPERVELOCITY VEHICLE STRAIN SENSOR
TOPIC# 250 OFFICE: AFSC/NAT IDENT#: 37991

ACCURATE REAL-TIME MONITORING OF STRAIN FORCES IN HYPERVELOCITY VEHICLES UNDER OPERATING CONDITIONS WILL REQUIRE NEW CONCEPTS IN

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SENSOR DESIGN. FIBER OPTIC SENSORS OFFER POSSIBLE SOLUTIONS BUT PRESENT DAY FIBERS OF GLASS OR SILICA WILL NOT TOLERATE THE EXTREME TEMPERATURES EXPERIENCED IN THESE VEHICLES. LASER-GENICS CORPORATION IS PROPOSING TO INVESTIGATE HIGH TEMPERATURE SINGLE CRYSTAL OPTICAL FIBERS. USING OUR NOVEL APPROACH, WE WILL INVESTIGATE THE FEASIBILITY OF SENSING STRAIN FORCES WITH A SINGLE CRYSTAL FIBER OPTIC. THIS CONCEPT WILL BE TESTED DURING THE PHASE I EFFORT AND A SYSTEM WILL BE DEVELOPED AND CHARACTERIZED DURING THE PHASE II PROGRAM.

LEHIGH VALLEY COMPUTER SERVICES INC
5962 KEYSTONE DR
BATH, PA 18014
CONTRACT NUMBER: F41622-89-C-0007
ROBERT REICH
TITLE:
AUTOMATED CUSTOM-FIT PRODUCTION
TOPIC# 76 OFFICE: HSD/SORT IDENT#: 34699

IN ORDER TO DETERMINE THE CONCEPTS FOR AUTOMATED PRODUCTION OF CUSTOM-FIT CLOTHING AND EQUIPMENT, LEHIGH VALLEY COMPUTER SERVICES, INC. (LVCS) AND CONSULTANTS FROM LEHIGH UNIVERSITY WILL INVESTIGATE THE TECHNOLOGICAL ADVANCES IN (1) DIGITIZING HUMAN TOPOLOGY, (2) DEVELOPING AND MANIPULATING GEOMETRIC MODELS OF THE DIGITIZED DATA AND (3) AUTOMATING THE MANUFACTURING PROCESS OF A CUSTOM-FIT DEVICE. THE DIGITIZATION AND GEOMETRIC MODELING WILL FOCUS ON THE FACIAL AREA BUT WILL ALSO INCLUDE AN INVESTIGATION OF THE FOOT, HAND AND BUTTOCK AREAS. LVCS SPECIALIZES IN THE USE OF CAD/CAM TO PRODUCE HIGH QUALITY THERMOFORMED PRODUCTS. THIS PHASE I PROJECT WILL ASSESS THE FEASIBILITY AND DEVELOP SPECIFICATIONS FOR THE INTEGRATION OF THE THREE TECHNOLOGIES FOR THE PRODUCTION OF A CUSTOM-FIT RESPIRATOR MASK. FOR THIS EXAMPLE, MASS-PRODUCED THERMOFORMED MASKS WILL BE AUTOMATICALLY TRIMMED TO FIT THE FACIAL CONTOURS OF THE INDIVIDUAL. METHODS OF LABELING THE INDIVIDUALIZED MASK WILL ALSO BE CONSIDERED.

LEVY S INC
3425 S BASCOM AVE
CAMPBELL, CA 95008
CONTRACT NUMBER: F33615-89-C-3403
DAVOOD ABDOLLAHIAN
TITLE:
CONCEPTUAL DESIGN OF A MODULAR TEST LOOP TO STUDY TWO-PHASE FLOW AND HEAT TRANSFER IN LOW AND HIGH ACCELERATIONS
TOPIC# 115 OFFICE: AFWAL/FIOP IDENT#: 33679

SUBMITTED BY

DESIGN OF THE TWO-PHASE FLOW SYSTEMS WHICH ARE ANTICIPATED TO BE UTILIZED IN THE FUTURE SPACECRAFT THERMAL MANAGEMENT SYSTEMS REQUIRE A KNOWLEDGE OF THE TWO-PHASE FLOW AND HEAT TRANSFER PARAMETERS IN LOW AND HIGH ACCELERATIONS. THE PROPOSED PROGRAM IS AIMED AT IDENTIFYING THE PARAMETERS OF IMMEDIATE IMPORTANCE AND DEVELOPING THE CONCEPTUAL DESIGN OF AN INNOVATIVE MODULAR FLIGHT TEST BED. THIS LOOP WILL GENERATE THE REQUIRED DATA AND ALSO ALLOW EVALUATION OF SEVERAL SYSTEM/COMPONENT CONCEPTS IN A MINIMUM NUMBER OF FLIGHTS. IN ADDITION TO MODULARITY, THE UNIQUE FEATURES OF THIS DESIGN INCLUDE ADAPTABILITY TO AIRPLANE TRAJECTORY TESTING AND CAPABILITY OF PERFORMING WITH ADIABATIC TWO-PHASE FLOW. THE PROJECT OBJECTIVES WILL BE ACHIEVED BY (1) IDENTIFYING AND CATEGORIZING THE PARAMETERS AND CRITERIA THAT REQUIRE FURTHER DATA; (2) EVALUATION OF THE STATE OF RESEARCH AND APPLICABLE DATA; (3) DEVELOPMENT OF A BASELINE DESIGN WHICH WOULD PROVIDE DATA FOR THE MAJOR PARAMETERS; (4) CONCEPTUAL DESIGN OF THE MODULATOR TEST BED; AND (5) SPECIFICATION OF GROUND-BASED CONFIRMATION TESTS.

LIGHTWAVE ELECTRONICS CORP
897-5A INDEPENDENCE AVE
MOUNTAIN VIEW, CA 94043
CONTRACT NUMBER: F33615-89-C-1092
DR TOM KANE
TITLE:
2.1 MICRON EYE-SAFE COHERENT LASER TRANSMITTER AND DETECTOR
TOPIC# 92 OFFICE: AFWAL/AAOP IDENT#: 32881

LIGHTWAVE IS PROPOSING TO STUDY TWO OF THE SUBSYSTEMS REQUIRED FOR HIGH PERFORMANCE COHERENT LASER RADAR. WE PROPOSE TO DEMONSTRATE ROOM-TEMPERATURE QUANTUM-LIMITED HETERODYNE DETECTION OF INFRARED RADIATION AT THE 2.1-MICRON WAVELENGTH OF Tm:Ho:YAG LASERS. THE LOCAL OSCILLATOR OF THE HETERODYNE DETECTOR WILL BE BUILT BY LIGHTWAVE, AND THE PHOTODIODE WILL BE PURCHASED FROM A COMMERCIAL SUPPLIER. WE WILL ALSO STUDY THE POSSIBILITY OF CONSTRUCTING A Q-SWITCHED COHERENT LASER TRANSMITTER WITH AN OUTPUT PULSE ENERGY OF 100 mJ AT THE SAME EYE-SAFE WAVELENGTH, USING COMMERCIALY AVAILABLE LASER DIODE PUMPS.

LITE-COM INC
20249 ELKWOOD ST
CANOGA PARK, CA 91306
CONTRACT NUMBER:
DR ROBERT FAN
TITLE:
FIBER OPTICS ORDNANCE
TOPIC# 234 OFFICE: BMO/MYSC IDENT#: 32733

SUBMITTED BY

THE DEVELOPMENT OF FIBER OPTICS ORDNANCE TO IMPROVE IN THE PERFORMANCE, TESTABILITY, AND HARDNESS. THE INNOVATIVE PROPOSED FIBER OPTIC ORDNANCE IS BASED ON THE DEVELOPMENT OF (1) THE METHOD OF LASER FIRING UNIT OPERABLE AT ADVERSE ENVIRONMENTS, (2) A NEW METHOD TO CONSTRUCT THE ETS WITH METAL COATED FIBERS TO OPERATE HIGH ENERGY "POWER" AND "SIGNAL" ON ONE FIBER, (3) A METHOD TO IMPROVE THE HIGH ENERGY FIBER OPTIC CONNECTOR, (4) A NEW METHOD TO CONSTRUCT THE FIBER OPTIC FEEDTHROUGH UNIT, (5) A METHOD TO DEVELOP THE FIBER OPTIC HIGH ENERGY TERMINI.

LITHIUM ENERGY ASSOCS
246 SYCAMORE ST
WATERTOWN, MA 02172
CONTRACT NUMBER: F33615-89-C-2938
FREDERICK W DAMPIER

TITLE:

LITHIUM RECHARGEABLE BATTERY WITH INORGANIC ELECTROLYTE FOR SILO ENERGY STORAGE

TOPIC# 140 OFFICE: AFWAL/POMP IDENT#: 32976

THIS PROJECT WILL DEVELOP AND EVALUATE NUMEROUS INNOVATIONS TO IMPROVE THE PERFORMANCE OF RECHARGEABLE Li/CuCl₂ CELLS USING INORGANIC ELECTROLYTES AND THICK CuCl₂ ELECTRODES (E.G. 2.5 TO 5.0 mm) SUITABLE FOR VERY LARGE BATTERIES FOR MISSILE SILO ENERGY STORAGE. THE LITHIUM/INORGANIC ELECTROLYTE/CuCl₂ CELL HAS BEEN FOUND TO GIVE EXCELLENT CYCLE LIFE AND ENERGY DENSITY (E.G. 200 CYCLES AT 75 Whr/lb) BUT SUITABLE THICK AND STRUDY CuCl₂ ELECTRODES FOR VERY LARGE BATTERIES (I.E. 50 KWhr) HAVE NOT YET BEEN DEVELOPED AND TESTED FOR THE 1000 DEEP CYCLES REQUIRED FOR THE MISSILE SILO APPLICATION. THE APPROACH IN PHASE I WILL BE TO EVALUATE SEVERAL INNOVATIONS TO IMPROVE THE PERFORMANCE AND CYCLE LIFE OF THICK CuCl₂ ELECTRODES IN Li/CuCl₂ CELLS. IN PARTICULAR, CHANGES IN THE COMPOSITION, CURRENT COLLECTOR GRID AND POROSITY OF THE CuCl₂ ELECTRODE WILL BE INVESTIGATED. THE PERFORMANCE OF THE Li ELECTRODE AND SEVERAL PROMISING INNOVATIONS INVOLVING THE SEPARATOR AND THE CELL DESIGN WILL ALSO BE INVESTIGATED.

M-TECH INC
1538 HARTSVILLE CIR
WARMINSTER, PA 18974
CONTRACT NUMBER: F08635-89-C-0382
W MEIKLEJOHN

TITLE:

MIL-STD-1760A COMPATIBLE MULTIPLE SMART WEAPON EMPLOYMENT MECHANI

TOPIC# 1 OFFICE: AD/PMR IDENT#: 34582

SUBMITTED BY

THIS PROJECT WILL DETAIL THE REQUIREMENTS TO ALLOW MULTIPLE MIL-STD-1760A COMPATIBLE STORES TO BE CARRIED AT A SINGLE MIL-STD-1760A AIRCRAFT/STORE INTERFACE LOCATION. M-TECH PROPOSES A CONCEPT THAT WILL INTEGRATE MULTIPLE MIL-STD-1760A COMPATIBLE STORES ON A SINGLE MIL-STD-1760A AIRCRAFT STATION THROUGH THE USE OF A MULTIPLE CARRIAGE RACK, (MCR). THIS CONCEPT WILL USE A NEWLY DEVELOPED ELECTRONICS PACKAGE IN THE MCR TO PERFORM THE EJECTION RACK OPERATIONS, MIL-STD-1553, AND MIL-STD-1760A FUNCTIONS. FEASIBILITY STUDIES BASED UPON THE STORE REQUIREMENTS WILL BE PERFORMED TO DETERMINE THE ELECTRONICS SIZE AND PACKAGING CONSTRAINTS. BASED UPON THE ELECTRONIC REQUIREMENTS, EXISTING MCR'S WILL BE ANALYZED TO DETERMINE IF THEY CAN BE MODIFIED OR IF NEW MCR'S NEED TO BE DEVELOPED TO INCORPORATE THE REQUIRED MIL-STD-1760A ELECTRONICS. THE END PRODUCT OF THIS SBIR PROJECT WILL BE A REPORT DETAILING THE RESULTS OF TRADE STUDIES RELATING TO PERFORMANCE, COST, DESIGN APPROACHES AND PRELIMINARY AEROMECHANICAL AND PACKAGING CONSIDERATIONS. INCLUDED ALSO IN THIS REPORT WILL BE A PRELIMINARY LEVEL I DRAWING IN ACCORDANCE WITH DOD-D-1000 OF THE MOST ADVANTAGEOUS DESIGN APPROACH.

M.L. ENERGIA INC
PO BOX 1468
PRINCETON, NJ 08542
CONTRACT NUMBER:
DR MOSHE LAVID

TITLE:
METASTABLE EXCITED REACTANTS FOR A QUANTUM INCREASE IN SCRAMJET PERFORMANCE
TOPIC# 248 OFFICE: AFSC/NAT IDENT#: 37988

SIGNIFICANT ADVANCES IN COMBUSTION TECHNOLOGY ARE NEEDED FOR THE NEW GENERATION OF HYPERSONIC FLIGHT VEHICLES. MOST COMBUSTION PROCESSES ARE CURRENTLY HINDERED BY CONSTRAINTS IMPOSED BY THE CONDITION OF HYPERSONIC FLOW. THIS PROPOSAL OFFERS A NOVEL IDEA FOR IMPROVING COMBUSTION BY IN-FLIGHT SYNTHESIS AND EMPLOYMENT OF METASTABLE EXCITED CHEMICAL SPECIES AS REACTANTS IN SUPERSONIC COMBUSTION ENGINES. THE OVERALL OBJECTIVE OF PHASE I RESEARCH IS TO EXPERIMENTALLY DEMONSTRATE THE CONCEPT USING A MODEL REACTANT,

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SINGLET MOLECULAR OXYGEN. SINGLET MOLECULAR OXYGEN WILL BE SYNTHESIZED FROM GROUND STATE OXYGEN BY A UNIQUE ELECTRICAL DISCHARGE-PHOTODISSOCIATION SEQUENCE, AND MIXED WITH REPRESENTATIVE FUELS. AUTOIGNITION TEMPERATURES AND INDUCTION TIMES OF THE ENSUING REACTIONS WILL THEN BE MEASURED. MARKEDLY ENHANCED REACTIVITY OVER GROUND STATE OXYGEN WILL DEMONSTRATE CONCEPT FEASIBILITY. IT IS ANTICIPATED THAT THIS NEW CONCEPT MAY BE APPLIED TO A SELECTED VARIETY OF ADVANCED FUELS AND OXIDANTS. THESE EXCITED REACTANTS WILL SUBSTANTIALLY INCREASE THE OVERALL COMBUSTION RATE. IMPROVE COMBUSTION WILL PROVIDE THE HIGH PERFORMANCE AND RELIABILITY NEEDED TO ADVANCE HYPERSONIC SYSTEMS TO PRACTICALITY AND COST EFFECTIVENESS.

MAINSTREAM ENGINEERING CORP
200 YELLOW PL
ROCKLEDGE, FL 32955
CONTRACT NUMBER: F08635-89-C-0354
LAWRENCE R GRZYL

TITLE:
INVESTIGATION OF THE THERMODYNAMIC PROPERTIES OF REFRIGERANT MIXTURES
TOPIC# 64 OFFICE: AFESC/RDXP IDENT#: 32032

TO ANALYZE THE EFFECT OF A REFRIGERANT ON THE CAPACITY OF REFRIGERATION EQUIPMENT THE THERMODYNAMIC PROPERTIES OF THE REFRIGERANT MUST BE KNOWN. MAINSTREAM WILL DEVELOP THE THERMODYNAMIC PROPERTIES OF VARIOUS BINARY AND TERNARY REFRIGERANT MIXTURES USING AN EQUATION OF STATE APPROPRIATE FOR REFRIGERANT MIXTURES. VARIOUS AZEOTROPIC AND NON-AZEOTROPIC MIXTURES WILL BE IDENTIFIED, AND THE NECESSARY CRITICAL DATA AND INVARIANT INTERACTION COEFFICIENTS FOR THE MIXTURES WILL BE COMPILED. A REFRIGERATION SYSTEM SIMULATOR WILL BE DEVELOPED, WITH A WIDE RANGE OF REFRIGERATION COMPONENTS, THAT WILL CALCULATE THE THERMODYNAMIC PERFORMANCE OF REFRIGERANTS IN VARIOUS REFRIGERATION SYSTEMS. THIS PROJECT WILL ALSO ANALYZE THE EFFECT THESE MIXTURES HAVE ON REFRIGERATION COMPONENTS. THE SELECTION OF THE OPTIMUM REFRIGERANT FOR A SPECIFIC REFRIGERATION SYSTEM CAN ALSO BE ACCOMPLISHED.

MARKO MATERIALS INC
144 RANGEWAY RD
NORTH BILLERICA, MA 01862
CONTRACT NUMBER: F33615-89-C-5641
DR RANJAN RAY

TITLE:
NIOBIUM ALUMINIDE (NbAl₃) BASED HIGH TEMPERATURE MATERIALS FOR ADVANCED SYSTEMS
TOPIC# 123 OFFICE: AFWAL/MLK IDENT#: 33504

SUBMITTED BY

NIOBIUM ALUMINIDE (NbAl₃) BASED MONOLITHIC AND COMPOSITE MATERIALS HAVE POTENTIAL AIR FORCE APPLICATIONS IN THE TEMPERATURE RANGE 2000-3000 DEG F IN ADVANCED GAS TURBINE ENGINES AND ADVANCED TRANSATMOSPHERIC FLIGHT VEHICLES. NbAl₃ BASED MATERIALS HAVE PROVED TO BE RATHER FORMIDABLE MATERIALS TO PROCESS BECAUSE OF ITS EXTREME BRITTLINESS. FOR SUCCESSFUL PERFORMANCE DURING LONG TERM ELEVATED TEMPERATURE SERVICE THESE MATERIALS MUST ALSO EXHIBIT HIGH CREEP RESISTANCE. THE PROPOSED RESEARCH WILL DETERMINE THE FEASIBILITY OF OPTIMIZING THE ROOM AND ELEVATED TEMPERATURE MECHANICAL PROPERTIES BY USE OF RAPID SOLIDIFICATION AND POWDER METALLURGICAL PROCESSING. THE LONG TERM OBJECTIVE IS TO DESIGN AN ENGINEERED MULTIPHASE NbAl₃ MATRIX COMPOSITE. PHASE I RESEARCH WILL INVESTIGATE THE EFFECT OF TiB₂ DISPERSOIDS ON THE MICROSTRUCTURAL AND MECHANICAL PROPERTIES OF RAPID SOLIDIFIED NbAl₃. DURING PHASE I RESEARCH SUITABLE THERMOCHEMICALLY STABLE DUCTILE PHASE AND CONTINUOUS FIBER REINFORCEMENTS TO THE NbAl₃ MATRIX WILL ALSO BE IDENTIFIED USING THERMODYNAMIC CALCULATIONS.

MATERIALS SCIENCES CORP
GWYNEDD PLAZA II - BETHLEHEM PIKE
SPRING HOUSE, PA 19477
CONTRACT NUMBER: F04611-89-C-0039
BRIAN J SULLIVAN

TITLE:
DEVELOPMENT OF ACCEPTANCE CRITERIA IN CARBON-CARBON MATERIALS FOR
SPACE STRUCTURES
TOPIC# 189 OFFICE: AFAL/TSTR IDENT#: 38861

CARBON-CARBON (C-C) COMPOSITES ARE AN ATTRACTIVE CLASS OF MATERIALS FOR SPACE SYSTEM COMPONENTS. THEY POSSES HIGH STIFFNESS AND STRENGTH TO DENSITY RATIOS, HIGH THERMAL CONDUCTIVITY, NEAR ZERO THERMAL EXPANSIONS, AND EXCELLENT THERMAL SHOCK RESISTANCE. THESE MATERIALS, HOWEVER, DUE TO THE NATURE OF THEIR FABRICATION AND PROCESSING, INEVITABLY CONTAIN DEFECTS. THE DEFECTS CONSIST OF BROKEN AND MISALIGNED FIBERS, MATRIX CRACKS, AND OTHER INHOMOGENEITIES AND DISCONTINUITIES SUCH AS EXTREMELY POROUS REGIONS AND LARGE REGIONS OF POORLY BONDED FIBERS RESULTING FROM POOR IMPREGNATION AND CARBONIZATION. TO DATE, THERE IS LITTLE UNDERSTANDING OF THE EFFECTS

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OF THESE FLAWS ON THE MECHANICAL STRENGTH AND STIFFNESS PROPERTIES, OR ON THE THERMAL PROPERTIES OF THE C-C MATERIALS. THE DEVELOPMENT OF IMPERFECTION ACCEPTANCE CRITERIA FOR C-C MATERIALS IS OF PRIME IMPORTANCE TO THE SUCCESSFUL UTILIZATION OF THESE MATERIALS IN SPACE STRUCTURES. CARBON-CARBON MATERIALS ARE EXPENSIVE; WITHOUT ANALYSIS FOR THE CORRELATION OF MATERIAL FLAWS WITH MATERIAL PERFORMANCE, A COMPREHENSIVE EXPERIMENTAL PROGRAM TO DEVELOP ACCEPTANCE CRITERIA IS PROHIBITIVE. THE FOUNDATION FOR ACCEPTANCE CRITERIA DEVELOPMENT, THEREFORE, MUST INCLUDE THE GENERATION OF MATERIAL MODELS WHICH WILL ALLOW FOR THE EVALUATION OF THE EFFECTS OF VARIOUS TYPES AND SIZES OF IMPERFECTIONS ON THE THERMOMECHANICAL PROPERTIES AND STRENGTHS OF C-C COMPOSITES. THE FEASIBILITY OF GENERATING SUCH MODELS IS THE GOAL OF THE PHASE I PROGRAM.

MAXDEM INC
267 S FAIR OAKS AVE
PASADENA, CA 91105
CONTRACT NUMBER:
DR MARK S TRIMMER
TITLE:
PREPARATION OF A NEW CLASS OF PROCESSIBLE INTRINSICALLY RIGID
POLYMERS
TOPIC# 239 OFFICE: AFOSR/XOT IDENT#: 34340

A NEW CLASS OF RIGID-ROD POLYMERS WILL BE PREPARED BY A NOVEL TRANSITION METAL CATALYZED COUPLING ROUTE. THE RESULTING POLYMERS OFFER A UNIQUE COMBINATION OF SYNTHETIC VERSATILITY, PROCESSIBILITY, AND MECHANICAL AND ELECTRONIC PROPERTIES NOT CURRENTLY AVAILABLE WITH RIGID REINFORCING AGENTS. WE PROPOSE TO CARRY OUT RESEARCH FOCUSING ON THE OPTIMIZATION OF THE POLYMERIZATION REACTION AND THE SCREENING OF NEW MONOMER MODIFICATIONS. OUR PRIMARY GOAL IS TO BE ABLE TO ROUTINELY PREPARE GRAM SCALE SAMPLES OF HIGH MOLECULAR WEIGHT POLYMER FOR EXTENSIVE TESTING OF PHYSICAL AND MECHANICAL PROPERTIES DURING LATER STAGES OF THE WORK.

MEADOWLARK OPTICS INC
7460 WELD COUNTY RD - 1
LONGMONT, CO 80501
CONTRACT NUMBER:
TOM BAUR
TITLE:
A LIQUID CRYSTAL WAVEPLATE TECHNIQUE FOR WAVELENGTH TUNING OF
NARROWBAND OPTICAL FILTERS
TOPIC# 199 OFFICE: AFGL/XOP IDENT#: 31843

SUBMITTED BY

WE PROPOSE TO INVESTIGATE WAVELENGTH TUNING OF NARROW BANDWIDTH OPTICAL FILTERS USING NEMATIC LIQUID CRYSTAL WAVEPLATES WITH A RETARDANCE THAT IS ELECTRICALLY TUNABLE. THESE TUNABLE LIQUID CRYSTAL WAVEPLATES OR RETARDERS HAVE DISTINCT ADVANTAGES OVER PRESENT TECHNOLOGIES IN THAT THEY PERMIT WAVELENGTH TUNING OF THE FILTER WITH NO MECHANICAL MOTION OR COMPLICATED ELECTROMECHANICAL CONTROL SYSTEMS, THEY TUNE QUICKLY, AND THEY CAN BE MADE IN LARGE CLEAR APERTURES AT A REASONABLE COST. WE WILL COMPLETELY CHARACTERIZE THE PERFORMANCE AND RELIABILITY OF THESE WAVEPLATES AND EXAMINE THE COMPATIBILITY OF THE PERFORMANCE WITH WHAT IS NEEDED FOR TUNABLE NARROWBAND OPTICAL FILTERS. SIMULTANEOUSLY, WE WILL DESIGN A SYSTEM FOR COMPUTER CONTROL OF RAPID WAVELENGTH TUNING OF THESE FILTERS, INCORPORATING AUTOMATIC CALIBRATION FOR RELIABLE RESULTS. WE ARE UNIQUELY QUALIFIED TO PURSUE THIS PROJECT BECAUSE OF OUR EXPERIENCE BOTH IN MANUFACTURING LIQUID CRYSTAL DEVICES AND IN DESIGNING AND MANUFACTURING LYOT-TYPE NARROWBAND OPTICAL FILTERS.

MERIT TECHNOLOGY INC

5068 W PLANO PKWY

PLANO, TX 75093

CONTRACT NUMBER:

JAY LABHART

TITLE:

HIGH SPEED INFERENCE ON 1750A

TOPIC# 186 OFFICE: AFSCT/XN IDENT#: 31725

PROGRESS IN EXPERT SYSTEMS IS MAKING IT POSSIBLE TO REALIZE PRACTICAL APPLICATIONS IN A WIDE RANGE OF SPACE SYSTEM TASKS. THE OPERATIONAL EMPLOYMENT OF EXPERT SYSTEMS ON SPACE PLATFORMS WILL BE DRIVEN BY THE EFFICIENT UTILIZATION OF COMPUTING RESOURCES WITHIN SPACE SYSTEM ENVIRONMENTS. THIS DOCUMENT PROPOSES TO IDENTIFY CHARACTERISTICS/ATTRIBUTES REQUIRED FOR SPACE SYSTEM APPLICATIONS, IDENTIFY THE EFFECTS OF 1750A ARCHITECTURE ON ATTRIBUTES, AND DESIGN AN APPROACH FOR IMPLEMENTING AN EXPERT SYSTEM DEVELOPMENT ENVIRONMENT.

METRO-LASER

18006 SKYPARK BLVD - STE 108

IRVINE, CA 92714

CONTRACT NUMBER:

CECIL F HESS

TITLE:

LASER FLUORESCENCE TECHNIQUE TO MEASURE MULTIPLE PARAMETERS IN HYPERSONIC FLOWS

TOPIC# 255 OFFICE: AFSC/NAT IDENT#: 31302

SUBMITTED BY

A NEW PLANAR LASER INDUCED FLUORESCENCE TECHNIQUE WHICH WILL PROVIDE THE FLOW VELOCITY AND THE CONCENTRATION OF VARIOUS SPECIES AT MANY POINTS ON A PLANE OF A HYPERSONIC FLOW (WITH AND WITHOUT CHEMISTRY) IS PRESENTED. THE TECHNIQUE HAS THE POTENTIAL OF MEASURING TEMPERATURE AS WELL. UNLIKE OTHER TECHNIQUES, THE PROPOSED APPROACH WILL MAKE USE OF BREADBOARD PULSED LASERS. IN THE PROPOSED METHOD, THE ABSORPTION LINE OF A SELECTED SPECIES IS EXCITED WITH A VARIABLE BANDWIDTH TUNABLE EXCIMER LASER. THE FLUORESCENCE IS PROPORTIONAL TO THE STRENGTH OF THE ABSORPTION LINE AND ITS POSITION WITHIN THE LASER LINE. THE FLOW VELOCITY CAUSES THE ABSORPTION LINE TO BE DOPPLER SHIFTED WITH THE LASER LINE RESULTING IN A CHANGE IN THE FLUORESCENT SIGNAL. SPECIES CONCENTRATION CAN BE DIRECTLY MEASURED FROM THE INTENSITY OF THE SIGNAL. TEMPERATURE MEASUREMENTS WOULD REQUIRE A SECOND LASER SHEET WITH A SHIFTED FREQUENCY. THE PROPOSED METHOD RESOLVES THE NARROWBAND REQUIREMENT NORMALLY ASSOCIATED WITH FLUORESCENCE SPECTROSCOPY AND WILL MAKE USE OF BROADBAND LASERS WHICH ARE READILY AVAILABLE. THIS METHOD HAS THE POTENTIAL OF LEADING TO INSTRUMENTS THAT WILL EXPAND CURRENT SPECTROSCOPIC CAPABILITIES AND WILL HAVE A WIDER COMMERCIAL ACCEPTANCE.

METRO-LASER

18006 SKYPARK DR - STE 108

IRVINE, CA 92714

CONTRACT NUMBER:

CECIL F HESS

TITLE:

TWO-PHOTON PHOTODISSOCIATION IMAGING OF WATER VAPOR TO MEASURE

HYDROGEN/AIR MIXING IN HYPERSONIC PROPULSION

TOPIC# 21 OFFICE: AEDC/PKP IDENT#: 31327

THE PRESENCE OF WATER VAPOR PROVIDES AN INDICATION OF THE RAPID MIXING OF HYDROGEN AND AIR IN HYPERSONIC PROPULSION ENGINES. THIS IS A CRITICAL ISSUE WHICH CAN BE ADDRESSED BY NONINTRUSIVE IMAGING OF WATER VAPOR TO EVALUATE EFFICIENT FULE/AIR MIXING APPROACHES FOR SCRAMJETS. RECENTLY, TWO-PHOTON PHOTODISSOCIATION OF WATER VAPOR HAS BEEN INDUCED BY A KrF EXCIMER LASER AT 248 nm. THE FLUORESCENCE FROM THIS PROCESS CAN BE MEASURED TO DETECT WATER VAPOR QUANTITATIVELY AND NONINTRUSIVELY. IN THIS WORK, WATER VAPOR IMAGING BY TWO-PHOTON

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PHOTODISSOCIATION WILL BE EVALUATED USING A NARROWBAND, TUNABLE KrF EXCIMER LASER. OPTIMAL STRATEGIES FOR SINGLE AND MULTIPOINT MEASUREMENT OF WATER VAPOR WILL BE DETERMINED SUCH AS PUMPING WAVELENGTH, DETECTION WAVELENGTH, DETECTION OPTICS, AND CAMERA. THE AIM OF THE WORK IS TO DEVELOP A NEW, RELIABLE, RUGGED, QUANTITATIVE IMAGING DETECTOR FOR WATER VAPOR.

METRO-LASER
18006 SKYPARK BLVD - #108
IRVINE, CA 92714
CONTRACT NUMBER: F08635-89-C-0350
CECIL F HESS

TITLE:
PHOTOTHERMAL LASER DEFLECTION AN INNOVATIVE TECHNIQUE TO MEASURE PARTICLES IN EXHAUSTS
TOPIC# 62 OFFICE: AFESC/RDXP IDENT#: 32011

AN INNOVATIVE TECHNIQUE TO MEASURE IN REAL-TIME THE MASS CONCENTRATION OF PARTICLES IN EXHAUSTS IS PROPOSED HERE. THE TECHNIQUE IS BASED ON THE DEFLECTION EXPERIENCED BY A LASER BEAM THAT TRAVELS THRU A THERMAL LENS. PHOTOTHERMAL LASER DEFLECTION (PLD) CAN ALSO MEASURE THE CONCENTRATION OF GASEOUS SPECIES SUCH AS NO(x) AND OTHERS. IT THEREFORE HAS THE POTENTIAL TO SIMULTANEOUSLY MEASURE THE PARTICLE CONCENTRATION AND VARIOUS POLLUTANTS SIMULTANEOUSLY. IN THE PROPOSED METHOD A PULSED LASER BEAM LOCALLY HEATS THE PARTICLES PRESENT IN THE EXHAUST THUS CHANGING THE INDEX OF REFRACTION OF THE SURROUNDING GAS AND FORMING A THERMAL LENS. A PROBE CW LASER WHICH TRAVELS THRU THE THERMAL LENS WILL BE DEFLECTED ACCORDINGLY. THE AMOUNT OF DEFLECTION IS PROPORTIONAL TO THE LOCAL MASS CONCENTRATION. THE LASER CAN ALSO BE TUNED TO PUMP A GASEOUS SPECIES OF INTEREST THUS FORMING ALSO A THERMAL LENS. SINCE THE HEAT ABSORBED BY THE PARTICLES IS NOT A STRONG FUNCTION OF THEIR SHAPE, PLD CAN WORK WITH PARTICLE CLUSTERS. BOTH MODELING AND EXPERIMENTAL WORK WILL BE CONDUCTED DURING PHASE I TO ESTABLISH THE FEASIBILITY OF THE PROPOSED TECHNIQUE.

METSAT INC
515 S HOWES ST
FORT COLLINS, CO 80521
CONTRACT NUMBER:
DR EDWARD TOMLINSON
TITLE:
CLOUD-FREE CONDITIONS SPECIFIED FROM SATELLITE
TOPIC# 197 OFFICE: AFGL/XOP IDENT#: 31815

SUBMITTED BY

MANY DOD WEAPON AND RECONNAISSANCE SYSTEMS ARE SERIOUSLY IMPACTED BY CLOUDS. NEW SYSTEMS WILL CONTINUE TO BE CONSTRAINED BY CLOUD OBSTRUCTIONS IN THE LINE-OF-SIGHT BETWEEN THE SYSTEM PLATFORM AND THE TARGET. CLOUD-FREE LINE-OF-SIGHT (CFLOS) EVALUATIONS USING CONVENTIONALLY OBSERVED CLOUD COVER HAVE BEEN PERFORMED FOR MANY YEARS TO OPTIMIZE THE PERFORMANCE OF THESE SYSTEMS. WITH DOD SYSTEMS REQUIRING WORLD-WIDE ASSESSMENTS OF CFLOS, TECHNOLOGY TO EFFECTIVELY UTILIZE SATELLITE CLOUD INFORMATION NEEDS TO BE DEVELOPED TO PROVIDE SATELLITE CFLOS ASSESSMENTS. METSAT, INC. PROPOSES TO EVALUATE THE VARIOUS SATELLITE DATA AVAILABLE AND DEVELOP NEW, INNOVATIVE TECHNOLOGICAL PROCESSES AND PRODUCTS TO PROVIDE CFLOS ASSESSMENT BASED SOLELY ON SATELLITE DATA. THE PHASE E EFFORT WILL PROVIDE DETAILED QUANTITATIVE INTER-COMPARISONS OF SATELLITE ASSESSMENTS AND DIGITAL WHOLE-SKY CLOUD IMAGES. REFINEMENTS IN TECHNIQUES DEVELOPED IN PHASE I WILL BE PERFORMED LEADING TO DESIGN OF OPTIMAL NEW PRODUCTS FOR SPECIFYING CFLOS AND CLOUD-FREE PATHS-OF-TRAVEL UNDER VARIOUS CLOUD CONDITIONS USING SATELLITE DATA ONLY. THESE INNOVATIVE TECHNOLOGY DEVELOPMENTS WILL PROVIDE SIGNIFICANT ENHANCEMENTS TO THE MISSION EFFECTIVENESS OF DOD SYSTEMS WORLD-WIDE.

MICROCOM CORP
965 THOMAS DR
WARMINSTER, PA 18974
CONTRACT NUMBER:
CHARLES ROSEN
TITLE:
SOUNDING ROCKET AIRBORNE INSTRUMENTATION SYSTEM
TOPIC# 233 OFFICE: BMO/MYSC IDENT#: 32730

MICROCOM PROPOSES TO STUDY AND DEFINE SOUNDING ROCKET INSTRUMENTATION REQUIREMENTS AND DESIGN A STANDARD IRIG TELEMETER WHICH WILL TRANSMIT DATA FOR ANALYSIS OF ROCKET PERFORMANCE. THE STUDY WILL USE TELEMETRY SYSTEM ANALYSIS TECHNOLOGY WHICH HAS BEEN DEVELOPED BY MICROCOM TO PROVIDE OPTIMUM OPERATION WITH MAXIMUM COST EFFECTIVENESS.

MILLITECH CORP
PO BOX 109 - S DEERFIELD RESEARCH PK
SOUTH DEERFIELD, MA 01373
CONTRACT NUMBER:
PAUL F GOLDSMITH
TITLE:
MILLIMETER WAVE ELECTRONIC BEAM SCANNING USING QUASIOPTICAL TECHNIQUES
TOPIC# 185 OFFICE: AFSCT/XN IDENT#: 31718

SUBMITTED BY

A NOVEL APPROACH FOR ACHIEVING BEAM-STEERING OF A 60 GHz COMMUNICATION SYSTEM IS DESCRIBED. THE PROPOSED TECHNIQUE ELIMINATES SOME OF THE SERIOUS DRAWBACKS OF THE CURRENT PHASED ARRAY CONCEPTS USING FERRITE OR SOLID-STATE PHASE SHIFTERS. THE SCHEME HAS A POTENTIAL FOR MONOLITHIC IMPLEMENTATION. THE PROPOSED SCANNING TECHNOLOGY USES GAUSSIAN OPTICS ELEMENT THAT IS CAPABLE OF SCANNING VARIOUS APERTURE SIZES IN ONE DIMENSION. TWO SUCH ELEMENTS CAN BE USED FOR TWO-DIMENSIONAL SCANNING. THE PROPOSED SCANNING TECHNIQUE OFFERS FAST SCANS LIMITED ONLY BY SEMICONDUCTOR DRIVER/LOGIC SPEEDS, CAPABLE OF HANDLING LARGE POWER, SUITABLE FOR LOW-NOISE APPLICATIONS. A COST-EFFECTIVE SOLUTION FOR BEAM STEERING CAN BE OBTAINED IN COMPARISON TO THE "TRADITIONAL" PHASE ARRAY APPROACHES.

MISSION RESEARCH CORP
PO DRAWER 719 - 735 STATE ST
SANTA BARBARA, CA 93102
CONTRACT NUMBER:
BARTON M GOLDSTEIN
TITLE:
FAR FIELD RADIATION PATTERNS IN THE PRESENCE OF AIR BREAKDOWN
TOPIC# 201 OFFICE: AFWL/PRC IDENT#: 31859

MODELS ARE DEVELOPED FOR THE INITIATION OF BREAKDOWN IN THE FIELD OF A MICROWAVE ANTENNA. BREAKDOWN AND PROPAGATION OF PHASED ARRAYS ARE MODELED AS WELL AS SINGLE ANTENNA SOURCES.

MISSION RESEARCH CORP
PO DRAWER 719
SANTA BARBARA, CA 93102
CONTRACT NUMBER:
DR STEVE F STONE
TITLE:
INTEGRATED CASE STRUCTURE/EXTERNAL PROTECTION SYSTEM
TOPIC# 231 OFFICE: BMO/MYSC IDENT#: 32722

MRC PROPOSES TO DEVELOP AND FABRICATE A HIGHLY INNOVATIVE SOLID

SUBMITTED BY

BOOSTER MOTORCASE, SKIRT AND PBV INTEGRAL EXTERNAL PROTECTION MATERIAL (IEPM) WHICH PROVIDES (1) LIGHT WEIGHT, (2) HANDLING PROTECTION, (3) STRUCTURAL LOAD CARRYING CAPABILITY, (4) NUCLEAR INDUCED DEBRIS, THERMAL FLASH (TF) AND X-RAY AND (5) DIRECTED ENERGY WEAPON (DEW- cw AND PULSED IR LASER PROTECTION). THE CONCEPT CONSISTS OF AN OUTER, THIN LOADED RUBBER MODIFIED EPOXY LAYER CONTAINING CERAMIC PARTICULATE LOADING TO PROVIDE TF PROTECTION, HIGH Z PARTICULATE LOADING TO PROVIDE X-RAY SHIELDING OF THE INNER LAYERS AND CONTINUOUS AXIAL/HOOP CARBON FIBER REINFORCEMENT TO PROVIDE LOAD/STIFFNESS SHARING, AND PRIMARY DEBRIS PROTECTION. THIS LAYER IS COCURED TO A CERAMIC FABRIC NET WHICH REPLACES THE CONVENTIONAL KEVLAR REINFORCEMENT AND PROVIDES ENHANCED DEBRIS PROTECTION. THE INNER STRUCTURAL LAYERS CONSIST OF REFRACTORY METAL COATED CARBON FIBERS IN A RUBBER MODIFIED EPOXY MATRIX WHICH PROVIDES THE LASER PROTECTION DUE TO ENHANCED REFLECTIVITY AND ENERGY CHANNELING. THE PHASE I EFFORT WILL FOCUS ON DESIGN TRADES AND PROTOTYPE SAMPLE FABRICATION FOLLOWED BY SCALE UP AND RING FABRICATION BY MORTON THIOKOL, THE CO-PROPOSER OF THIS EFFORT. PHASE II WILL CONSIST OF SCALE UP STUDIES LEADING TO 18 INCH BOTTLE FABRICATION, PROCESSING OPTIMIZATION AND AGT/UGT TESTING. PHASE III WILL INVOLVE FULL SCALE FABRICATION AND TESTING.

MODELL DEVELOPMENT CORP
39 LORING DR
FRAMINGHAM, MA 01701
CONTRACT NUMBER:
MICHAEL MODELL

TITLE:
DISPOSAL OF SOLID ROCKET PROPELLANTS BY SUPERCRITICAL WATER
OXIDATION
TOPIC# 61 OFFICE: AFESC/RDXP IDENT#: 32001

THIS PROPOSAL DESCRIBES AN SBIR PROJECT TO EVALUATE A NEW APPROACH TO PROPELLANT DEMILITARIZATION USING SUPERCRITICAL WATER OXIDATION (SCWO). THIS NEW TECHNOLOGY HAS BEEN SHOWN TO EFFECTIVELY DESTROY TOXIC AND HAZARDOUS WASTES. THE OXIDATION IS CONDUCTED IN A CLOSED SYSTEM WHICH VIRTUALLY ELIMINATES POLLUTANT EMISSION TO THE ENVIRONMENT. THE EFFLUENTS OF PROPELLANT DESTRUCTION ARE ANTICIPATED TO BE NON-HAZARDOUS, POTENTIALLY REUSABLE AND/OR READILY DISPOSED.

SUBMITTED BY

THE GOAL OF THE PROPOSED PROJECT IS TO DEMONSTRATE TECHNICAL FEASIBILITY OF SCWO FOR PROPELLANT DISPOSAL, TO DEVELOP A FULL SCALE DESIGN, AND TO PROVIDE PRELIMINARY ECONOMIC ESTIMATES.

MacAULAY-BROWN INC
3915 GERMANY LN
DAYTON, OH 45431
CONTRACT NUMBER: F33615-89-C-1095
LOWELL F WILLIAMS
TITLE:
TRANSITION AND CONNECTIVITY BETWEEN ELECTRONIC COMBAT DIGITAL MODELS AND HYBRID SIMULATORS
TOPIC# 94 OFFICE: AFWAL/AAOP IDENT#: 32895

THE OBJECTIVES OF THIS EFFORT ARE TO DESIGN THE CONNECTION OF A REAL TIME HYBRID SIMULATION OF AN INFRARED MISSILE DETECTION AND TRACKING SIMULATION TO AN EC DIGITAL MODEL (PROBABLY SUPPRESSOR). SUCH EC DIGITAL MODELS ARE EVENT DRIVEN AND CAPABLE OF CONTROLLING LOWER LEVEL DIGITAL MODELS LIKE ESAMS THAT ARE NECESSARY TO PROVIDE THE REQUIRED INPUTS TO THE HYBRID SIMULATION. THE DETERMINATION OF THE REAL TIME COMPUTING REQUIREMENTS AND THE NECESSARY HARDWARE ARE OBJECTIVES OF THE PROGRAM. SEVERAL EXISTING HYBRID MISSILE DETECTION SIMULATIONS WILL BE CONSIDERED AS CANDIDATES INCLUDING THE AAR-44, THE IRAR, AND THE FLY'S EYE SYSTEM. ONE OF THESE MODELS AND THEIR ASSOCIATED ADVANCED DECOY SIMULATIONS WILL BE CONNECTED TO THE HIGHER LEVEL EC DIGITAL SIMULATIONS.

MacAULEY-BROWN INC
3915 GERMANY LN
DAYTON, OH 45431
CONTRACT NUMBER: F33657-89-C-2292
VERNON D BEST
TITLE:
IR/EO SENSOR TRENDS AND REQUIREMENTS
TOPIC# 162 OFFICE: ASD/XRX IDENT#: 32466

THE AERONAUTICAL SYSTEMS DIVISION HAS THE RESPONSIBILITY TO ENSURE

SUBMITTED BY

THAT NEW WEAPON SYSTEMS DEVELOPMENT AND ACQUISITION PLANNING ARE SOUNDLY BASED. ACQUISITION PLANNING REQUIREMENTS IN ADDITION TO MAJCOM NEEDS WHICH DRIVE MISSION AREA PLANS INCLUDE TWO OTHER MAJOR SYSTEM ACQUISITION DRIVERS - BUDGET AND TECHNOLOGY AVAILABILITY. TO BUILD TECHNICAL CREDIBILITY AND REFLECT FISCAL REALITY, SYSTEMS ACQUISITION PLANNING MUST BE LINKED WITH THE DEVELOPMENT PLANNING PROCESS AT THE BEGINNING OF THE DEVELOPMENT PHASE. EMBEDDED WITHIN THE DEVELOPMENT PLANNING PROCESS IS THE NEED TO DEFINE MISSION REQUIREMENTS TO WHICH LABORATORY DEVELOPMENT ACTIVITIES CAN BE RESPONSIVE. TO ENSURE THE AVAILABILITY OF THE TECHNOLOGY BASE, AN ASSESSMENT OF THE ON-GOING TECHNOLOGIES IS APPROPRIATE. THIS EFFORT WILL PROVIDE THE AIR FORCE AND DOD WITH: (1) A COMPREHENSIVE ASSESSMENT OF THE PERFORMANCE CAPABILITY AVAILABLE FROM INFRARED (IR) AND ELECTRO-OPTICAL (EO) SENSOR TECHNOLOGY FROM EXPLORATORY AND ADVANCED DEVELOPMENT APPLICABLE TO THE NEXT GENERATION AIR VEHICLE (YEAR 2010); (2) AN EXTENSION OF THAT ASSESSMENT OF EXPLORE IR/EO FAR TERM TECHNOLOGY AVAILABILITY (BEYOND YEAR 2010); AND (3) THE CONCEPTUAL FRAMEWORK TO EXPLOIT THE TECHNOLOGY IN AN ENGAGEMENT ANALYSIS TO UNDERSTAND THE ROLE AND UTILITY OF INFRARED SENSORS IN FUTURE AIR WARFARE MISSIONS.

MacDONALD CONSULTING
3056 GREER RD
PALO ALTO, CA 94303
CONTRACT NUMBER:
A D MacDONALD

TITLE:

FAR FIELD RADIATION PATTERNS IN THE PRESENCE OF AIR BREAKDOWN
TOPIC# 201 OFFICE: AFWL/PRC IDENT#: 31858

WHEN HIGH POWER MICROWAVES ARE TRANSMITTED THROUGH THE ATMOSPHERE, AIR BREAKDOWN MAY OCCUR. THIS CAN PRODUCE REGIONS OF PLASMA WHICH MAY DISTORT THE MICROWAVE BEAM PATTERN. THERE ARE MANY VARIABLES, SUCH AS POWER LEVEL, FREQUENCY, PULSE DURATION AND ALTITUDE, WHICH DETERMINE WHETHER OR NOT BREAKDOWN CAN TAKE PLACE. ANOTHER KEY VARIABLE IS THE AMBIENT ELECTRON CONCENTRATION, n , IN THE BEAM PATH. THE ELECTRONS ARE PRODUCED BY COSMIC RAY PARTICLES, AND SO n IS A VERY COMPLICATED FUNCTION OF SPACE AND TIME BECAUSE OF THE NATURE OF COSMIC RAY STATISTICS. THE PROPOSED RESEARCH IS THEREFORE DESIGNED

SUBMITTED BY

TO ACCOMPLISH FOUR OBJECTIVES: 1) CALCULATE n BASED ON CURRENT KNOWLEDGE OF COSMIC RAY PARTICLES; 2) CALCULATE BREAKDOWN FIELDS FOR THE REQUIRED VARIABLES; 3) CALCULATE THE EFFECT OF THE RESULTING PLASMAS ON BEAM PATTERNS; AND 4) COMBINE 1), 2), AND 3) TO OBTAIN AN ALGORITHM TO DESCRIBE THE FAR FIELD PATTERNS OF MICROWAVE RADIATION AS A FUNCTION OF THE APPROPRIATE VARIABLES.

NATIONAL SECURITY ANALYSTS INC
4900 SEMINARY RD - STE 1150
ALEXANDRIA, VA 22311
CONTRACT NUMBER: F41622-89-C-0016
WILLIAM E ARDERN
TITLE:
INSTRUCTIONAL METHODOLOGY FOR MULTISHIP AIR COMBAT TRAINING
TOPIC# 74 OFFICE: HSD/SORT IDENT#: 34749

MULTISHIP AIR COMBAT TRAINING REPRESENTS THE FIGHTER PILOT'S MOST COMPLEX AND DEMANDING PEACETIME CHALLENGE. MASTERY OF THIS ART IS CRUCIAL TO THIS SUCCESS IN COMBAT. YET, CURRENT PROGRAMS AFFORD THE FIGHTER PILOT LITTLE OPPORTUNITY TO TRAIN FOR MULTISHIP AIR COMBAT. MOST AVAILABLE FLYING TIME IS DEVOTED TO THE ACQUISITION AND MAINTENANCE OF INDIVIDUAL SKILLS WHICH ARE PREREQUISITE TO MULTISHIP TRAINING. THE FIGHTER FORCE NEEDS AN INSTRUCTIONAL METHODOLOGY WHICH INCREASES MULTISHIP AIR COMBAT TRAINING WITHOUT INCREASING FLYING HOUR REQUIREMENTS. RECENT ADVANCES IN COMPUTER TECHNOLOGY SUPPORT THE DEVELOPMENT OF RELATIVELY LOW COST INSTRUCTIONAL MEDIA WHICH CAN INCREASE THE FREQUENCY AND EFFECTIVENESS OF MULTISHIP AIR COMBAT TRAINING. DEVELOPING THE MEANS TO ACQUIRE AND PRACTICE THE NECESSARY INDIVIDUAL AND TEAM SKILLS WHILE ON THE GROUND WILL ALLOW MORE ACTUAL FLYING TIME TO BE DEVOTED TO MULTISHIP TRAINING. THIS PHASE I EFFORT WILL DEFINE TRAINING CONCEPT AND OUTLINE REQUIREMENTS NECESSARY TO DEVELOP AN INSTRUCTIONAL METHODOLOGY.

NAVSYS CORP & SPREAD SPECTRUM SCIENCES
18725 MONUMENT HILL RD
MONUMENT, CO 80132
CONTRACT NUMBER:
ALISON BROWN
TITLE:
GPS TRANSLATOR DATA RECORDER AND DATA RELAY LINK DEVELOPMENT
TOPIC# 183 OFFICE: SAMTO/XO IDENT#: 31710

SUBMITTED BY

GPS TRANSLATORS ARE PRESENTLY USED BY BOTH THE TRIDENT AND ERIS TEST PROGRAMS TO PROVIDE REAL-TIME TSPI DATA FOR MISSILE GUIDANCE AND RANGE SAFETY. ONE PRESENT LIMITATION IS THE SITE AND COST OF THE TRANSLATOR PROCESSING SYSTEM (TPS) WHICH CONSTRAINS IT TO A FEW GROUND-BASED INSTALLATIONS. THIS LIMITS THE RANGE OF OPERATION OF THE TRANSLATOR BASED TRACKING SYSTEM AND ALSO THE NUMBER OF PARTICIPANTS THAT CAN BE TRACKED. SIGNIFICANT BENEFITS AND COST SAVINGS COULD BE ACHIEVED THROUGH THE USE OF A TRANSLATOR RECORDER OR DATA RELAY LINK. A RECORDER WOULD ALLOW DATA FROM MULTIPLE TRANSLATORS TO BE STORED FOR LATER PROCESSING, THUS INCREASING THE NUMBER OF PARTICIPANTS THAT CAN BE TRACKED. THE LOW SIZE AND WEIGHT OF THE TRANSLATOR DATA RECORDER AND DATA RELAY LINK ALSO ALLOWS THEM TO BE CARRIED ON BOARD AN AIRCRAFT, WHICH SIGNIFICANTLY INCREASES THE RANGE OF OPERATION OF THE TRACKING SYSTEM AND PERMITS GROUND-BASED PARTICIPANTS TO BE TRACKED. UNDER THE PHASE I STUDY, THE REQUIREMENTS WILL BE IDENTIFIED FOR A TRANSLATOR DATA RECORDER AND A DATA RELAY LINK AND A STUDY WILL BE PERFORMED OF EXISTING EQUIPMENT THAT MAY BE ADAPTED FOR THIS PURPOSE. BASED ON A COST/PERFORMANCE TRADE-OFF ANALYSIS A SYSTEMS DESIGN WILL BE SELECTED FOR CONSTRUCTION OF A PROTOTYPE UNDER PHASE II.

NETROLOGIC
4241 JUTLAND DR
SAN DIEGO, CA 92117
CONTRACT NUMBER: F33657-89-C-2265
JAMES JOHNSON
TITLE:
ADAPTIVE CONTROL OF A ROBOTIC ARM
TOPIC# 163 OFFICE: ASD/XRX IDENT#: 32395

EXISTING ROBOTIC MOTION CONTROL TECHNOLOGY IS LIMITED IN ITS ABILITY TO HANDLE DYNAMIC EFFECTS (SUCH AS CHANGING PAYLOADS, INCREASED FRICTION DUE TO WEAR, ETC.) WITHOUT A DEGRADATION IN PERFORMANCE. IN ADDITION, THE TECHNIQUES CURRENTLY USED FOR REPOSITIONING END-EFFECTORS IN SPACE CANNOT HANDLE CASES WHERE MULTIPLE POSSIBILITIES EXIST FOR THE INTERMEDIATE AND FINAL POSITIONS OF EACH JOINT OF THE ROBOT (I.E. THE EXISTENCE OF REDUNDANT DEGREES OF FREEDOM). HOWEVER, IT IS THROUGH THIS TYPE OF REDUNDANCY THAT FLEXIBILITY IS ACHIEVED

SUBMITTED BY

TO ALLOW FOR SUCH THINGS AS COLLISION AVOIDANCE. THE OBJECTIVE OF THIS PROGRAM IS TO DEMONSTRATE A NOVEL APPROACH TO THE ADAPTIVE CONTROL OF A ROBOTIC ARM WITH REDUNDANT JOINTS. WE PROPOSE TO USE TECHNIQUES FROM THE FIELD OF ARTIFICIAL NEURAL SYSTEMS TO CONSTRUCT A SIMULATION OF THE ADAPTIVE CONTROL OF A ROBOTIC ARM. THE SIMULATION WOULD DEMONSTRATE THE ABILITY TO ADJUST TO CHANGES IN THE ROBOT'S PAYLOAD AND THE FRICTION IN ITS JOINTS, AS WELL AS THE ABILITY TO SMOOTHLY EXECUTE MOVEMENTS OF THE PAYLOAD THROUGH THE "BEST" SELECTION OF THE POSSIBLE JOINT VELOCITY PROFILES.

NIGHT VISION CORP
2250 S DEVON AVE - STE 219
DES PLAINES, IL 60018
CONTRACT NUMBER: F41622-89-C-0014
GREGORY KULYKIVSKY
TITLE:
ENHANCED CREW INTERFACE DESIGN ENHANCED NIGHT VISION GOGGLES
CONFIGURATION
TOPIC# 76 OFFICE: HSD/SORT IDENT#: 34724

THE PROPOSED NIGHT VISION GOGGLES "EAGLE EYE", DEVELOPED BY NIGHT VISION CORPORATION WEIGHT UNDER 500 GRAMS, AND ARE HELMET MOUNTED CLOSE TO THE FACE, PROVIDING MAXIMUM FREEDOM OF MOVEMENT WHILE GREATLY ATTENUATION VIBRATION. THE CENTER OF GRAVITY IS A MERE 18 mm IN FRONT OF EYES, MAKING THEM EJECTION-SAFE. "EAGLE EYE" NVG'S EMPLOY A UNIQUE FOLDED OPTICAL PATH INCORPORATING A PROPRIETARY LENS SYSTEM AND SPECIAL FIBER OPTICS TO KEEP THEM COMPACT. THIS ENABLES THE GEN III IMAGE INTENSIFIERS TO BE SET BACK AND TO THE SIDE OF THE EYE AND INTO THE COMBINING GLASSES WHICH ARE SET IN FRONT OF THE EYES. PERIPHERAL FOV IS 120 DEG H X 110 DEG V. THE OPTICAL PORT FOR HEAD-UP DISPLAY IMAGERY INJECTION IS INCORPORATED INTO THE OPTICAL SYSTEM. THE PROPOSED ENHANCEMENTS TO BE UNDERTAKEN: INTEGRATING THE NVG WITH HGU-55P HELMET AND MAKING THEM COMPATIBLE WITH MBU-12P, MBU-5P, AND NEW "HALP" OXYGEN MASKS. IN ADDITION, FURTHER WEIGHT REDUCTION WILL BE INVESTIGATED BY REDESIGNING SELECTED OPTICAL GLASS COMPONENTS AND REPLACING THEM WITH PLASTIC ELEMENTS.

NIMBLE COMPUTER (OLD: SYNAPSE COMPUTER)
16231 MEADOW RIDGE WY
ENCINO, CA 91436
CONTRACT NUMBER: F33615-89-C-1083
DR HENRY G BAKER
TITLE:
THE AUTOMATIC TRANSLATION OF LISP APPLICATIONS INTO ADA: A
FEASIBILITY STUDY
TOPIC# 85 OFFICE: AFWAL/AAOP IDENT#: 32774

SUBMITTED BY

THE OBJECTIVE OF THIS STUDY IS TO DETERMINE THE FEASIBILITY OF THE AUTOMATIC TRANSLATION OF ARTIFICIAL INTELLIGENCE AND EXPERT SYSTEMS APPLICATIONS WRITTEN IN COMMON LISP WITH THE COMMON LISP OBJECT SYSTEM (CLOS) EXTENSIONS INTO EFFICIENT ADA. A COMPARISON OF COMMON LISP/CLOS WITH ADA WILL BE PERFORMED, AND CORRESPONDENCES NOTED; PREVIOUS WORK BY THE CONTRACTOR ON EFFICIENT TRANSLATION TECHNIQUES FOR LISP TO OTHER LANGUAGES WILL BE EXTENDED TO INCLUDE CLOS CONSTRUCTS; REAL-TIME RESPONSE AND PARALLELISM IN LISP WILL BE SURVEYED; AND A CHOICE OF AI APPLICATIONS FOR PHASE II TRANSLATION WILL BE MADE.

NORTH AMERICAN DYNAMICS
1541-F PARKWAY LOOP
TUSTIN, CA 92680
CONTRACT NUMBER: F08635-89-C-0287
RICHARD L HAGEN
TITLE:
ARMAMENT RESEARCH MUNITION TRAILER TECHNOLOGY
TOPIC# 1 OFFICE: AD/PMR IDENT#: 34588

THE PROJECT OBJECTIVE IS TO ADAPT STATE OF THE ART AUTOMOTIVE TECHNOLOGY TO THE SOLUTION OF AN AIR FORCE REQUIREMENT THAT MUNITIONS TRAILERS BE ABLE TO OPERATE OVER ADVERSE TERRAIN AND TO PROVE THAT THIS OBJECTIVE CAN BE MET BY MODERNIZATION OF EXISTING INVENTORY EQUIPMENT.

NTI INC
4130 LINDEN AVE - STE 235
DAYTON, OH 45432
CONTRACT NUMBER: F41622-89-C-0026
DR ROBERT D O'DONNELL
TITLE:
MODELING ASSESSMENT AND ENHANCEMENT OF COGNITIVE PERFORMANCE
TOPIC# 68 OFFICE: HSD/SORT IDENT#: 34848

TACTICAL MISSION EFFECTIVENESS IS DEPENDENT ON A VERY FEW

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INDIVIDUALS WHO DISPLAY EXTRAORDINARY CAPACITY TO PERCEIVE, INTEGRATE, AND ACT. THE PRIMARY PURPOSE OF THE PRESENT EFFORT IS TO ENHANCE THE ABILITY TO IDENTIFY AND TRAIN SUCH INDIVIDUALS BY DEVELOPING A NOVEL ASSESSMENT APPROACH BASED ON A NEW THEORETICAL MODEL OF COGNITIVE PERFORMANCE. TO ACHIEVE THIS, A MODEL OF COMPLEX COGNITIVE PERFORMANCE WHICH YIELDS MEASUREMENT APPROACHES AND TRAINING PRESCRIPTIONS WILL BE PRODUCED. THE FIRST TASK, DEVELOPMENT OF THE INTEGRATED MODEL OF COGNITIVE PERFORMANCE, WILL BE BASED ON THREE MAJOR CONSTRUCTS OR PROCESSING DOMAINS; "INTUITIVE" PROCESSES, "REFLECTIVE" PROCESSES, AND "INTEGRATIVE" PROCESSES. THE INTERACTIONS AND INTERDEPENDENCIES AMONG THESE THREE PERFORMANCE DOMAINS WILL BE EXPLORED. THE SECOND PART OF THIS EFFORT WILL IDENTIFY THE MEASUREMENT APPROACHES AND SPECIFIC METRICS APPROPRIATE TO THE MODEL DEFINED ABOVE. A SUB-SET OF THESE MEASURES WILL THEN BE TESTED IN AN EXPERIMENT USING AN OPERATIONALLY RELEVANT CRITERION (NOVICE VERSUS. EXPERIENCED PILOTS).

OHRN ENTERPRISES
5164 W LAKE RD
CAZENOVIA, NY 13035
CONTRACT NUMBER:
RICHARD PLUMB
TITLE:
REENTRY VEHICLE ANTENNA WINDOW RCS EFFECTS
TOPIC# 220 OFFICE: BMO/MYSC IDENT#: 32629

IN ORDER TO DESIGN ADVANCED REENTRY VEHICLE WINDOW SYSTEMS, BOTH THE INTERIOR AND EXTERIOR ELECTROMAGNETIC FIELD PROBLEMS MUST BE ACCURATELY ANALYZED. FOR PHASE I OF THIS PROJECT, WE PROPOSE TO DEVELOP A THEORETICAL METHOD OF ANALYSIS. THIS WILL INCLUDE THE EFFECT OF SYSTEMS OF WINDOWS, PLUS THEIR INTERNAL MICROWAVE NETWORKS, ON THE RADAR CROSS SECTION OF THE VEHICLE, AS WELL AS THEIR ANTENNA PERFORMANCE. WE WILL FIRST INVESTIGATE SINGLE WINDOWS, AND THEN SYSTEMS OF SUCH WINDOWS, SUCH AS PHASED ARRAYS. THE PROPOSED THEORETICAL METHODS ARE APPLICABLE TO LOW AND INTERMEDIATE FREQUENCIES THROUGH THE METHOD OF MOMENTS, AND TO HIGH FREQUENCIES THROUGH THE PHYSICAL THEORY OF DIFFRACTION. THE METHOD OF ANALYSIS TO BE USED IS THAT FORMULATED IN THE PAPER "A GENERALIZED NETWORK FORMULATION FOR APERTURE PROBLEMS." THIS METHOD IS BASICALLY

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APPLICABLE TO BOTH LOW FREQUENCIES AND HIGH FREQUENCIES, BUT IT HAS NEVER BEEN SYSTEMATICALLY APPLIED TO ANTENNA AND RADAR SCATTERING PROBLEMS.

OPERATIONAL TECHNOLOGIES CORP
58825 CALLAGHAN RD - STE 225
SAN ANTONIO, TX 78228
CONTRACT NUMBER: F41622-89-C-0029
DR C B HARRAH

TITLE:
DEVELOPMENT OF A DECISION SUPPORT SYSTEM FOR HAZARDOUS MATERIALS IDENTIFICATION AND MANAGEMENT IN LARGE SCALE SYSTEMS
TOPIC# 71 OFFICE: HSD/SORT IDENT#: 34783

THE IDENTIFICATION AND MANAGEMENT OF HAZARDOUS MATERIALS THROUGHOUT THE ACQUISITION LIFE CYCLE OF LARGE-SCALE SYSTEMS ARE ESSENTIAL FOR THE EFFECTIVE CONTROL OF TOTAL LIFE CYCLE COSTS. THE EXPLICIT INCLUSION OF HEALTH, SAFETY AND ENVIRONMENTAL FACTORS, ALONG WITH OTHER SUPPORTABILITY CONSIDERATIONS, WILL ENHANCE THE SYSTEM PERFORMANCE. THE PROPOSED RESEARCH WILL EXPLORE ALTERNATIVE APPROACHES FOR DEVELOPMENT OF AN INTEGRATED DECISION SUPPORT SYSTEM REFERRED TO AS THE SYSTEM DESIGNER'S "ASSOCIATE." IT IS EXPECTED TO BE EXPERT SYSTEM BASED BUT ALSO HAVE CONVENTIONAL SOFTWARE COMPONENTS AS APPROPRIATE. THE MOST FEASIBLE APPROACH WILL BE SELECTED AND DESCRIBED. A CRITICAL MODULE WITHIN THE DESIGNER'S ASSOCIATE IS THE HAZARDOUS MATERIAL'S IDENTIFICATION DATABASE. TECHNIQUES, INCLUDING QUANTITATIVE STRUCTURE ACTIVITY RELATIONSHIPS, WILL BE EVALUATED FOR ESTIMATING MISSING TOXICOLOGICAL PARAMETERS FOR ENTRY INTO THE DATABASE. THE DATABASE ARCHITECTURE WILL BE DRIVEN BY STRONG CONSIDERATION OF THE WORK BREAKDOWN STRUCTURE OF THE SYSTEM IN ORDER TO COMMUNICATE WITH THE DESIGNER IN A SYSTEMS ENGINEERING CONTEXT.

OPTIVISION INC
2655 PORTAGE BAY AVE
DAVIS, CA 95616
CONTRACT NUMBER:
JOSEPH W GOODMAN

TITLE:
AMPLIFYING OPTICAL ELEMENTS FOR OPTICAL INTERCONNECTING CIRCUITS
TOPIC# 50 OFFICE: RADC/XPX IDENT#: 31525

SUBMITTED BY

THE WORK PROPOSED HERE SEEKS A SOLUTION TO THE LOSS PROBLEM INHERENT IN THE EMERGING OPTICAL INTERCONNECT SYSTEMS WITH HIGH FAN-OUT AND FAN-IN, SUCH AS ALL-OPTICAL CROSSBAR SWITCHES. A POTENTIAL SOLUTION OF INTEREST IS OFFERED BY THE NEWLY DEVELOPED LASER AMPLIFYING DEVICES. A STUDY OF THE CHARACTERISTICS OF THESE DEVICES, THEIR APPLICABILITY TO THE PROBLEM AND AN INVESTIGATION OF PROJECTED SYSTEM PERFORMANCE IS SUGGESTED. SPECIFICALLY A STUDY PROGRAM IS PROPOSED THAT WILL INVESTIGATE THE CHARACTERISTICS OF OPTICAL AMPLIFYING DEVICES (E.G., III-V QUANTUM WELL DEVICES AND OTHERS) AND THE ISSUES OF THEIR INSERTION IN OPTICAL INTERCONNECTING SYSTEMS.

OPTRA INC
66 CHERRY HILL DR
BEVERLY, MA 01915
CONTRACT NUMBER:
GEERT J WYNTJES
TITLE:
MULTI-PHASE ANGULAR DISPLACEMENT MEASUREMENT TECHNIQUE
TOPIC# 184 OFFICE: SAMTO/XO IDENT#: 31708

THE STATE OF THE ART IN PRECISE AND ACCURATE MEASUREMENT OF ANGULAR DISPLACEMENT REPRESENT THE CULMINATION OF NEARLY A HALF CENTURY OF REFINEMENT AND EVOLUTION OF WELL KNOWN OPTICAL AND ELECTRICAL TECHNIQUES. CONSEQUENTLY FURTHER IMPROVEMENTS IN A PARTICULAR PERFORMANCE AREA GENERALLY INVOLVE SUBSTANTIAL TRADEOFFS IN OTHER EQUALLY CRITICAL AREAS. IN PARTICULAR, PRESENT TECHNOLOGY DOES NOT DEAL EFFECTIVELY WITH THE TRADEOFF BETWEEN ACCURACY AND ANGULAR SPEED OR SLEW RATE. SUBMICRORADIAN ANGULAR MEASUREMENTS AT RATES IN EXCESS OF 100 TIMES PER SECOND IS THE EXPECTED PERFORMANCE OF AN OPTRA PROPOSED SYSTEM. THE TECHNICAL BASIS FOR THIS SYSTEM REPRESENTS A SIGNIFICANT DEPARTURE FROM ESTABLISHED METHODOLOGY FOR READING THE POSITION OF AN ENCODER SCALE. A LASER DIODE LIGHT SOURCE, AN INNOVATIVE OPTICAL SCHEME FOR GENERATING A VIRTUAL READOUT GRATING, AND A RECENTLY DEVELOPED MULTI-PHASE DETECTION AND PROCESSING TECHNIQUE WHEN COMBINED WITH ESTABLISHED RADIAL GRATING GENERATION TECHNOLOGIES FORM THE BASIS FOR A SYSTEM WHICH HAS NO PRACTICAL LIMIT TO THE TRADEOFF BETWEEN SPEED AND ACCURACY OR PRECISION. ADDITIONAL BENEFITS INCLUDE SIGNIFICANT REDUCTIONS IN SIZE, WEIGHT

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AND COST OVER PRESENTLY AVAILABLE SYSTEMS.

OPTRA INC
66 CHERRY HILL DR
BEVERLY, MA 01915
CONTRACT NUMBER:
DAVID VOORHES
TITLE:
ULTRA-HIGH TEMPERATURE LASER EXTENSOMETER
TOPIC# 250 OFFICE: AFSC/NAT IDENT#: 37992

OPTRA WILL DEVELOP AN ULTRA-HIGH TEMPERATURE LASER EXTENSOMETER FOR USE WITH LOAD FRAME TEST SAMPLES AS WELL AS STRUCTURES IN WIND TUNNELS. OPTRA PLANS TO MEASURE STRAINS AT 4000 F, ALTHOUGH THE EXTENSOMETER WILL HAVE A CAPABILITY UP TO 5500 F-WELL BEYOND THE CAPABILITY OF ANY EXISTING STRAIN MEASURING TECHNIQUES. THE EXTENSOMETER WILL PROVIDE 5 MICROSTRAIN RESOLUTION AND WILL HAVE AN ELECTRICAL BANDWIDTH SUFFICIENT FOR HIGH FREQUENCY CYCLIC TESTING (UP TO 500 Hz). IN ADDITION, THE ULTRA-HIGH TEMPERATURE LASER EXTENSOMETER WILL BE ENTIRELY NON-CONTACTING, REQUIRING ABSOLUTELY NO SAMPLE PREPARATION OF ANY KIND. THE EXTENSOMETER WILL BE ABLE TO HANDLE MOST MATERIALS, INCLUDING DARK COMPOSITES WITH LOW EMISSIVITIES. IN ADDITION TO DEMONSTRATING ULTRA-HIGH TEMPERATURE CAPABILITY, OPTRA WILL DEMONSTRATE THAT THE LASER EXTENSOMETER IS INSENSITIVE TO TURBULENCE CAUSED BY WIND TUNNEL FLOW.

OPTRON SYSTEMS INC
3 PRESTON CT
BEDFORD, MA 01730
CONTRACT NUMBER:
TODD TSAKIRIS
TITLE:
ELECTRON-BEAM-ADDRESSED TERNARY-STATE LIQUID CRYSTAL SPATIAL LIGHT MODULATOR
TOPIC# 49 OFFICE: RADC/XPX IDENT#: 31522

AN ELECTRICALLY ADDRESSED SPATIAL LIGHT MODULATOR IS PROPOSED THAT IS

SUBMITTED BY

CAPABLE OF IMPLEMENTING RECENTLY PROPOSED TERNARY PHASED-AMPLITUDE FILTERS FOR OPTICAL CORRELATOR SYSTEMS. BASED ON AN e-BEAM ADDRESSED LIQUID CRYSTAL FABRY-PEROT CELL, THE e-TLCM (ELECTRICALLY ADDRESSED TERNARY LIQUID CRYSTAL MODULATOR) PROVIDES THREE AMPLITUDE MODULATION STATES: -1, 0, AND +1. THE ADDITION OF A THIRD STATE, THE 0 STATE, IMPROVES CORRELATION PERFORMANCE IN MANY SITUATIONS BY ALLOWING ATTENUATION OF HIGH NOISE ENERGY FREQUENCIES. THE e-TLCM IS CONTROLLED FROM A PERSONAL COMPUTER AND CAN SERVE AS A FAST, PROGRAMMABLE FOURIER FILTER IN AN OPTICAL CORRELATOR. AN INNOVATIVE FEATURE OF THE DESIGN IS THE INCORPORATION OF A HIGH RESOLUTION CHARGE-TRANSFER PLATE (CTP) TO TRANSFER CHARGE FROM THE INTERIOR TO THE EXTERIOR OF AN EVACUATED ELECTRON-GUN ASSEMBLY. THE CTP IS INTEGRAL WITH THE LIQUID-CRYSTAL CELL AND SERVES AS AN ELECTRODE ARRAY FOR ESTABLISHING e-FIELD DISTRIBUTIONS ACROSS THE LIQUID CRYSTAL. PERFORMANCE CHARACTERISTICS OF THE e-TLCM TO BE INVESTIGATED INCLUDE: SPATIAL RESOLUTION, FRAMING SPEED, CONTRAST RATIO, AND SPATIAL UNIFORMITY.

OPTRON SYSTEMS INC
3 PRESTON CT
BEDFORD, MA 01730
CONTRACT NUMBER:
TONY NICOLI

TITLE:
RECONFIGURABLE OPTICAL PROCESSOR INCORPORATING MASSIVE HOLOGRAPHIC
FAN-IN/FAN-OUT
TOPIC# 55 OFFICE: RADC/XPX IDENT#: 31579

OPTICAL SIGNAL PROCESSORS HAVE BEEN LIMITED IN COMPUTATION THROUGHPUT BY A LACK OF PRACTICAL DEVICES TO IMPLEMENT THE INTERCONNECTION (FAN-IN AND FAN-OUT) OF MASSIVE PIXEL ARRAYS. OPTRON PROPOSES A RECONFIGURABLE OPTICAL PROCESSOR INCORPORATING MASSIVE HOLOGRAPHIC FAN-IN/FAN-OUT DEVICES (HFFDs) TO INTERCONNECT PIXEL ARRAYS BETWEEN OPTRON'S LIQUID CRYSTAL SPATIAL LIGHT MODULATOR USED AS A PATTERN GENERATOR, OPTRON'S TRANSMASSIVE AMPLITUDE MODULATOR, AND A DETECTOR ARRAY. TOGETHER, A PROCESSOR INCORPORATING THESE DEVICES WILL ULTIMATELY BE CAPABLE OF PROCESSING AN ARRAY OF 4×10^5 INPUT PIXELS WITH A SINGLE RECONFIGURABLE FAN-OUT OR 200×200 PIXELS WITH A FAN-OUT OF UP TO $10(4 \times 10^5)$ INTERCONNECTS) AT A FRAME RATE OF GREATER THAN

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30Hz. THE PHASE I PROGRAM SEEKS TO DEMONSTRATE THE FEASIBILITY OF THE MASSIVE HOLOGRAM ARRAY THROUGH THE OPTICAL CONSTRUCTION OF A NUMBER OF EXPERIMENTAL ARRAYS WITH SIZES OF UP TO 15x15 PIXELS, SINGLE PIXEL FAN-OUT OF UP TO 3, AND SUBHOLOGRAM DIMENSIONS AS SMALL AS 500 um. DEVICE OPERATION WILL BE DEMONSTRATED IN A SIMPLIFIED PROCESSOR USING COMPONENTS AVAILABLE AT OPTKON. COMPUTER GENERATION OF MASSIVE ARRAYS WILL ALSO BE EXPLORED. IF SUCCESSFUL, Optron PROPOSES TO CONTINUE DEVELOPMENT IN PHASE II WITH THE CONSTRUCTION OF HFFDs OF ARRAY SIZE UP TO 350x350 WITH SINGLE PIXEL A FAN-OUT OF UP TO 10, AND THE IMPLEMENTATION OF A RECONFIGURABLE OPTICAL PROCESSOR CAPABLE OF HANDLING A 50x50 INPUT ARRAY WITH FAN-OUT OF 10.

ORBITAL TECHNOLOGIES CORP (ORBITEC)
PO BOX 861
MIDDLETON, WI 53562
CONTRACT NUMBER: F41622-89-C-0020
RONALD R TEETER
TITLE:
TELEROBOTIC CONTROL GLOVE
TOPIC# 68 OFFICE: HSD/SORT IDENT#: 34763

THIS PROJECT PROPOSES TO DEVELOP A TELEROBOTIC CONTROL GLOVE (TCG) FOR THE CONTROL OF ROBOTIC DEXTROUS HANDS. THE GLOVE WILL BE CAPABLE OF CONTROLLING BOTH THE POSITION OF AND THE FORCES EXERTED BY THE FINGERS OF THE ROBOTIC HAND. FEEDBACK OF BOTH TACTILE AND FORCE INFORMATION WILL BE PROVIDED TO THE OPERATOR. THE SYSTEM WILL BE EASILY INTEGRABLE WITH TELEROBOTIC ARM CONTROL SYSTEMS. THE TCG WILL GREATLY ENHANCE THE ABILITY OF OPERATORS TO PERFORM WORK USING TELEROBOTS EQUIPPED WITH DEXTROUS HAND SYSTEMS.

ORLANDO TECHNOLOGY INC
PO BOX 855
SHALIMAR, FL 32579
CONTRACT NUMBER: F08635-89-C-0368
DANIEL A MATUSKA
TITLE:
ADVANCED CONTINUUM MECHANICS WORKSTATION DEVELOPMENT: SUBSYSTEM (HULL)
TOPIC# 1 OFFICE: AD/PMR IDENT#: 31045

SMALL BUSINESS INNOVATION RESEARCH (SBIR) PROGRAM - PHASE 1
BY SERVICE
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AF

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THIS PROGRAM IS TO EVALUATE THE FEASIBILITY OF DEVELOPING A PARALLEL HARDWARE/SOFTWARE SUBSYSTEM FOR RUNNING A PARALLEL VERSION OF THE HULL CODE. THE HARDWARE INTERFACE WOULD BE THE VME BUS. THE SOFTWARE INTERFACE ASSUMES UNIX V.x OR BSD 4.x. IMPLEMENTATION WOULD BE ON EXISTING BOARD-LEVEL HARDWARE COMPONENTS. IF FEASIBLE, THIS SYSTEM WOULD BE DEMONSTRATED DURING PHASE II ON A COMPLETE WORKSTATION WITH A MODIFIED VERSION OF THE HULL CODE.

PACER SYSTEMS INC
300 WELSH RD - BLDG 4
HORSHAM, PA 19044

CONTRACT NUMBER:

DR JOAN RYDER

TITLE:

STUDENT PERFORMANCE MODEL

TOPIC# 73 OFFICE: HSD/SORT IDENT#: 34766

THIS INVESTIGATION EXAMINES THE DEVELOPMENT PROCESS FOR STUDENT MODELS TO SUPPORT INTELLIGENT TUTORING SYSTEMS, COGNITIVE TRAINING, AND COGNITIVE RESEARCH. SPECIFICALLY, THE INVESTIGATION WILL SURVEY CURRENT METHODOLOGIES IN STUDENT MODEL DEVELOPMENT TO DETERMINE MORE EFFICIENT MEANS TO USE COGNITIVE TASK ANALYSIS DATA FOR THE DEFINITION OF STUDENT MODELS. THE STUDENT MODELS ARE BEING DEVELOPED TO IMPROVE PERFORMANCE EVALUATION IN COGNITIVE TRAINING AND RESEARCH PROGRAMS. AN IMPORTANT ASPECT OF THIS RESEARCH WILL BE TO IDENTIFY STUDENT MODEL DEVELOPMENT TECHNIQUES THAT ARE LARGELY INDEPENDENT OF THE TUTORING OR EXPERT SYSTEM IT SUPPORTS. THE RESEARCH WILL CULMINATE IN A PLAN FOR EVALUATING THE STUDENT PERFORMANCE DEVELOPMENT METHODOLOGY INCLUDING THE DEVELOPMENT OF A PROTOTYPE STUDENT PERFORMANCE MODEL.

PDA ENGINEERING
2975 REDHILL AVE
COSTA MESA, CA 92626

CONTRACT NUMBER:

DENNIS R KRAUSE

TITLE:

ANTENNA WINDOW HIGH TEMPERATURE PROPERTY MEASUREMENT

TOPIC# 216 OFFICE: BMO/MYSC IDENT#: 32595

SUBMITTED BY

ACCURATE PREDICTIONS OF THE WINDOW/HEATSHIELD ABLATED SHAPE AND IN-DEPTH HEAT TRANSFER ARE VITAL TO ENSURE VEHICLE SURVIVAL AND THE ANTENNA WINDOW'S TRANSMISSION PERFORMANCE. THESE PREDICTIONS REQUIRE ACCURATE THERMOPHYSICAL PROPERTY DATA ON THE MATERIAL. SOME OF THE THERMOPHYSICAL DATA CURRENTLY USED AT HIGH TEMPERATURE HAS A HIGH UNCERTAINTY AS IT HAS BEEN EXTRAPOLATED FROM LOW TEMPERATURE DATA OR HAS BEEN PREDICTED FROM ANALYSES OF WINDOW PERFORMANCE TESTING IN WHICH THERE ARE A NUMBER OF UNKNOWN VARIABLES. THE OBJECTIVE OF THIS PROPOSED EFFORT IS TO DEVELOP THE CAPABILITY OF OBTAINING THIS DATA AT HIGH TEMPERATURES. IN PHASE I, THE OBJECTIVE WILL BE TO EVALUATE CANDIDATE TEST TECHNIQUES, SELECT THE TECHNIQUES MOST SUITABLE, AND PREPARE A PRELIMINARY DESIGN OF THE TEST HARDWARE AND PROCEDURES. THIS WILL INCLUDE MEASUREMENT SYSTEMS WITH THE CAPABILITY FOR MEASURING THE VISCOSITY, DENSITY, AND THERMAL COEFFICIENT OF EXPANSION AT TEMPERATURES UP TO, AND EXCEEDING IF POSSIBLE, 5000 DEG R. THE PHASE II EFFORT WILL INCLUDE THE ASSEMBLY OF THE MEASUREMENT SYSTEMS SELECTED, AN EVALUATION OF THE ASSEMBLED SYSTEMS, AND MATERIAL CHARACTERIZATION TESTING. IN ADDITION, THE FEASIBILITY OF DEVELOPING MEASUREMENT TECHNIQUES FOR OTHER PROPERTIES WILL BE EVALUATED.

PDA ENGINEERING
2975 REDHILL AVE
COSTA MESA, CA 92626
CONTRACT NUMBER:
DR K A ARUNKUMAR
TITLE:
PORTABLE ELECTRO-OPTIC NDT TECHNIQUE FOR SOLID ROCKET MOTORS
TOPIC# 228 OFFICE: BMO/MYSC IDENT#: 32701

THE DETECTION AND CHARACTERIZATION OF DEFECTS IN SOLID PROPELLANTS, NOZZLES, CONES AND OTHER PROPULSION COMPONENTS ARE OF GREAT IMPORTANCE IN THE MANUFACTURING OF SOLID ROCKET MOTORS. TO IMPLEMENT THE REQUIRED QUALITY CONTROL, PROPER TEST METHODS THAT CAN BE CARRIED OUT AT THE MANUFACTURING SITE MUST BE DEVELOPED. HENCE, THERE EXISTS A NEED TO DEVELOP PORTABLE NDT TECHNIQUES THAT COULD BE RAPIDLY AND CONVENIENTLY USED AT THE FABRICATION SITE. WE PROPOSE THAT SHEAROGRAPHY, AN INTERFEROMETRIC OPTICAL TECHNIQUE THAT HAS

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MAJOR ADVANTAGES OVER THE MORE CONVENTIONAL APPROACHES, BE USED IN THE DETECTION AND CHARACTERIZATION OF DEFECTS SUCH AS SURFACE AND SUBSURFACE CRACKS AND NEAR SURFACE VOIDS ON THE INNER SURFACE OF THE PROPELLANTS IN SOLID ROCKET MOTORS. PREVIOUS WORK HAS SHOWN THAT THIS TECHNIQUE CAN BE EMPLOYED IN THE NON-DESTRUCTIVE DETECTION AND CHARACTERIZATION OF THESE TYPES OF FLAWS. IT IS A NONCONTACT TECHNIQUE, INVOLVES RELATIVELY INEXPENSIVE EQUIPMENT AND NEEDS NO ELABORATE DATA ACQUISITION PROCEDURES. UNLIKE THE CONVENTIONAL INTERFEROMETRIC TECHNIQUES, SHEAROGRAPHY IS IMMUNE TO ENVIRONMENTAL VIBRATIONS. HENCE, THE SHEAROGRAPHIC NON-DESTRUCTIVE EXAMINATION METHOD CAN BE AN IDEAL CANDIDATE FOR IMPLEMENTATION AS A PORTABLE ON-SITE INSPECTION TOOL.

PERIGEE WEST CO
PO BOX 1292
LA JOLLA, CA 92038
CONTRACT NUMBER: F04701-89-C-0060
EDWARD J HUJSAK
TITLE:
A SEA BASED MEDIUM PAYLOAD LOW COST LAUNCH SYSTEM
TOPIC# 177 OFFICE: AFSTC/OLAB IDENT#: 34433

THE PROPOSED STUDY FOCUSES ON DETERMINING TECHNICAL FEASIBILITY AND VERIFYING LOW LIFE CYCLE COST OF A SEA BASED SPACE LAUNCH SYSTEM. THE EFFORT CONCENTRATES ON SEPARATE DEFINITIONS OF AND ADVANCED LAUNCH VEHICLE AND A SEA BASED LAUNCHER. THE STUDY THEN COMPLETES A SYSTEM INTEGRATION TO VERIFY LAUNCH SYSTEM METHODS AND PROCESSES, LOGISTICS PECULIAR TO A SEA BASED OPERATION AND A LIFE CYCLE COST ESTIMATE. THE DEFINITION CONCENTRATES ON THE MEDIUM PAYLOAD CLASS OF VEHICLE WHERE NO NOTEWORTHY OPPORTUNITIES HAVE BEEN IDENTIFIED FOR SIGNIFICANT LOWERING OF LAUNCH COSTS. SPACE TRANSPORTATION TARGETS TO BE EXAMINED INCLUDE LOW EARTH AND GEOSYNCHRONOUS ORBITS.

PHASEX CORP
287 EMERSON RD
LEXINGTON, MA 02173
CONTRACT NUMBER: F04611-89-C-0043
VAL KRUKONIS
TITLE:
SEPARATION AND PURIFICATION OF PROPELLANT POLYMERS
TOPIC# 193 OFFICE: AFAL/TSTR IDENT#: 38865

SUBMITTED BY

THE USE OF SUPERCRITICAL FLUID SOLVENTS IS DESCRIBED AS A MEANS OF IMPROVING THE PERFORMANCE OF PROPELLANT BINDER POLYMERS BY EXTRACTING LOW MOLECULAR WEIGHT INTERFERING SPECIES. PREVIOUS BACKGROUND IN A WIDE RANGE OF POLYMER EXTRACTION/FRACTIONATION AREAS IS PRESENTED TO POINT OUT THE BREADTH OF POLYMERS THAT CAN BE SEPARATED/PURIFIED AND SIMULTANEOUSLY TO SHOW THAT THE STRUCTURES THAT HAVE BEEN STUDIED ARE SIMILAR TO THE STRUCTURES OF SOME PROPELLANT POLYMER BINDERS THAT ARE CURRENTLY USED IN ROCKET MOTOR APPLICATIONS. THE PROGRAM PLAN THAT IS DESCRIBED NOT ONLY ADDRESSES THE FEASIBILITY OF DISSOLVING THESE INTERFERING SPECIES FROM BINDER POLYMERS BUT PROPOSES THE EXTENSION OF FEASIBILITY TESTS TO THE EXTRACTION OF LARGE SAMPLES IN ORDER TO PROVIDE AFAL WITH MATERIAL SUFFICIENT TO EVALUATE THE IMPROVED PERFORMANCE THAT CAN DERIVE FROM SUPERCRITICAL FLUID EXTRACTION. AS A MEANS OF ASSESSING THE VALUE OF PHASE II EFFORT AN ECONOMIC VIABILITY EVALUATION OF THE PROCESS FOR PRODUCING IMPROVED POLYMER WILL BE MADE ON THE PHASE I PROGRAM.

PHE INNOVATIONS
PO BOX 1381
MORGANTOWN, WV 26507
CONTRACT NUMBER:
HOWARD E PURDUM
TITLE:
PERSONAL COOLING VEST
TOPIC# 68 OFFICE: HSD/SORT IDENT#: 39366

PERSONNEL WORKING IN EXTREME ENVIRONMENTS OR WEARING BALLISTIC AND/OR NUCLEAR/BIOLOGICAL/CHEMICAL (NBC) PROTECTIVE CLOTHING ARE SUBJECT TO THE HAZARDS OF OVERHEATING. THESE HAZARDS INCLUDE PHYSICAL DISCOMFORT, DECREASED PHYSICAL AND MENTAL ABILITIES, DEHYDRATION, AND EVENTUALLY DEATH FROM HEAT STRESS. THE NUMBER OF PERSONNEL VULNERABLE TO THESE HAZARDS IS ALREADY QUITE LARGE AND IS STEADILY INCREASING AS MORE EMPHASIS IS PLACED ON PROTECTIVE EQUIPMENT AND THE ABILITY TO OPERATE UNDER SEVERE CONDITIONS. THE GOAL OF THIS PROJECT IS TO DEVELOP A PERSONAL COOLING VEST THAT CAN FUNCTION WITHOUT AN EXTERNAL ENERGY SOURCE. THE DEVELOPMENT SYSTEM MUST BE LOW COST, LIGHTWEIGHT, MECHANICALLY SIMPLE, RELIABLE, AND QUITE.

PHOENIX DIGITAL CORP
2315 N 35TH AVE
PHOENIX, AZ 85009
CONTRACT NUMBER:
RONALD A BROWN
TITLE:
ELECTRO-OPTIC COUNTERMEASURES FOR DETECTING AND ISOLATING UNAUTHO
RIZED OPTICAL COMMUNICATION INTRUSION SURVEILLANCE AND MONITORING
TOPIC# 225 OFFICE: BMO/MTSC IDENT#: 22683

SUBMITTED BY

NEWLY DEVELOPED OPTICAL COMMUNICATION SURVEILLANCE TECHNOLOGIES PROVIDE BOTH DIRECT COUPLED AND PROXIMITY TAPPING OF FIBER OPTIC NETWORKS, WITHOUT BREAKING OR DISRUPTING THE OPTICAL CHARACTERISTICS OF THE MEDIA ITSELF, RESULTING IN VIRTUALLY UNDETECTABLE SURVEILLANCE OF THE OPTICAL COMMUNICATION IN PROGRESS. PHOENIX DIGITAL HAS DEVELOPED NEW OPTICAL TECHNOLOGIES CAPABLE OF OPTICAL COMMUNICATION FAULT PREDICTION AND DIMENSIONAL FAULT ISOLATION. DURING THE COURSE OF THESE DEVELOPMENTS, A NEW TECHNIQUE FOR PROVIDING ON-LINE, CONTINUOUS, REAL TIME OPTICAL DATA PROTECTION, WITH OPTICAL TAP DETECTION AND ON-LINE DIMENSIONAL TAP ISOLATION, WAS UNCOVERED. THIS TECHNICAL DATA PROTECTION, AND ON-LINE BACKSCATTER SIGNATURE ANALYSIS OF THE DATA TRANSMISSIONS FOR OPTICAL TAP DETECTION. THROUGH ON-LINE COMPARISON OF THE OPTICAL DATA BACKSCATTER SIGNATURE TO A PREDEFINED SIGNATURE REFERENCE (DEVELOPED THROUGH MATHEMATICAL MODELING) LOW LEVEL SIGNATURE DISCONTINUITIES (FRESNEL) RESULTING FROM OPTICAL TAP INTRUSIONS CAN BE DETECTED. DURING PHASE I OF THIS PROJECT A FUNCTIONAL DESIGN METHODOLOGY WILL BE DEVELOPED FOR A UNIVERSAL COMMUNICATION DEVICE (TEMPEST DESIGN) CAPABLE OF PHYSICAL LAYER PORTABILITY INTO EXISTING COMMUNICATION SYSTEMS FOR ULTRA-SECURE COMMUNICATION, WITH ON-LINE OPTICAL DATA PROTECTION, SURVEILLANCE MONITORING, AND REAL TIME INTRUDER DETECTION AND LOCATION CAPABILITY.

PHOTO-METRICS INC
4 ARROW DR
WOBURN, MA 01801
CONTRACT NUMBER:
WARREN MOSKOWITZ
TITLE:
TUNABLE NARROWBAND OPTICAL FILTERS FOR LIDAR
TOPIC# 199 OFFICE: AFGL/XOP IDENT#: 31844

WE PROPOSE TO DESIGN TUNABLE NARROW BANDWIDTH OPTICAL FILTERS FOR USE IN DAYLIGHT LIDAR SYSTEMS. THESE FILTERS WILL SATISFY THE FOLLOWING DESIGN REQUIREMENTS: PICOMETER BANDWIDTH IN THE VISIBLE REGION; WIDE ANGULAR ACCEPTANCE ($f/1$); FAST RESPONSE <100 ns; HIGH QUANTUM EFFICIENCY $>10\%$; STABLE, TUNABLE OPERATION; LOW BACKGROUND; AND STRAIGHTFORWARD, EFFICIENT COUPLING TO PHOTOMULTIPLIER. THE

SUBMITTED BY

DESIGN WAVELENGTHS WILL BE THOSE OF INTEREST FOR RAYLEIGH, MIE, AND RESONANCE/FLUORESCENCE LIDARS. THE FILTERS WILL EXPLOIT GAS-PHASE ATOMIC ABSORPTIONS. THIS CHOICE AUTOMATICALLY SATISFIES THE FIRST THREE DESIGN REQUIREMENTS. THE CRITICAL TASKS OF THE PROPOSED RESEARCH WILL BE: IDENTIFYING SUITABLE ABSORPTION SPECIES; DESIGNING EFFICIENT, BACKGROUND-FREE TRANSFER MECHANISMS FOR RE-RADIATING THE ABSORBED ENERGY; DESIGNING A LOW-LOSS COUPLING TO PHOTOMULTIPLIER; AND SELECTING A TUNING MECHANISM.

PHOTO-METRICS INC
4 ARROW DR
WOBURN, MA 01801
CONTRACT NUMBER:
DAVID L A RALL
TITLE:
EXCITED STATE POPULATIONS IN A NEURAL PARTICLE BEAM
TOPIC# 207 OFFICE: AFWL/PRC IDENT#: 31899

EFFECTIVE PLANNING OF DIAGNOSTICS FOR WEAPONIZED NEUTRAL PARTICLE BEAMS (NPBs) REQUIRES EXPERIMENTAL DETERMINATION OF THE EXCITED STATE DENSITIES IN THE H(α) BEAM AS IT EMERGES FROM ITS CHARGE-STRIPPING VOLUME. WE PROPOSE OPTICAL SUBSTITUTION AS THE MEANS OF ABSOLUTE CALIBRATION OF A PASSIVE RADIOMETRIC SYSTEM TO MEASURE THE FLUXES OF H(α) PARTICLES IN ELECTRONICALLY EXCITED STATES. AN ATOMIC HYDROGEN EMISSION LINE SOURCE WHICH EMULATES THE GEOMETRY AND SPECTRUM OF AN NPB IS PROPOSED AS THE CALIBRATED RADIATION SOURCE. DESIGN OF THE OPTICAL SYSTEM WILL FOLLOW FROM THE ANALYSIS OF THE EXPECTED RADIATION YIELDS FROM EXCITED STATES AS A FUNCTION OF THE NPB'S PARAMETERS. CASCADE CONTRIBUTIONS TO THE EXCITED STATES WILL BE ESTIMATED FROM THE APPROPRIATE SET OF COUPLED RATE EQUATIONS. THE IMPORTANT PERTURBATION OF ALTERATION OF SUBLEVEL DISTRIBUTION BY ELECTROMAGNETIC FIELDS ON THE CASCADE RATE EQUATIONS WILL BE INVESTIGATED. THE NECESSARY MEASUREMENTS AND DATA EVALUATION PROCEDURE WILL BE FORMULATED ACCORDING TO THE CASCADE ANALYSIS IN ORDER TO WORK BACK FROM THE ORIGINAL MEASUREMENTS (AT SOME DISTANCE DOWN THE BEAM PATH) TOWARDS THE BEAM NEUTRALIZATION REGION TO DETERMINE THE INITIAL DENSITIES OF THE EXCITED STATES.

PHYSICAL DYNAMICS INC
PO BOX 1883
LA JOLLA, CA 92038
CONTRACT NUMBER:
BOB L MACKEY
TITLE:
HIGH THERMAL CONDUCTIVITY ELECTRONIC SUBSTRATE
TOPIC# 209 OFFICE: BMO/MYSC IDENT#: 32575

SUBMITTED BY

WE PROPOSE TO INITIATE DEVELOPMENT OF A HIGH THERMAL CONDUCTIVITY PRINTED CIRCUIT BOARD (PCB) ASSEMBLY. USE OF A HEAT PIPE TECHNIQUE IS EXPECTED TO YIELD THERMAL CONDUCTIVITIES MANY TIMES THAT OF COPPER OR EXPENSIVE CERAMICS. THE PRINCIPLES OF HEAT PIPE OPERATION ARE DISCUSSED, AND A SIMPLE PRINTED CIRCUIT BOARD CONSTRUCTION IS PROPOSED TO TAKE ADVANTAGE OF THOSE PRINCIPLES. USE OF THIS TECHNIQUE PROMISES TO ELIMINATE DISCREET HEAT SINKS IN MANY APPLICATIONS. PHASE I WORK WILL DEMONSTRATE THE FEASIBILITY OF A HEAT PIPE/PRINTED CIRCUIT BOARD HYBRID. A COMPUTER MODEL WILL BE DEVELOPED AND USED TO OPTIMIZE THE DESIGN OF A PROTOTYPE. PROTOTYPE DEVICES TO BE FABRICATED AND TESTED IN PHASE II WORK WILL USE AVAILABLE MATERIALS AND CONSTRUCTION TECHNIQUES. THESE DEVICES WILL BE TESTED TO DETERMINE THEIR OPERATING LIMITS.

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

CONTRACT NUMBER:

DR RAY T CHEN

TITLE:

MULTIPLE MODE OPTICAL SWITCHING ARRAY FOR FIBER OPTIC NETWORKS

TOPIC# 257 OFFICE: AFSC/NAT IDENT#: 31321

IN THIS PROGRAM, A NOVEL MULTIPLE MODE OPTICAL SWITCHING ARRAY FOR FIBER OPTIC NETWORKS IS PROPOSED. THE NEW ARCHITECTURE COMBINES THE OUTSTANDING FEATURES OF SPATIAL LIGHT MODULATORS AND INTEGRATED OPTIC SWITCHES. IMPROVEMENTS IN COST, SPEED, SYSTEM PERFORMANCE, RELIABILITY, RADIATION FIDELITY AND ALTERNATIVE PATH BEYOND THE PRESENT STATE OF THE ART WILL BE ADDRESSED IN THIS RESEARCH PROGRAM. COLINEAR AND COPLANAR BEAM STEERING ARE ACHIEVED THROUGH PROPERLY DESIGNED ELECTROOPTIC SWITCHING ELEMENTS. LUMPED AND TRAVELING WAVE ELECTRODE STRUCTURES ARE EMPLOYED TO UPGRAD SWITCHING SPEED AND POWER CONSUMPTION. ONE CHANNEL FULLY INTEGRATED FIBER OPTIC NETWORK COMPONENTS, INCLUDING LASER DIODE, FIBER, NIO COUPLER, TIR HOLOGRAM, GLASS WAVEGUIDE AND ELECTROOPTIC SWITCHING ELEMENT, WILL BE DELIVERED AT THE END OF PHASE I. THE SUCCESS OF THIS PACKAGE WILL PROVE THE FEASIBILITY OF A NEW ARCHITECTURE WHICH WILL BE PURSUED IN PHASE II.

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

CONTRACT NUMBER:

DR FREDDIE LIN

TITLE:

INTEGRATED OPTICAL HOLOGRAPHIC RANDOM ACCESS MEMORY WITH HIGH-DENSITY STORAGE AND HIGH-SPEED ACCESS

TOPIC# 52 OFFICE: PADC/NPX IDENT#: 31543

SUBMITTED BY

IN ORDER TO MEET THE NEED FOR SMALL, NON-MECHANICAL, HIGH CAPACITY, EXTREMELY HIGH ACCESS MEMORIES FOR INFORMATION HANDLING IN SUPER COMPUTERS, A NEW GENERATION OF VOLUME HOLOGRAPHIC STRUCTURES IS PROPOSED. WE NORMALLY THINK OF HIGH-INDEX-MODULATION HOLOGRAMS, SUCH AS DICHROMATED GELATIN, AS BEING INHERENTLY THIN (LIMITED BY COATING, <50 um), SINCE LIGHT IMPINGES ON THE PLANE OF THE HOLOGRAM. IN ORDER TO OBTAIN VERY HIGH DENSITY STORAGE, ANY MEDIA UTILIZING VOLUME HOLOGRAPHY EFFECTS MUCH ACHIEVE LARGE MATERIAL THICKNESS. THE ONLY WAY TO MAKE A VERY THICK HOLOGRAM (>1 cm) IS TO HAVE THE LIGHT ENTER AND LEAVE THE HOLOGRAM ALONG ITS GRATING FRINGE PATTERNS. THEREFORE, THE COMBINATION OF HOLOGRAMS AND INTEGRATED OPTICAL WAVEGUIDES RESULTS IN A NEW APPROACH TO OBTAINING HIGH CAPACITY HIGH ACCESS OPTICAL MEMORIES IN COMPACT AND RUGGED MONOLITHIC PACKAGING. THIS APPROACH HAS THE FOLLOWING UNIQUE CHARACTERISTICS (NOT ACHIEVABLE BY ANY OTHER STATE-OF-THE-ART HOLOGRAMS): 1) VERY LARGE NUMBER OF BRAGG ANGULAR/WAVELENGTH MULTIPLEXED CHANNELS (>10⁴), 2) VERY HIGH INFORMATION STORAGE CAPACITY (>10¹⁰ BITS PER WAVEGUIDE SUBSTITUTE), 3) INTEGRATION WITH MONOLITHIC MICROELECTRONIC/OPTOELECTRONIC COMPONENTS, AND 4) FAST ACCESS TIME (us^mns).

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

CONTRACT NUMBER:

DR GAJENDRA D SAVANT

TITLE:

CONJUGATE ... BOND POLYMERS WITH ULTRASENSITIVE NONLINEARITIES AT 0.8 AND 1.3 MICRONS

TOPIC# 200 OFFICE: AFWL/PRC IDENT#: 31852

PHYSICAL OPTICS CORPORATION (POC) PROPOSES TO DEVELOP A NEW HIGHLY CONJUGATED ORGANIC POLYMER WITH UNUSUALLY HIGH THIRD ORDER NONLINEARITY IN ORDER TO FULFILL THE CONDITION OF GIGAWATT/cm² LASER DAMAGE THRESHOLD AND MILLIWATT LEVEL SENSITIVITY AT 0.8 AND 1.3 MICRONS. POC'S INTERNAL RESEARCH INDICATES THAT SUCH A POLYMER CAN BE SYNTHESIZED FROM SUBSTITUTED INDANOSTYRENE AND CYANOGEN COPOLYMERIZATION. THE GOAL OF THIS RESEARCH IS TO FURTHER DEFINE AND INTEGRATE THE PREPARATIVE METHODOLOGY AND ENHANCE THE FIGURES

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OF MERIT TO ACHIEVE: (1) HIGH X(3), (2) MILLIWATT LEVEL SENSITIVITY AT 0.5 TO 3 MICRON REGION AND (3) FABRICATION FLEXIBILITY. POC'S NEW MATERIALS WILL BE FREE OF ABSORPTION DEPENDENT EXCITON OVERLAPPING AND RESONANCE SATURATION RESPONSIBLE FOR LOWERING THE NONLINEAR REFRACTIVE INDEX GENERALLY EXPERIENCED BY GaAs/AlGaAs MULTIPLE QUANTUM WELL STRUCTURES AT 0.8 AND 1.3 MICRON WAVELENGTHS. FURTHER, WAVEGUIDE/OPTICAL SWITCH WILL BE FABRICATED FROM THE COMPOSITE POLYMER TO DETERMINE IMPLANT SCATTERING, PHOTO REFRACTIVE (OPTICAL) DAMAGE AND PROPAGATION LOSSES INCLUDING VOLUME SCATTERING, ROUGHNESS AND ABSORPTION.

PHYSICAL OPTICS CORP
2545 W 237TH ST - STE B
TORRANCE, CA 90505
CONTRACT NUMBER: F33615-89-C-1093
DR RAY T CHEN
TITLE:
HOLOGRAPHIC LITHOGRAPHY FOR MICROCIRCUITS
TOPIC# 88 OFFICE: AFWAL/EL IDENT#: 32812

IN THIS PROGRAM, THE FEASIBILITY OF PRODUCING A HOLOGRAPHIC LITHOGRAPHY MACHINE WILL BE INVESTIGATED. SUCH A MACHINE SHOULD HAVE HIGH RESOLUTION, LARGE FIELD MASKS, AND MINIMUM ABERRATION. BOTH THEORETICAL AND EXPERIMENTAL EFFORTS WILL BE MADE IN PHASE I TO FULLY DETERMINE THE LIMITS OF THIS APPROACH AND THE POSSIBILITY OF DESIGNING A PRACTICAL LITHOGRAPHY MACHINE FOR INTEGRATED CIRCUIT APPLICATIONS. TECHNICAL ISSUES INCLUDING MATERIAL REQUIREMENTS, DIFFRACTION LIMIT OF DIFFERENT HOLOGRAPHIC OPTICAL SYSTEM (HOS), ABERRATION, MAGNIFICATION/DEMAGNIFICATION, NOISE ELIMINATION AND POWER DISTRIBUTION AND UNIFORMITY ARE TO BE INTENSIVELY STUDIED WITHIN THE TIME FRAME OF PHASE I. HOLOGRAPHIC MATERIALS THAT CAN PROVIDE IMAGE RESOLUTION $<0.1 \mu\text{m}$ IS AVAILABLE IN THIS PROGRAM BASED ON POC'S PROPRIETARY HOE FABRICATION LABORATORY. LARGE NUMERICAL APERTURE AND FEATURE SIZE ARE PROVIDED WITH OUR NOVEL RECORDING AND RECONSTRUCTION GEOMETRY WHICH USES GUIDED WAVE AND EVANESCENT WAVE AS A REFERENCE BEAM. THE HOLOGRAPHIC MACHINE PROPOSED IN THIS PROGRAM EXCLUDES THE EXPENSIVE OPTICAL PARTS ASSOCIATED E-BEAM AND X-RAY LITHOGRAPHY. THEREFORE, THE GOAL OF COST EFFECTIVENESS WILL ALSO BE ACHIEVED.

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PHYSICAL OPTICS CORP
2545 W 237TH ST - STE B
TORRANCE, CA 90505
CONTRACT NUMBER: F33615-89-C-1104
DR WILLIAM PHILLIPS
TITLE:
DETECTION OF SUPERCONDUCTING CURRENTS WITH MAGNETO-OPTIC FILM PRO
TOPIC# 100 OFFICE: AFWAL/EL IDENT#: 32835

THIS PROPOSAL ADDRESSES THE NEED FOR A METHOD OF OPTICALLY PROBING A SUPERCONDUCTING CIRCUIT ELEMENT TO: a) DETERMINE IF IT IS IN THE SUPERCONDUCTING OR THE NORMAL STATE, AND b) MEASURE THE CURRENT FLOW IN THE ELEMENT. POC'S CONCEPT ACCOMPLISHES THIS THROUGH USE OF A NOVEL MAGNETO-OPTIC SENSOR. THE EVANESCENT FIELD OF A GUIDED WAVE IN A FIBER IS MADE TO INTERACT WITH A STRONGLY MAGNETO-OPTIC FILM APPLIED TO THE SUPERCONDUCTOR. THIS RESULTS IN MODULATION OF THE LIGHT IN THE FIBER IN PROPORTION TO THE MAGNITUDE OF THE SUPERCONDUCTING CURRENT. THE APPLICATIONS OF THIS PROBE RANGE FROM REMOTE SENSING OF DC CURRENT IN HAZARDOUS ENVIRONMENTS TO ULTRAHIGH SPEED LIGHT MODULATION.

PHYSICAL OPTICS CORP
2545 W 237TH ST - STE B
TORRANCE, CA 90505
CONTRACT NUMBER:
DR GAJENDRA D SAVANT
TITLE:
HOLOGRAPHIC VIDEO OPTICAL DISK FROM COMPOSITE GRAFT POLYMERS
TOPIC# 206 OFFICE: AFWL IDENT#: 37985

PHYSICAL OPTICS CORPORATION PROPOSES A NEW ERASABLE OPTICAL VIDEO DISK (EVOD) SYSTEM AS AN ALTERNATIVE TO EXISTING VIDEO FRAMES WITH THE CAPABILITY OF A HIGH SPEED PARALLEL ARRAY, PROGRAMABILITY AND COMPATABILITY TO MINI OR MICROCOMPUTERS WITH VIDEO DIGITIZERS. POC'S NEW SYSTEM WILL BE BASED ON A NOVEL COMPOSITE-GRAFT POLYMER DYE WORKING BOTH IN HOLOGRAPHIC AND BIREFRINGENT MODES. THE NOVELTY OF

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THE SYSTEM LIES IN THE STORAGE OF THE INFORMATION AND REPRODUCTION IN A THREE DIMENSIONAL FORMAT USING EITHER AN ARGON, He-Ne OR DIODE LASER. WITH THE ADDITIONAL DEGREE OF FREEDOM RESULTING FROM THE ANGLE OF THE INDUCED BIREFRINGENCE IN COMPOSITE-GRAFT-POLYMER, POC'S HOLOGRAPHIC VIDEO DISK WILL HAVE A DOUBLE SIDED STORAGE CAPACITY OF 10 GIGABYTES.

PHYSICAL SCIENCES INC
PO BOX 3100 - RESEARCH PK
ANDOVER, MA 01810
CONTRACT NUMBER: F40600-89-C-0009
WILLIAM J MARINELLI
TITLE:
NON-INTRUSIVE FLOW TURBULENCE MEASUREMENT SYSTEM
TOPIC# 25 OFFICE: AEDC/PKP IDENT#: 31365

PHYSICAL SCIENCES INC. (PSI) PROPOSES TO DEVELOP AN INNOVATIVE NON-INTRUSIVE FLOW DIAGNOSTIC TO MEASURE TURBULENCE IN HIGH TEMPERATURE ARC JET FLOWS. LASER-INDUCED FLUORESCENCE OF Cu ATOM IMPURITIES PRESENT IN THE FLOW WILL BE DETECTED USING DIGITAL IMAGING TECHNIQUES TO MAP THE FLOWFIELD. THE OVERLAP BETWEEN A FIXED FREQUENCY LASER AND THE DOPPLER-SHIFTED ABSORPTION LINESHAPE WILL VARY WITH FLOW VELOCITY. THE FLUORESCENCE INTENSITY MAY BE RELATED TO THE VELOCITY AND FLUCTUATIONS IN THE FLUORESCENCE MAY BE RELATED TO THE TURBULENCE INTENSITY. AN INNOVATIVE CROSSED BEAM APPROACH IS PROPOSED TO DISTINGUISH TEMPERATURE AND DENSITY FLUCTUATIONS FROM VELOCITY FLUCTUATIONS. AN EXPERIMENTAL PROOF OF CONCEPT TASK IS COUPLED TO AN ANALYTICAL MODELING TASK IN THE PHASE I PROGRAM TO DETERMINE THE FEASIBILITY OF THE CONCEPT.

PHYSICAL SCIENCES INC
PO BOX 3100 - RESEARCH PK
ANDOVER, MA 01810
CONTRACT NUMBER:
GEORGE E CALEDONIA
TITLE:
BALLISTIC RANGE BOUNDARY LAYER TRANSITION DIAGNOSTICS
TOPIC# 218 OFFICE: BMO/MYSC IDENT#: 32607

SUBMITTED BY

TWO STATE-OF-THE-ART NON-INTRUSIVE OPTICAL TECHNIQUES ARE PROPOSED FOR USE IN MEASURING THE LAMINAR-TO-TURBULENT BOUNDARY LAYER TRANSITION POINT ON BALLISTIC RANGE MODELS. THE TECHNIQUES ADVOCATED ARE PULSED LASER-INDUCED-FLUORESCENCE DIFFERENTIAL IMAGING AND LASER HOLOGRAPHIC INTERFEROMETRY. BOTH TECHNIQUES HAVE THE SECONDARY POTENTIAL OF PROVIDING INFORMATION ON CHEMICAL SPECIES CONCENTRATIONS IN THE BOUNDARY LAYER. THE PHASE I STUDY WILL RESULT IN THE ULTIMATE DIAGNOSTIC SYSTEM DESIGN AND CAPABILITY SCOPING.

PHYSICAL SCIENCES INC
PO BOX 3100 - RESEARCH PK
ANDOVER, MA 01810
CONTRACT NUMBER: F33615-89-C-2946
MARK G ALLEN

TITLE:
PLANA LASER-INDUCED FLUORESCENCE MEASUREMENTS OF SPECIES
CONCENTRATION AND TEMPERATURE IN SPRAY FLAMES
TOPIC# 148 OFFICE: AFWAL/POMP IDENT#: 33199

THIS SBIR PROPOSAL DESCRIBES AN INNOVATIVE PROGRAM TO DEVELOP INSTRUMENTATION FOR INSTANTANEOUS, TWO-DIMENSIONAL MEASUREMENTS OF THE SPATIALLY RESOLVED DISTRIBUTION OF SPECIES CONCENTRATION AND TEMPERATURE FIELDS IN SPRAY FLAMES. THE TECHNIQUE IS BASED ON PLANAR LASER-INDUCED FLUORESCENCE (PLIF). SPECIES TO BE INVESTIGATED INCLUDE A FUEL-LIKE SPECIES, C(2)H(2), TWO INTERMEDIATE SPECIES, OH AND NO, AND A PRODUCT-LIKE SPECIES, CO. TEMPERATURE MEASUREMENTS WILL BE PRODUCED BY EXAMINING THE FLUORESCENCE FROM THE SAME SPECIES USING TWO DIFFERENT EXCITATION WAVELENGTHS. PHASE I WILL DEMONSTRATE THE FEASIBILITY OF THESE CONCEPTS IN A LABORATORY SCALE SPRAY FLAME BURNER BY DEVELOPING MEAN AND INSTANTANEOUS CONCENTRATION MEASUREMENTS AND MEAN TEMPERATURE MEASUREMENTS. THESE RESULTS WILL GUIDE THE DESIGN AND DEVELOPMENT OF A SYSTEM CAPABLE OF MAKING INSTANTANEOUS MEASUREMENTS IN A FULL-SCALE TEST BED.

PHYSICAL SCIENCES INC
PO BOX 3100 - RESEARCH PK
ANDOVER, MA 01810
CONTRACT NUMBER:
B DAVID GREEN

TITLE:
DEVELOPMENT OF A SENSOR PACKAGE FOR HYPERVELOCITY SPACE VEHICLE
INTERACTIONS AND SIGNATURES
TOPIC# 249 OFFICE: AFSC/NAT IDENT#: 37990

SUBMITTED BY

AN OPERATIONAL HYPERSONIC VEHICLE WILL BE ABLE TO TRAVEL OVER THE ENTIRE RANGE OF ALTITUDES FROM THE SURFACE OF THE EARTH TO LOW EARTH ORBIT. IT WILL BE ESSENTIAL FOR THE VEHICLE SECURITY THAT IT REMAIN IN CONTACT WITH THE COMMAND CENTERS AND BE ABLE TO OBSERVE ITS NEAR FIELD ENVIRONMENT THROUGHOUT ITS FLIGHT CORRIDOR. PHYSICAL SCIENCES INC. (PSI) PROPOSES TO DEVELOP A DESIGN FOR A SENSOR PACKAGE WHICH WILL PROBE THE INTERACTIONS OF THE HYPERSONIC AIRCRAFT AND ITS EFFLUENTS WITH THE RESIDUAL ATMOSPHERE. IT WILL BE ESSENTIAL THAT THE VEHICLE BE ABLE TO SENSOR BOTH THE REMOTE ENVIRONMENT (AND NOT BE "BLINDED" BY NEAR FIELD EMISSIONS) AND THAT IT BE ABLE TO UNDERTAKE TWO-WAY COMMUNICATIONS WITH THE GROUND CONTROLLERS AT ALL TIMES. A VARIETY OF PROCESSES WILL BE OCCURRING SURROUNDING THE AIRCRAFT ABOVE 100 km IN ALTITUDE. THE INTERACTION DENSITIES WILL BE PREDICTED BASED ON A TRANSITIONAL FLOWFIELD MODEL. THESE DENSITIES WILL THEN BE USED TO QUANTITATIVELY PREDICT THE PROPAGATION FREQUENCIES THROUGH THE PLASMA SHEATH AND THE GAS PHASE AND SURFACE COLLISIONALLY EXCITED EMISSIONS OVER THE HIGH ALTITUDE PORTION OF THE AIRCRAFT FLIGHT PATH AND AS A FUNCTION OF VEHICLE ACTIVITY. A UNIQUE PACKAGE OF SENSORS CAPABLE OF MONITORING THESE INTERACTIONS/SIGNATURES WILL BE DESIGNED. A TEST PLAN WILL BE DEVELOPED FOR THE PACKAGE WHICH WOULD BE ASSEMBLED DURING PHASE I OF THIS PROGRAM.

POWER SPECTRA INC
42660 CHRISTY ST
FREMONT, CA 94538
CONTRACT NUMBER: F08635-89-C-0414
DR HEIKKI HELAVA

TITLE:
WEAPONIZATION OF OPTICALLY TRIGGERED BULK SEMICONDUCTOR SWITCHES
FOR PROGRAMMABLE HIGH PERFORMANCE FUZING APPLICATIONS
TOPIC# 1 OFFICE: AD/PMR IDENT#: 31047

PREVIOUS WORK HAS SHOWN THAT THE BULK AVALANCHE SEMICONDUCTOR SWITCH (BASS) DRAMATICALLY ENHANCES THE CAPABILITIES OF EXPLODING FOIL INITIATORS (EFI). THE VERY HIGH POWER DENSITY CAPABILITY OF THE BASS ALLOWS VERY SMALL SWITCHES. THE VERY FAST RISE TIME AND LOW ON-STATE RESISTANCE MAKE THE SWITCH VERY EFFICIENT. THE LOW JITTER (PICO-

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SECONDS) ALLOWS ARRAYS OF EFIS TO BE INITIATED SIMULTANEOUSLY OR IN ACCURATELY TIMED SEQUENCE FOR PROGRAMMABLE ORDNANCE. THE BASS ALLOWS THE ENTIRE EFI SYSTEM TO BE TESTED FOR CONTINUITY AND INDUCTANCE WITHOUT DISCONNECTING THE BRIDGE. THE OBJECTIVE OF PHASE I IS TO DEMONSTRATE A CRITICAL PHASE (THERMAL ENVIRONMENT) OF THE WEAPONIZATIONABILITY OF THE BASS AND TO PROVIDE A PROGRAM FRAMEWORK FOR EXTENDING THIS DEVELOPMENT TO A WEAPONS QUALIFIABLE SWITCH. ANALYSIS WILL BE USED TO DETERMINE THE EXPECTED OPERATING ENVELOPE OF THE BASS SWITCH IN ANTICIPATED WEAPON ENVIRONMENTS. PHASE I EXPERIMENTS WILL DEMONSTRATE BASS PERFORMANCE OVER THE TEMPERATURE RANGE -55 DEG C TO +150 DEG C. AFTER ANALYSIS AND EXPERIMENTAL VERIFICATION, A QUALIFICATION PROGRAM WILL BE PROPOSED FOR PHASE II WHICH WILL RESULT IN A SWITCH READY FOR WEAPONS APPLICATIONS.

POWER SPECTRA INC
42660 CHRISTY ST
FREMONT, CA 94538
CONTRACT NUMBER:
DR HEIKKI HELAVA
TITLE:
COMPACT ULTRAFAST MICROWAVE SWITCHING
TOPIC# 47 OFFICE: RADC/XPX IDENT#: 31507

POWER SPECTRA HAS ALREADY DEVELOPED, UNDER PRIVATE FUNDING, A COMPACT, ULTRA-EFFICIENT, ULTRA-FAST, LOW JITTER, HIGH VOLTAGE MICROWAVE-FREQUENCY SWITCH. EVALUATION CONDUCTED TO DATE HAS DEMONSTRATED GREATER THAN 10GW/cm(3) AT 15 KV, AS WELL AS DIAGNOSTICS-LIMITED RISE TIME LESS THAN 50ps WITH AN ELECTRONICS-LIMITED JITTER LESS THAN 4-5ps. THE SWITCH IS A BULK AVALANCHE SEMICONDUCTOR SWITCH (BASS) WHICH IS BASED ON PROPRIETARY POWER SPECTRA TECHNOLOGY. FOR PHASE I, IT IS PROPOSED TO DEMONSTRATE THE PERFORMANCE OF MULTIPLE SWITCHES THAT MEET THE GOAL OF PHASE II: CONTROLLED DELAY OF MULTIPLE HIGH-POWER SWITCHES WITH LOW JITTER. THIS DEMONSTRATION IS POSSIBLE DUE TO THE CONTINUED PRIVATE FUNDING WHICH IS BEING APPLIED TO THIS SWITCH DEVELOPMENT. IN ADDITION, A PROPOSED PHASE II PROGRAM, TO DEMONSTRATE A VIABLE MICROWAVE SOURCE BASED ON BASS, WILL BE PROVIDED.

POWER SPECTRA INC
42660 CHRISTY ST
FREMONT, CA 94538
CONTRACT NUMBER:
JEFFREY OICLES
TITLE:
DISTRIBUTED RADAR FOR OUTDOOR SITE SURVEILLANCE
TOPIC# 224 OFFICE: BMO/MYSC IDENT#: 32670

SUBMITTED BY

RELIABLE DETECTION, IDENTIFICATION AND TRACKING OF HOSTILE INTRUDERS INTO A CONTROLLED, OUTSIDE AREA BECOMES EXTREMELY DIFFICULT UNDER A VARIETY OF ENVIRONMENTAL CONDITIONS, INCLUDING NIGHT, PRECIPITATION, FOG AND OTHER WEATHER RELATED FACTORS. THE SITUATION CAN DETERIORATE FURTHER WHEN HIGH VALUE AND NUCLEAR ASSETS, WHICH COULD ATTRACT VERY SOPHISTICATED PENETRATION ATTEMPTS ARE INVOLVED. FINALLY, DEPLOYMENT OF THESE ASSETS IN MOBILE OR TEMPORARY MILITARY SITUATIONS CAN CREATE AN EXTREMELY DIFFICULT SECURITY SITUATION. THE CONFLICTING GOALS OF INCREASING SECURITY EFFECTIVENESS WHILE REDUCING INVOLVED PERSONNEL LEADS TO THE INVESTIGATION OF TECHNOLOGICAL ALTERNATIVES. A DISTRIBUTED RADAR IS APPLIED TO THE MOBILE/PORTABLE SITE SECURITY SURVEILLANCE IN THE PROPOSED STUDY. NO EXISTING SYSTEM OFFERS INTRUDER DETECTION, CLASSIFICATION AND TRACKING ABILITIES UNDER ALL ENVIRONMENTAL CONDITIONS. THE STUDY WILL ASSESS THE PERFORMANCE POTENTIAL OF THIS HIGH RESOLUTION IMAGING CONCEPT AND COMPARE IT WITH EXISTING TECHNOLOGIES. PERFORMANCE AND COST EFFECTIVENESS WILL BE PREDICTED AND RECOMMENDATIONS FOR FURTHER DEVELOPMENT PRESENTED.

PRECISION COMBUSTION INC
25 SCIENCE PK
NEW HAVEN, CT 06511
CONTRACT NUMBER: F08635-89-C-0347
WILLIAM C PFEFFERLE
TITLE:
CATALYTIC LINER FOR GAS TURBINE
TOPIC# 58 OFFICE: AFESC/RDXP IDENT#: 31971

PRECISION COMBUSTION, INC. IS WORKING TO RESEARCH, DEVELOP AND COMMERCIALIZE CATALYTICALLY STABILIZED THERMAL COMBUSTION TECHNOLOGIES. OUR CHIEF SCIENTIST, DR. WILLIAM PFEFFERLE, INVENTED THE CATALYTIC COMBUSTOR, AND OUR YALE UNIVERSITY CONSULTANT FIRST DISCOVERED AND MEASURED THE FREE RADICAL-PRODUCING EFFECTS ON COMBUSTION OF HOT CATALYTIC SURFACES. BUILDING UPON THEIR EXPERTISE AND OUR EXPERIENCE FROM OTHER CATALYTIC COMBUSTION PROJECTS, WE PROPOSE TO WORK TO DEVELOP A CATALYTICALLY ACTIVE COMBUSTOR LINING FOR A TURBINE ENGINE COMBUSTOR WITH THE OBJECTIVE OF REDUCING HYDROCARBON EMISSIONS. BUILDING UPON EXPERIENCE WITH A CATALYTIC

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IGNITION LINER INVENTED BY DR. PFEFFERLE AND NOW IN USE BY THE MILITARY FOR HIGH ALTITUDE RELIGHT, APPROPRIATE CATALYST SURFACES WILL BE SCREENED IN AN ACTIVITY TESTING APPARATUS. IN CONJUNCTION WITH AN AEROSPACE GAS TURBINE MANUFACTURER, ONE OR MORE CATALYTIC SURFACE DESIGNS WILL BE INCORPORATED INTO AN EXISTING GAS TURBINE COMBUSTOR CERAMIC LINING, AND WILL THEN UNDERGO IDLE AND LOW LOAD ENGINE TESTING, IN CONCERT WITH OTHER AIR FORCE PROGRAMS, TO MEASURE THE EFFECTS ON HYDROCARBON EMISSIONS.

PRINCETON SCIENTIFIC INSTRUMENTS INC
306 ALEXANDER ST
PRINCETON, NJ 08540
CONTRACT NUMBER:
A D COPE
TITLE:
DEVELOPMENT OF HIGH SENSITIVITY SWIR AND MWIR CAMERAS
TOPIC# 194 OFFICE: AFGL/XOP IDENT#: 31738

SHORTWAVE INFRARED (SWIR) AND MEDIUMWAVE INFRARED (MWIR) MEASUREMENTS ARE NEEDED TO CHARACTERIZE EMISSIONS PRODUCED IN SPACE BY SPACECRAFT SURFACES, ENGINE EXHAUST AND OTHER SPACECRAFT CONTAMINANTS AS WELL AS THE SPATIAL VARIABILITY OF ATMOSPHERIC IR EMISSIONS. THE PROPOSED STUDY IS TO COMPLETE THE DESIGN OF AN IR CAMERA SUITABLE FOR GROUND BASED OBSERVATIONS OF ATMOSPHERIC EMISSIONS. IT IS EXPECTED THAT THIS CAMERA DESIGN WILL ALSO BE USEFUL IN THE DESIGN OF A SPACE QUALIFIED CAMERA FOR MEASURING IR OPTICAL EMISSIONS IN SPACE. IN PHASE II AN OPERATIONAL GROUND BASED IR CAMERA SYSTEM WOULD BE PRODUCED AND A PROTOTYPE OF THE FLIGHT INSTRUMENT WOULD BE DESIGNED AND BUILT.

PROGRAM DEVELOPMENT CORP OF SCARSDALE
5 HIGHLAND WY
SCARSDALE, NY 10583
CONTRACT NUMBER: F08635-89-C-0352
PETER R EISEMAN
TITLE:
EAGLE WITH REAL-TIME INTERACTIVE GRID MANIPULATION
TOPIC# 1 OFFICE: AD/PMR IDENT#: 31048

SUBMITTED BY

THE BASIS FOR REAL-TIME INTERACTIVE GRID MANIPULATION WOULD BE ESTABLISHED WITHIN THE EAGLE CODE. THIS WOULD BRING THE INTERACTION DIRECTLY INTO THE EXECUTION PHASE OF GRID GENERATION AND WOULD THEREBY REPRESENT A SIGNIFICANT DEPARTURE FROM OTHER INTERACTIVE GRID GENERATION CODES. ALTOGETHER, THE PROPOSED DEVELOPMENT WOULD COMPLEMENT THOSE OTHER INTERACTIVE CONSTRUCTIONS AND WOULD PROCEED WELL BEYOND THEM. IN ESSENCE, THE MOST SOPHISTICATED 3D BLOCK-STRUCTURED GRID GENERATION CODE, EAGLE, WOULD BE COMBINED WITH THE MOST FLEXIBLE ALGEBRAIC GRID GENERATION SCHEME, THE "CONTROL POINT FORM OF ALGEBRAIC GRID GENERATION". THE EAGLE CODE WAS DEVELOPED AT THE AIR FORCE ARMAMENT LABORATORY, EGLIN AFB, AND MISSISSIPPI STATE UNIVERSITY. THE "CONTROL POINT FORM" WAS DEVELOPED AT COLUMBIA UNIVERSITY. WITH THIS COMBINATION, THERE WOULD BE THE CAPABILITY TO PERFORM LOCAL MANIPULATIONS OF THE GRID. THAT IS, THE GRID COULD BE ALTERED IN ONE REGION TO MEET SOME GRID CLUSTERING OR STRUCTURAL DEMANDS OR TO CHANGE THE SHAPE OF SOME BODY. DURING THAT PROCESS, THE REMAINING GRID WOULD REMAIN INTACT AND UNALTERED. THIS ALTERATION COULD FUNCTION AS EITHER A POST-PROCESSOR OR AN EXISTING GRID OR AS A PART OF AN INITIAL CONSTRUCTION OF THE GRID.

PROGRAM DEVELOPMENT CORP SCARSDALE INC
5 HIGHLAND WY
SCARSDALE, NY 10583
CONTRACT NUMBER:
PETER R EISEMAN
TITLE:
INTERACTIVE GRID GENERATION ON SMALL COMPUTERS
TOPIC# 244 OFFICE: FOSR/XOT IDENT#: 34085

THE BASIS FOR FLEXIBLE INTERACTIVE GRID GENERATION SOFTWARE ON SMALL COMPUTERS WOULD BE ESTABLISHED. THE MAIN ISSUES IN THIS PROJECT ARE BOTH MATHEMATICAL AND COMPUTATIONAL. IN PARTICULAR, WE WOULD BUILD UPON THE CONTROL POINT FORM OF ALGEBRAIC GRID GENERATION AND ITS INTEGRATION INTO A POWERFUL SOFTWARE SYSTEM. THE CONTROL POINT FORM PROVIDES A DISTRIBUTED CONTROL OVER THE GRID AND AT THE SAME TIME EACH BOUNDARY MAY BE TAKEN AS EITHER FREE-FORMABLE OR SPECIFIED. AS A FEASIBILITY PROCESS, A PROTOTYPE OF THE DESIRED SOFTWARE WOULD BE CREATED FOR A BASIC ANALYSIS AND EXAMINATION OF THE FUNDAMENTAL

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ISSUES THAT WILL BE PRESENT IN THE GENERAL VERSION IN THE FUTURE. ACCORDINGLY, THE PROTOTYPE WOULD BE CREATED IN TWO DIMENSIONS IN A BLOCK STRUCTURED FORMAT WITH ONLY A FEW BLOCKS. THIS WILL PROVIDE A SMALL SCALE SETTING IN WHICH TO EXAMINE THE TREATMENT OF MULTIPLE BLOCKS AND VARIOUS LEVELS OF AUTOMATION. IN PARTICULAR, WE WOULD STUDY THE INITIALIZATION PROCESS, THE TREATMENT OF BOUNDARIES, THE GRID TOPOLOGY, THE SPEED OF OPERATIONS, AND THE AUTOMATIC FEATURES.

PROPULSION SCIENCES CO
42 CHERRY LN
HUNTINGTON, NY 11743

CONTRACT NUMBER:

VITO AGOSTA

TITLE:

VELOCITY OF SOUND MEASUREMENTS FOR THE DETERMINATION OF GAS TEMPERATURE

TOPIC# 250 OFFICE: AFSC/NAT IDENT#: 31276

INSTRUMENTATION IS NEEDED IN RESEARCH AND DEVELOPMENT FOR TESTING THE AEROTHERMOCHEMICAL PROPERTIES OF GASES AT HIGH TEMPERATURES, UP TO 5000 C. APPLICATIONS OCCUR NOT ONLY IN THE DEVELOPMENT OF VEHICLES FOR HYPERSONIC FLIGHT, BUT ALSO TO PROVIDE MEASUREMENTS IN FUNDAMENTAL RESEARCH IN PLACES AND UNDER CONDITIONS NOT PRESENTLY POSSIBLE. TEMPERATURE IS DEFINED FOR THOSE GASES NOT IN THERMODYNAMIC EQUILIBRIUM AS THE TRANSLATIONAL TEMPERATURE, I.E., THAT TEMPERATURE WITH THE LEAST RELAXATION TIME AND THUS MOST EQUAL TO THE THERMODYNAMIC EQUILIBRIUM TEMPERATURE. THE TRANSLATIONAL TEMPERATURE OF GASES BOTH IN EQUILIBRIUM AND NON-EQUILIBRIUM STATES, HAS BEEN MEASURED BY DR. AGOSTA. THE PRIMARY OBJECTIVE IN PHASE I IS TO DESIGN AN INSTRUMENT TO MEASURE THE VELOCITY OF SOUND IN GASES AND THUS DETERMINE TEMPERATURE UP TO 2000 C. AN EXPERIMENTAL FACILITY WILL BE MODIFIED TO PROVIDE PARAMETERS FOR THE DESIGN OF THE INSTRUMENT. INDEED, DURING THE PARAMETRIC STUDIES, VELOCITY OF SOUND MEASUREMENTS WILL BE MADE AND GAS TEMPERATURES DETERMINED THEREFROM PROVING AGAIN THE FEASIBILITY OF THE METHOD. THE DESIGN OF THE INSTRUMENT WILL BE SUCH THAT IT CAN BE EXTENDED TO DETERMINE TEMPERATURES UP TO 5000 C, MATERIALS WITHSTANDING.

Q-DOT INC
1069 ELKTON DR
COLORADO SPRINGS, CO 80907
CONTRACT NUMBER: F33615-89-C-1768
DR DAVID E REED

TITLE:

LOW-PROBABILITY-OF-INTERCEPT FREQUENCY-HOP WAVEFORM

TOPIC# 98 OFFICE: AFWAL/AAOP IDENT#: 32953

SUBMITTED BY

AN INNOVATIVE TECHNIQUE IS PROPOSED TO GENERATE A FREQUENCY-HOP COMMUNICATION SIGNAL WHICH IS DIFFICULT TO INTERCEPT. THE IMPLEMENTATION PROPOSED WILL ALLOW SWITCHING TRANSIENTS AND, THEREFORE, THE SIDE-LOBE ENERGY, TO BE MINIMIZED. THIS WILL SIGNIFICANTLY REDUCE THE PROBABILITY OF INTERCEPT.

QUANTUM ELECTRONICS TECHNOLOGY INC
24 ROBIN HILL RD
SCARSDALE, NY 10583
CONTRACT NUMBER: F41622-89-C-0009
YING-CHIH CHEN
TITLE:
DEVICE FOR CAPTURING DYNAMIC BLEACHING EFFECTS OF SINGLE-EVENT PICOSECOND LASER PULSE
TOPIC# 72 OFFICE: HSD/SORT IDENT#: 34704

WE PROPOSE A DEVICE FOR CAPTURING SINGLE-EVENT PICOSECOND PROCESSES USING THE LASER-POWER-INDUCED INTERFERENCE FRINGE MOVEMENT IN A NONLINEAR ETALON. THIS SIMPLE DEVICE WILL BE ABLE TO PERFORM FUNCTIONS WHICH ARE CURRENTLY DONE BY STREAK CAMERAS.

QUANTUM EPITAXIAL DESIGNS INC
S MOUNTAIN DR - BEN FRANKLIN TECH CTR
BETHLEHEM, PA 18015
CONTRACT NUMBER: F33615-89-C-5645
THOMAS HIERL
TITLE:
ULTRASTRUCTURED MATERIALS
TOPIC# 128 OFFICE: AFWAL/MLK IDENT#: 33382

THE MOST PROMISING CANDIDATE FOR THE NEXT GENERATION, HIGH SPEED ELECTRONIC DEVICES IS THE PSEUDOMORPHIC HIGH ELECTRON MOBILITY TRANSISTOR (pHEMT). DEVICES BASED ON pHEMT TECHNOLOGY HAVE DEMONSTRATED EXTREMELY HIGH CUT-OFF FREQUENCIES. FULL UTILIZATION OF THE MODULATION DOPING PHENOMENA CAN BE ACHIEVED BY INCREASING THE CONDUCTION BAND DISCONTINUITY BETWEEN THE InGaAs CHANNEL AND AlGaAs

SUBMITTED BY

DONOR LAYER BY INCREASING THE INDIUM MOLE FRACTION TO 40%. IN ORDER TO PREVENT LATTICE STRAIN RELAXATION DUE TO THE LARGE LATTICE MISMATCH BETWEEN MATERIALS, CONVENTIONAL MBE MUST BE SUPPLEMENTED WITH THE ADVANCED GROWTH TECHNIQUES OF MIGRATION ENHANCED EPITAXY (MEE) AND PHASED LOCKED EPITAXY (PLE). PHASE I WILL DEVELOP THE MEE AND PLE TECHNIQUES REQUIRED TO GROW pHEMTs HAVING InGaAs CHANNELS WITH INDIUM MOLE FRACTIONS OF 40%. PHASE II WORK WILL EXTEND AND REFINED THE TECHNIQUES FOR THE MANUFACTURE OF A WIDER RANGE OF STRATEGIC ELECTRONIC MATERIALS.

R*SCAN CORP
1200 WASH AVE S - MN SUPERCOMPUTER CTR
MINNEAPOLIS, MN 55415
CONTRACT NUMBER: F04701-89-C-0052
DR WALTER A LYONS
TITLE:
PREDICTING 3-D WINDFLOWS AT VENDENBERG AFB USING A MESOSCALE NUMERICAL MODEL
TOPIC# 170 OFFICE: AFSTC/OLAB IDENT#: 34347

THE PREDICTION OF MESOSCALE DISPERSION, FOR EMERGENCY RESPONSE PURPOSES, IS CRITICALLY DEPENDENT UPON ACCURATELY FORECASTING THE 3-D WIND FIELD WITHIN THE DOMAIN OF INTEREST SEVERAL HOURS IN ADVANCE. CURRENTLY AVAILABLE EMERGENCY RESPONSE SYSTEMS, WHICH TYPICALLY USE SOME FORM OF GAUSSIAN DIFFUSION MODEL COMBINED WITH WIND FIELDS INTERPOLATED FROM SCATTERED SURFACE LAYER WIND MEASUREMENTS, ARE, UNDER MANY MESOSCALE REGIMES, INCAPABLE OF DESCRIBING THE CURRENT COMPLEX TRANSPORT AND DIFFUSION FOUND IN REGIONS SUCH AS VANDENBERG AFB, MUCH LESS PROJECTING SEVERAL HOURS INTO THE FUTURE. A NEW GENERATION OF MESOSCALE NUMERICAL MODELS APPEARS CAPABLE OF FORECASTING THE DETAILED 3-D WINDFLOW IN COASTAL COMPLEX TERRAIN TO A DEGREE SUFFICIENT TO SIGNIFICANTLY IMPROVE REGIONAL DIFFUSION PREDICTIONS. PHASE I AIMS AT DEMONSTRATING THAT THE REGIONAL ATMOSPHERIC MODELING SYSTEM (RAMS) CAN ACCOMPLISH THIS TASK. IF SUCCESSFUL, THIS PAVES THE WAY FOR SUBSEQUENT EFFORTS TO PORT THE RAMS MODEL INTO AN OPERATIONAL ENVIRONMENT.

RADIUS ENGINEERING & TOOLING INC
3474 S 2300RD E
SALT LAKE CITY, UT 84109
CONTRACT NUMBER: F33615-89-C-5723
DIMITRIJE MILOVICH
TITLE:
LOW COST NET SHAPE COMPOSITE STRUCTURES FABRICATION
TOPIC# 133 OFFICE: AFWAL/MLK IDENT#: 33732

SUBMITTED BY

A PROGRAM IS PROPOSED FOR RESEARCH OF INNOVATIVE METHODS FOR MANUFACTURING THERMOSET COMPOSITE AIRCRAFT STRUCTURES. CONCEPTS TO BE STUDIED WILL REDUCE COSTS WHILE MAINTAINING OR IMPROVING CURRENT AEROSPACE QUALITY STANDARDS. THE PROGRAM WILL IDENTIFY AND EVALUATE LOW COST METHODS AND APPROACHES TO AUTOMATED FABRICATION OF AIRPLANE PRIMARY AND SECONDARY STRUCTURES. CONCEPTS CHOSEN FOR EVALUATION WILL SHOW PARTICULAR INNOVATION RELATIVE TO CURRENT PRACTICES. TYPICAL CRITERIA FOR INCLUSION OF MANUFACTURING CONCEPTS IN THIS STUDY ARE: LOW COST, HIGH RATE, ADAPTABILITY TO AUTOMATION, CAPABILITY OF ON-LINE PROCESS MONITORING, AND IN-PROCESS FINAL PART QUALITY CONTROL. SEVERAL EXAMPLES OF INNOVATIVE CONCEPTS ARE GIVEN. EMPHASIS WILL BE ON INNOVATIVE NET-SHAPE MANUFACTURING TECHNIQUES THAT USE LOW-COST RAW MATERIAL FORMS AND CURRENT OR NEAR-TERM MATERIAL HANDLING METHODS AND CAN EMPLOY AUTOMATION TECHNOLOGIES CURRENTLY AVAILABLE IN INDUSTRY. CHOSEN METHODS WILL BE EVALUATED AND RANKED WITH FINAL RECOMMENDATION OF A PREFERRED CONCEPT TO BE DEMONSTRATED IN A PHASE II.

REFRACTORY COMPOSITES INC
12220-A RIVERA RD
WHITTIER, CA 90606
CONTRACT NUMBER:
E L TED PAQUETTE
TITLE:
CERAMIC COMPOSITE FASTENERS WITH METALLIC THREAD ZONES
TOPIC# 251 OFFICE: AFSC/NAT IDENT#: 31283

RCI PROPOSES TO COMBINE REFRACTORY METAL CVD TECHNOLOGIES AND CVI CERAMIC AND CARBON-CARBON COMPOSITE TECHNOLOGIES TO PRODUCE SMALL DIAMETER FASTENERS WITH METALLIC THREAD ZONES. THESE FASTENERS ARE EXPECTED TO BE PRINCIPALLY USED IN HOT COMPOSITE TO COOLED METAL STRUCTURE ATTACHMENTS WHERE THE METALLIC ZONE IS BURIED IN THE COOLED METAL STRUCTURE IN THE ASSEMBLED STATE OR IN APPLICATIONS WHERE THE THREADS ARE PROTECTED FROM OXIDATION. PRIOR TAPE LOCK COMPOSITE FASTENER WORK BY RCI WILL BE USED AS THE FOUNDATION FOR THIS PROJECT. VARIOUS FASTENER DESIGNS AND MATERIALS OF CONSTRUCTION BEYOND THESE TYPES WILL BE NEEDED FOR HYPERSONIC VEHICLES.

RISK ENGINEERING INC
5255 PINE RIDGE RD
GOLDEN, CO 80403
CONTRACT NUMBER:
ROBIN K MCGUIRE
TITLE:
SITE CHARACTERIZATION BY PASSIVE MONITORING OF HIGH FREQUENCY MICROSEISMS
TOPIC# 221 OFFICE: BMO/MYSC IDENT#: 22550

SUBMITTED BY

THIS WORK WILL EXAMINE THE FEASIBILITY OF RECORDING MICROEARTHQUAKES AND MICROTREMOR NOISE AT HIGH FREQUENCIES (UP TO 50 Hz), ANALYZING THE FOURIER AND RESPONSE SPECTRUM CHARACTER AT HIGH FREQUENCIES TO DETERMINE NEAR SURFACE ROCK ATTENUATION, AND RELATING THIS TO ENGINEERING ROCK PROPERTIES. TWO SITES WILL BE INSTRUMENTED IN CALIFORNIA (A HARD- AND SOFT-ROCK SITE) WHERE AVAILABLE WELL DATA INDICATE ROCK PROPERTIES TO DEPTHS OF 0.6 AND 1.8 km, RESPECTIVELY. MICROSEISMS WILL BE RECORDED AT THESE TWO SITES AND WILL BE ANALYZED TO EVALUATE HIGH FREQUENCY CHARACTERISTICS AND TO CALCULATE INTRINSIC ATTENUATION. THE INFERRED ENGINEERING PROPERTIES OF THE ROCK WILL BE COMPARED TO BOREHOLE DATA TO EVALUATE THE FEASIBILITY OF THE METHOD AS A SCREENING TOOL FOR SITE CHARACTERIZATION.

SAFETY CONSULTING ENGINEERS INC
5240 PEARL ST
ROSEMONT, IL 60018
CONTRACT NUMBER:
C JAMES DAHN
TITLE:
PROPELLANT SENSITIVITY TO ELECTROSTATIC DISCHARGE (ESD)
TOPIC# 211 OFFICE: BMO/MYSC IDENT#: 32578

ESD PHENOMENA IN ALUMINIZED PROPELLANT CASTING IS ANALYZED AND MATHEMATICALLY MODELLED. MODELS WILL BE INDIVIDUALLY DEVELOPED FOR THE ESD PHENOMENA AND THEN COMBINED FOR AN OVERALL MODEL. SAFE METHODS OF CASTING WILL BE DEVELOPED FROM THE MODELS.

SCHMIDT INSTRUMENTS
2474 BOLSOVER - STE 234
HOUSTON, TX 77005
CONTRACT NUMBER: F41622-89-C-0017
DR HOWARD K SCHMIDT
TITLE:
TOXIN DETECTION BY UV LIDAR
TOPIC# 69 OFFICE: HSD/SORT IDENT#: 34816

REAL TIME DETECTION OF TOXIC MATERIALS CAN LIKELY BE PERFORMED BY

SUBMITTED BY

MEANS OF LIDAR (LIGHT DETECTION AND RANGING) USING CALIBRATED ULTRA-VIOLET (UV) LASER INDUCED FLUORESCENCE (LIF) SIGNATURES. SUCH A SYSTEM WOULD BE USEFUL FOR STAND-OFF DETECTION OF DISTANT THREATS AS WELL AS IN LOCAL DECONTAMINATION PROCEDURES. REALIZATION OF UVLIDAR IS PRESENTLY HINDERED BY: 1) LACK OF A LIF SIGNATURE DATA BASE, AND 2) COMPLEX SIGNAL PROCESSING REQUIREMENTS DUE TO COMPETING ATMOSPHERIC SIGNALS. IN THE PHASE I PROGRAM, FUNDAMENTAL LIF DATA WILL BE OBTAINED EXPERIMENTALLY, WHILE DETECTION CONFIDENCE AND HARDWARE REQUIREMENTS WILL BE DETERMINED USING SYNTHETIC LIDAR RETURNS. EMPHASIS WILL BE PLACED ON UV WAVELENGTHS ACCESSIBLE USING COMPACT, RELIABLE AND EFFICIENT Nd:YAG LASERS. SCHMIDT INSTRUMENTS IS PARTICULARLY CAPABLE AT DEVELOPING EFFICIENT DIGITAL SIGNAL PROCESSING HARDWARE IN-HOUSE, AND DURING PHASE II WE WILL CONSTRUCT PROTOTYPE UVLIDAR HARDWARE FOR FIELD TESTING.

SCHWARTZ ELECTRO-OPTICS INC
3404 N ORANGE BLOSSOM TRAIL
ORLANDO, FL 32804
CONTRACT NUMBER:
DR MADHU A ACHAREKAR
TITLE:
FIBER OPTICS ORDNANCE
TOPIC# 234 OFFICE: BMO/MYSC IDENT#: 32732

SEO PROPOSES A PHASE I STUDY PROGRAM TO ASSESS THE FEASIBILITY OF A RADIATION HARD Q-SWITCHED Nd:Cr:GSGG FIBER LASER FOR USE IN A FIBER OPTICS ORDNANCE SYSTEM. SEO WILL IMPROVE COUPLING EFFICIENCY BETWEEN THE INITIATOR AND OPTICAL FIBERS AND ALSO IMPROVE IONIZATION RESISTANCE TO NUCLEAR WEAPONS EFFECTS. Nd:Cr:GSGG FIBER WILL BE USED FOR THE LASER BREADBOARD. THE Nd:Cr:GSGG MATERIAL HAS BEEN TESTED TO 10,000 RAD DOSE LEVEL. THE SELECTION OF OTHER LASER COMPONENTS INCLUDING PUMP SOURCE, Q-SWITCH, BEAM POLARIZERS, AND DIELECTRIC COATINGS WILL BE MADE BASED ON THEIR PERFORMANCE AT SIMILAR DOSE LEVELS. THE BREADBOARD ASSEMBLED WILL BE A FLASHLAMP/LASER DIODE PUMPED Nd:Cr:GSGG FIBER LASER SOURCE.

SCHWARTZ ELECTRO-OPTICS INC
45 WINTHROP ST
CONCORD, MA 01742
CONTRACT NUMBER:
DR DAVID WELFORD
TITLE:
DEVELOPMENT OF A MODE-LOCKED Ti:SAPPHIRE LASER
TOPIC# 235 OFFICE: AFOSR/XOT IDENT#: 34232

SUBMITTED BY

ADVANCES IN THE DEVELOPMENT OF TUNABLE SOLID-STATE LASER MATERIALS FOR THE NEAR-INFRARED PROVIDES US WITH THE OPPORTUNITY TO DEVELOP A CLASS OF HIGH PERFORMANCE LASER SYSTEMS THAT OVER-COME THE LIMITATIONS OF PRESENTLY AVAILABLE DYE LASERS. IN PARTICULAR, THE BROADLY TUNABLE Ti:Al(2)O(3) SYSTEM IS ATTRACTIVE AS A NEAR-INFRARED DYE LASER SUBSTITUTE THAT OPERATES FROM 680 nm TO 1000 nm WHEN Ar(+)-ION LASER PUMPED. THE SUBJECT OF THIS PROPOSAL IS THE DEVELOPMENT OF A NOVEL MODE-LOCKING TECHNIQUE FOR THE Ti:Al(2)O(3) LASER THAT WILL PROVIDE A SOURCE OF PICOSECOND/SUBPICOSECOND DURATION PULSES OVER THE ENTIRE LASER TUNING RANGE OF 680 nm TO 1000 nm. WE PROPOSE INTRODUCING A NONLINEAR REFLECTOR INTO A LOSS MODULATED CW MODELOCKED LASER. AN ANALOGY MAY BE DRAWN BETWEEN THE USE OF A SATURABLE ABSORBER IN HYBRID-MODELOCKING OF DYE LASERS AND THE USE OF THE NONLINEAR REFLECTOR FOR THE TiAl(2)O(3) LASER. THE SATURABLE ABSORBER IS A NONLINEAR ELEMENT WITH INCREASING TRANSMISSION AS A FUNCTION OF INCREASING INCIDENT INTENSITY. OUR NONLINEAR REFLECTOR IS A GERMANIUM OPTICAL FLAT WITH INCREASING REFLECTIVITY AS A FUNCTION OF INCREASING INCIDENT INTENSITY. BOTH NONLINEAR DEVICES ARE CAPABLE OF PROVIDING PULSE COMPRESSION IN A SUITABLE RESONATOR CONFIGURATION WITH A GAIN MEDIUM. THE NONLINEAR REFLECTOR THAT SHOULD PROVIDE US WITH A BROAD-BANDWIDTH INTRACAVITY PULSE COMPRESSION ELEMENT WITH SUPERIOR DURABILITY. SUCCESSFUL OPERATION WOULD PROVIDE THE PROOF OF CONCEPT NECESSARY FOR FURTHER DEVELOPMENT OF A SCIENTIFIC INSTRUMENT.

SCIENCE RESEARCH LAB INC
15 WARD ST
SOMERVILLE, MA 02143
CONTRACT NUMBER:
DR DANIEL L BIRX
TITLE:
MICROWAVE POWER MULTIPLICATION USING A SWITCHED HIGH Q RESONANT
CAVITY
TOPIC# 203 OFFICE: AFWL/PRC IDENT#: 31868

AN RF PULSE COMPRESSION TECHNIQUE IS PROPOSED AS A MEANS OF EFFICIENTLY ACHIEVING VERY HIGH PEAK POWER PULSES FROM LOWER POWER, LONGER DURATION PULSES. ELECTROMAGNETIC ENERGY FROM A LOW POWER

SUBMITTED BY

SOURCE (E.G. KLYSTRON) IS STORED OVER A RELATIVELY LONG PERIOD (MICROSEC) IN A HIGH Q RESONANT CAVITY. THIS ENERGY IS THEN SWITCHED OUT OF THE CAVITY IN A MUCH SHORTER TIME (< OR - 100 NSEC) RESULTING IN TEMPORAL ENERGY COMPRESSION AND THEREBY POWER GAIN. THE SWITCHING IS ACCOMPLISHED INSTANTANEOUSLY BY CREATING A LARGE INCREASE IN THE COUPLING COEFFICIENTS OF SEVERAL OUTPUT PORTS BY USING A DISCHARGE SWITCH.

SCIENTIFIC ASSOCS

2464 S STUART ST
DENVER, CO 80219

CONTRACT NUMBER:

DAVID G MERCRAJ

TITLE:

TUNABLE IR DETECTOR

TOPIC# 195 OFFICE: AFGL/XOP IDENT#: 31811

THE INCREASED SENSITIVITY ACHIEVED WITH INFRARED SOLID STATE PHOTOMULTIPLIER DETECTORS MAKE IT POSSIBLE FOR SENSORS TO OPERATE IN VERY NARROW WAVELENGTH INTERVALS. THE USE OF THESE NARROW BAND SYSTEMS HAS THE POSSIBILITY OF ACHIEVING ADDITIONAL SENSITIVITY WHEN OPERATED AGAINST ATMOSPHERIC BACKGROUNDS BY WORKING OVER SUCH NARROW SPECTRAL REGIONS THAT THE BACKGROUND RADIATION CAN BE SIGNIFICANTLY REDUCED. ACHIEVING SUCH A SPECTRAL NARROW BAND PASS WITH REASONABLE THROUGHPUT IS DIFFICULT PARTICULARLY WHERE THE "FILTER" HAS TO BE CRYOGENICALLY COOLED. FABRY-PEROT INTERFEROMETER SYSTEMS OFFER A POTENTIAL TECHNIQUE FOR ACHIEVING THE DESIRED SPECTRAL RESOLUTION IN AN OPTICAL CONFIGURATION THAT CAN BE COOLED. WE PROPOSE TO DESIGN A CONFOCAL FABRY-PEROT SYSTEM WHICH CAN BE TUNED AND CRYOGENICALLY COOLED.

SCIENTIFIC RESEARCH ASSOCS INC

PO BOX 1053 - 50 NYE RD
ELASTONBERY, CT 06033

CONTRACT NUMBER:

STEPHEN J SHAMROTH

TITLE:

WREESTATION REACTING NAVIER-STOKES COMPUTER CODE

TOPIC# 205 OFFICE: AFWL/PRC IDENT#: 31883

SUBMITTED BY

AN INNOVATIVE APPROACH IS PROPOSED TO THE DESIGN PROBLEMS OF COMPONENTS FOR CHEMICALLY REACTING FLOWS. UNDER THIS PROPOSAL, A COMPUTER CODE WOULD BE DEVELOPED FOR USE IN A WORKSTATION ENVIRONMENT. ALL INPUT/OUTPUT WOULD BE PERFORMED ON THE WORKSTATION VIA INTERACTIVE PROTOCOLS AND ACTUAL COMPUTATIONS WOULD BE PERFORMED EITHER ON THE WORKSTATION OR ROUTED TO A MAINFRAME COMPUTER AT THE DISCRETION OF THE USER. DEVELOPMENT OF SUCH A PROCEDURE WOULD OVERCOME THE CHIEF PROBLEM IN APPLYING SOPHISTICATED CODES TO THE DESIGN PROCESS; THAT BEING EASE OF SETTING UP THE FLOW PROBLEM AND INTERROGATING RESULTS. UNDER PHASE I, A WORKSTATION INPUT MODULE FOR CHEMICAL LASER NOZZLES WOULD BE CONSTRUCTED AND A DEMONSTRATION CALCULATION MADE. PHASE II EFFORTS WOULD INCLUDE MORE SOPHISTICATED CHEMISTRY PACKAGES, DEVELOPMENT OF A WALL FUNCTION VERSION OF THE CODE, INCLUSION OF MORE SOPHISTICATED TRANSPORT MODELS, EXTENSION TO MORE GENERAL REACTING FLOW SYSTEMS, DEVELOPMENT OF AN INTERACTIVE WORKSTATION OUTPUT INTERROGATION PROTOCOL AND CONVERSION OF THE CODE TO ALLOW COMPUTATIONS TO BE RUN ON A WORKSTATION. THIS WORKSTATION CREATED CODE WOULD BE A MAJOR BOON TO DESIGN AND DEVELOPMENT ENGINEERS AND SCIENTIFICS.

SCIENTIFIC RESEARCH ASSOCS INC
PO BOX 1058 - 50 NYE RD
BLASTONBURY, CT 06108
CONTRACT NUMBER: F33615-89-C-2926
DAVID V ROSCOE
TITLE:
ADVANCED SECONDARY GAS PATH DESIGN SYSTEM
TOPIC# 157 OFFICE: AFWAL/POMP IDENT#: 33244

AN INNOVATIVE APPROACH IS PROPOSED FOR THE DESIGN OF SECONDARY GAS PATH SYSTEMS FOR GAS TURBINE ENGINES. THE PROPOSED PHASE I/PHASE II PROGRAM WOULD BE PURSUED BY SRA AS A PRIME CONTRACTOR WITH TELEDYNE CAE PARTICIPATING AS A SUBCONTRACTOR. UNDER THIS EFFORT AN EXISTING CODE WOULD BE FURTHER DEVELOPED, ASSESSED AND MODIFIED FOR USE IN A WORKSTATION ENVIRONMENT. ALL INPUT/OUTPUT WOULD BE PERFORMED EITHER ON THE WORKSTATION OR ROUTED TO A MAINFRAME COMPUTER AT THE DISCRETION OF THE USER. DEVELOPMENT OF SUCH A PROCEDURE WOULD OVERCOME A MAJOR PROBLEM IN INCORPORATING SOPHISTICATED CFD CODES IN

SUBMITTED BY

THE DESIGN PROCESS; THAT BEING SETTING UP THE FLOW PROBLEM AND INTERROGATING RESULTS. UNDER PHASE I, SRA AND TELEDYNE WOULD DESIGN AN INTERACTIVE WORKSTATION INPUT MODULE SUITABLE FOR INCORPORATION INTO THE DESIGN SYSTEM. THIS PROCEDURE WOULD BE DEMONSTRATED ON ONE OR MORE CONFIGURATIONS CHOSEN BY SRA AND TELEDYNE. UNDER PHASE II, SRA WOULD DEVELOP THE WORKSTATION OUTPUT CONFIGURATION PROCEDURES, CONVERT THE CODE TO RUN ON A WORKSTATION AND EXTEND THE CODE LABYRINTH SEAL CONFIGURATIONS. SRA AND TELEDYNE CAE WOULD JOINTLY ASSESS THE CODE AGAINST A VARIETY OF EXPERIMENTAL DATA AND TELEDYNE CAE WOULD OBTAIN ADDITIONAL DATA IF DEEMED NECESSARY. THIS WORKSTATION-BASED CODE WOULD BE A SIGNIFICANT AID IN DESIGNING ADVANCED CAVITIES AND SEALS FOR GAS TURBINE APPLICATIONS.

SIEGFRIED ENTERPRISES INC
PO BOX 2308 - 7 DULITTLE ST
NORTH BABYLON, NY 11703
CONTRACT NUMBER: F41622-89-C-0005
SIEGFRIED GOLDSTEIN

TITLE:
UNIFIED LIFE CYCLE ENGINEERING (ULCE) RAM DESIGN EVALUATION AIDS
TOPIC# 75 OFFICE: HSD/SORT IDENT#: 34650

WE WILL DEVELOP NEW RELIABILITY, AVAILABILITY AND MAINTAINABILITY (RAM) COMPUTER APPLICATIONS FOR USE DURING THE EARLY PHASES OF DESIGN WHEN INADEQUATE INFORMATION IS AVAILABLE FOR RIGOROUS RAM ANALYSES. THE APPLICATIONS WILL BE INTERACTIVE, QUICK AND "DESIGN ENGINEER USER-FRIENDLY". THE ASSESSMENTS WILL COMPLY WITH APPLICABLE RAM MILITARY SPECIFICATIONS AND STANDARDS. THEY WILL ASSESS DESIGN DECISIONS AS EARLY AS DURING A PROPOSAL PHASE AND ASSIST IN DESIGN TRADE-OFFS. PHASE I AND PHASE II DEVELOPMENT WILL CONCENTRATE ON APPLICATIONS FOR ELECTRONICS DESIGN. OTHER DISCIPLINES CAN BE ADDED DURING PHASE III. PHASE I WILL RESULT IN A READY-TO-USE PROTOTYPE SOFTWARE TO TEST FEASIBILITY AND ENGINEER'S ACCEPTANCE. A COMMERCIALY AVAILABLE, TAILORABLE DECISION-MAKING MODEL WILL BE PROGRAMMED TO ASSESS TESTABILITY PER MIL-STD-2076. UP-TO-DATE CAD INTEGRATION AND INTERACTING TECHNIQUES WILL BE RESEARCHED TO DETERMINE REQUIREMENTS FOR COMPATIBILITY WITH CONTEMPORARY CAD WORKSTATIONS. PUBLISHED INTERIM RESULTS OF THE RAMCAD SOFTWARE, FY'87 PHASE II SBIR DEVELOPMENTS, AND CALS REQUIREMENTS WILL SUPPORT

SUBMITTED BY

THIS RESEARCH. IMPORTANT MISSING RAM ASSESSING TECHNIQUES WILL BE IDENTIFIED AND RECOMMENDATIONS FOR ADDITIONAL DEVELOPMENT MADE. PHASE II WILL RESULT IN AS MANY CAD INTERACTIVE APPLICATIONS AS CAN BE DEVELOPED WITHIN THE CONSTRAINTS OF TIME AND MONEY.

SILHOUETTE TECHNOLOGY INC
PO BOX 1479
MORRISTOWN, NJ 07962
CONTRACT NUMBER: 89-C-0004
DR EUGENE J DWYER III
TITLE:
IMPROVING TEST EQUIPMENT WITH HEAD UP DISPLAY TECHNOLOGY
TOPIC# 68 OFFICE: HSD/SORT IDENT#: 34634

SILHOUETTE TECHNOLOGY PROPOSES TO DEVELOP A DEVICE THAT ALLOWS A TECHNICAN TO VIEW TEST EQUIPMENT DISPLAYS IN THE SAME VISUAL FIELD AS THE CIRCUITRY HE/SHE IS TESTING. THE DEVICE UTILIZES NEW DEVELOPMENTS IN "HEAD UP" DISPLAY TECHNOLOGY TO PROVIDE A COST-EFFECTIVE SOLUTION TO FEEDBACK PROBLEMS FROM TEST EQUIPMENT. THE HIGH COST OF MAINTENANCE AND THE HIGH INCIDENCE OF TROUBLE-SHOOTING ERRORS BY MAINTENANCE TECHNICIANS MAKE THE IMPLEMENTATION OF SUCH A DEVICE VERY COST EFFECTIVE TO THE MILITARY.

SOFTWARE PRODUCTIVITY SOLUTIONS INC
PO BOX 361697
MELBOURNE, FL 32936
CONTRACT NUMBER:
DR J KAYE GRAU
TITLE:
SYSTEM ENGINEERING LIFE CYCLE DATA MODEL
TOPIC# 38 OFFICE: RADC/XPX IDENT#: 31445

THE OBJECTIVE OF THIS SBIR IS TO SPECIFY A DATA MODEL OF THE C3I SYSTEM ENGINEERING AND DEVELOPMENT LIFE CYCLE, AND DESCRIBE AN ASSOCIATED SYSTEM LIFE CYCLE TOOLSET. DURING PHASE I, A DATA MODEL, OR SCHEMA, THAT IDENTIFIES AND DEFINES ALL TECHNICALLY ORIENTED DATA CREATED AND MANIPULATED DURING THE AIR FORCE C3I AND DOD SYSTEM

SUBMITTED BY

DEVELOPMENT LIFE CYCLE WILL BE DEVELOPED. IDENTIFICATION OF DATA WILL BE DRIVEN BY SELECTED AIR FORCE AND DOD SYSTEM/SOFTWARE DEVELOPMENT REGULATIONS AND STANDARDS. THE DATA MODEL WILL BE SPECIFIED USING ENTITY-RELATIONSHIP MODELLING TECHNIQUES AND SHALL BE DOCUMENTED, BOTH TEXTUALLY AND GRAPHICALLY, IN A TECHNICAL REPORT. BASED ON THE PHASE I DATA MODEL, PHASE II WILL INVESTIGATED STATE-OF-THE-ART CASE AND CAD/CAM TOOLS WHICH ARE CAPABLE OF SUPPORTING THE CREATION AND MANIPULATION OF LIFE CYCLE DATA IDENTIFIED IN THE DATA MODEL. IN ADDITIONAL, NEW TOOLS WILL BE RECOMMENDED. FURTHERMORE, THE POTENTIAL FOR USE OF A KNOWLEDGE-BASED IN A SYSTEM ENGINEERING ENVIRONMENT WILL BE DETERMINED.

SOFTWELL ASSOCS INC
5 FLAGG LN
MILFORD, NH 03055
CONTRACT NUMBER:
DR SHAHRIAR MOVAFAGHI
TITLE:
UNIFIED LIFE CYCLE ENGINEERING (PART C) ULCE
TOPIC# 75 OFFICE: HSD/SORT IDENT#: 34663

IN THIS PROJECT, SOFTWELL ASSOCIATES, INC. SEEKS TO RESEARCH AND DEVELOP VARIOUS CONCEPTS APPLICABLE TO DATA/KNOWLEDGE INTEGRATION FOR DIVERSE ULCE (UNIFIED LIFE CYCLE ENGINEERING) AUTOMATED TOOLS IN DISTRIBUTED HETEROGENEOUS ENVIRONMENT. IN PHASE I, OUR GOAL IS TO DEVELOP THE FUNCTIONAL SPECIFICATION AND DESIGN OUTLINES FOR AN AUTOMATED TOOL FOR SEMANTIC DATA INTEGRATION PROCESSOR, NAMELY INTEGDATA. INTEGDATA SHALL NOT ONLY BE ABLE TO HANDLE DATA INTEGRATION FROM EACH CATEGORY OF TOOLS USED IN AN ULCE ENVIRONMENT, BUT SHALL ALSO BE ABLE TO HANDLE THE INTEGRATION OF DATA FROM THE SEVERAL TOOLS FOUND WITHIN A CATEGORY. OUR RESEARCH WILL INCLUDE A IN-DEPTH STUDY OF NEURAL NETWORKING AND ITS APPLICATION TO DATA INTEGRATION. THE PURPOSE IN CREATING INTEGDATA IS TO OVERCOME PROBLEMS ENCOUNTERED IN CURRENT IDEF SYSTEMS SUCH AS NEED FOR A GREAT DEAL OF MANPOWER TIME AND LACK OF SEMANTICS RICHNESS.

SOUTHWEST SCIENCES INC
1570 PACHECO ST - STE E-11
SANTA FE, NM 87501
CONTRACT NUMBER:
DR ALAN C STANTON
TITLE:
A NONINTRUSIVE DIAGNOSTIC FOR WATER VAPOR IN HIGH TEMPERATURE FLOW FIELDS
TOPIC# 255 OFFICE: AFSC/NAT IDENT#: 31306

SUBMITTED BY

A FAST-RESPONSE METHOD FOR MEASUREMENT OF WATER VAPOR CONCENTRATIONS IN HIGH TEMPERATURE FLOWS IS NEEDED FOR RESEARCH ON HYPERSONIC AIR-BREATHING ENGINES AS WELL AS OTHER APPLICATIONS IN COMBUSTION RESEARCH OR CONTROL. THE PROPOSED INNOVATION WILL UTILIZE INEXPENSIVE ROOM TEMPERATURE LASER DIODES TO MEASURE ABSORPTION BY WATER VAPOR AT NEAR-IR WAVELENGTHS. THESE LASERS WILL BE USED IN COMBINATION WITH HIGH FREQUENCY DETECTION TECHNIQUES TO DEVELOP A WATER VAPOR DIAGNOSTIC WITH HIGH SENSITIVITY, WIDE DYNAMIC RANGE, AND THE CAPABILITY FOR EXTREMELY FAST TIME RESPONSE. THE DIAGNOSTIC COULD ALSO BE USED FOR MEASUREMENT OF TEMPERATURE AND FLOW VELOCITY IN HYPERSONIC FLOWS. AN IMPORTANT CHARACTERISTIC OF THIS INNOVATION IS THAT THE MEASUREMENTS ARE NONINTRUSIVE. IN COMPARISON WITH OTHER POTENTIAL OPTICALLY-BASED METHODS FOR MEASURING WATER VAPOR CONCENTRATIONS, THE PROPOSED APPROACH USES EXCEPTIONALLY RELIABLE AND INEXPENSIVE LASER SOURCES WHICH CAN READILY BE COMBINED WITH FIBER OPTICS FOR MULTI-POINTING MONITORING. THE FEASIBILITY OF THE TECHNIQUE WILL BE DEMONSTRATED IN PHASE I BY MEASUREMENTS IN A ROOM TEMPERATURE ABSORPTION CELL AND IN THE POST-FLAME GASES OF A METHANE-AIR FLAME.

SPACE SCIENCES CORP
1101 MIDLAND AVE - STE 22
BRONXVILLE, NY 10708
CONTRACT NUMBER:
JAMES J FALLON
TITLE:
HIGH-SENSITIVITY SHORT AND MEDIUM WAVE INFRARED CAMERAS
TOPIC# 194 OFFICE: AFGL/XOP IDENT#: 31739

SPACE SCIENCES CORPORATION PROPOSES THE DEVELOPMENT OF HIGH PERFORMANCE INFRARED CAMERAS FOR SPACE-BORNE, AVIONIC AND GROUND BASED APPLICATIONS. COMMON SYSTEM LEVEL PERFORMANCE ISSUES ARE ADDRESSED INCLUDING OPTICS, DETECTOR TECHNOLOGY, CRYOGENIC COOLING SYSTEMS, VIDEO BANDWIDTH ANALOG TO DIGITAL CONVERTERS, AND IMAGE COMPENSATION PROCESSING FOR DETECTOR DARK CURRENT, RESPONSIVITY VARIATIONS, AND INSTRUMENT BACKGROUND. TARGET OBJECTS FOR EACH CLASS OF MISSION REQUIREMENTS ARE CLASSIFIED IN TERMS OF SPATIAL DISTRIBUTION AND SPECTRAL EMISSIONS. FOR EACH APPLICATION A BASELINE

SMALL BUSINESS INNOVATION RESEARCH (SBIR) PROGRAM - PHASE I
BY SERVICE
FISCAL YEAR 1989
AF

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SUBMITTED BY

SET OF MISSION DESIGN GOALS ARE ESTABLISHED WITH THE COMMENSURATE CLASS OF APPLICATION SPECIFIC TECHNOLOGICAL CHALLENGES ADDRESSED. UNIQUE AND INNOVATIVE SOLUTIONS ARE PROPOSED FOR REAL-TIME IMAGE COMPENSATION PROCESSING. ALSO A BRIEF SYNOPSIS IS GIVEN OF SPACE SCIENCES DEVELOPMENT OF THE Ptsi INFRARED TARGET TRACKER/RESOLVED RADIOMETER FOR THE SDIO STARLAB PROGRAM. PHASE I TASK A AND TASK B DEVELOPMENT EFFORTS ARE OUTLINED IN PRELIMINARY STATEMENTS OF WORK.

SPARTA INC
1055 WALL ST - STE 200
LA JOLLA, CA 92037
CONTRACT NUMBER: F08635-89-C-0391
GARY D WONACOTT
TITLE:
HIGH TEMPERATURE COMPOSITE WEAPONS
TOPIC# 3 OFFICE: AD/PMR IDENT#: 31077

STRAWMAN ROAD MAPS ARE BEING LAID OUT FOR IMPLEMENTATION IN THE MID TO LATE NINETIES OF MISSILE SYSTEMS (E.G., HAVE DASH) INCORPORATING COMPOSITE AIRFRAME STRUCTURES. IN SOME CASES, MATERIALS AND STRUCTURES HAVE BEEN IDENTIFIED AS A MISSION ENABLING TECHNOLOGY; HOWEVER, THERE IS NO COMPREHENSIVE PLAN TO DEVELOP LOW COST MATERIALS AND MANUFACTURING PROCESSES IN A TIMELY MANNER FOR INSERTION INTO PROTOTYPE AND FULL SCALE ENGINEERING DEVELOPMENT PROGRAMS. IN MOST CASES, NEITHER THE PRIMES NOR THE MATERIAL SUPPLIERS HAVE SUFFICIENT INSIGHT INTO THE MATERIALS AND MANUFACTURING REQUIREMENTS TO ESTABLISH A DIRECTION. TRADE STUDIES ARE URGENTLY NEEDED TO QUANTIFY PERFORMANCE PAYOFFS AND MANUFACTURING COSTS ASSOCIATED WITH ALTERNATIVE NEAR AND FAR TERM MATERIALS, DESIGN APPROACHES, AND MANUFACTURING STRATEGIES. A NEW COALITION IS REQUIRED BETWEEN THE GOVERNMENT LABORATORIES AND COMPANIES LIKE SPARTA WHO ARE INNOVATIVE AND WILLING TO ADVANCE HIGH PAYOFF, LOW COST MATERIALS AND MANUFACTURING APPROACHES TO INSURE THAT APPROPRIATE TECHNOLOGY IS DEVELOPED FOR FUTURE DOD WEAPON SYSTEMS.

SPARTA INC
16516 BERNARDO CENTER DR - STE 200F
SAN DIEGO, CA 92128
CONTRACT NUMBER: F19628-89-C-0151
DOUGLAS W CARMICHAEL
TITLE:
COMMAND CONTROL AND COMMUNICATIONS SYSTEMS/SUBSYSTEMS
TOPIC# 31 OFFICE: ESD/AVP IDENT#: 31585

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SPARTA IS PROPOSING TO DEFINE AND EVALUATE A SITUATION RECOGNITION CONCEPT THAT AFFORDS A NOVEL AND WE BELIEVE A PRACTICAL APPROACH TO USING EXISTING AND PROGRAMMED BATTLE MANAGEMENT COMMAND CONTROL AND COMMUNICATIONS, SURVEILLANCE SENSORS AND OTHER SPACE AND GROUND BASED SYSTEMS TO PROVIDE COMMON DISPLAYS IN THE MAJOR US COMMAND CENTER THAT WILL VARIOUS LEVELS OF DECISION MAKING AUTHORITY IN THE MANAGEMENT OF US STRATEGIC FORCES DURING A PERIOD OF CONFLICT. MUCH OF THE DATA FROM SURVEILLANCE SYSTEMS THAT COULD BE MADE AVAILABLE OVER EXISTING STRATEGIC COMMAND CONTROL AND COMMUNICATIONS SYSTEMS IS NOT BEING UTILIZED. US SENSORS HAVE THE CAPABILITY TO PROVIDE THE NCA AN EARLY ESTIMATE OF THE EFFECTIVENESS OF HIS ATTACKING FORCES AND WHICH HOSTILE TARGETS ARE AT RISK AND WHICH ARE UNCOVERED DUE TO LOSS OR MALFUNCTION OF US STRATEGIC FORCES. BASED ON THE PROPOSED SITUATION RECOGNITION INFORMATION THAT IS PROPOSED TO BE PROVIDED, A REALLOCATION OF US FORCES CAN BE MADE BASED ON TARGET PRIORITY.

SPARTA INC
23041 AVENIDA De La CARLOTA - STE 400
LAGUNA HILLS, CA 92653
CONTRACT NUMBER:
GARY FALACARA
TITLE:
A METHOD FOR DETERMINING THE RELIABILITY OF SATELLITE BASED EXPER
SYSTEMS
TOPIC# 186 OFFICE: AFSTC/XN IDENT#: 31731

MANY AREAS OF SATELLITE PROCESSING AND CONTROL HAVE BEEN FOUND TO LEND THEMSELVES WELL TO AN EXPERT SYSTEM APPROACH. HOWEVER, IT IS NOT PRUDENT TO USE A RULE-OF-THUMB ORIENTED EXPERT SYSTEM WITH POTENTIAL FOR ERROR AS A CRITICAL SATELLITE PROCESSING SOLUTION WITHOUT SOME METHOD OF VALIDATING THE EXPERT SYSTEM AND EVALUATING ITS RELIABILITY. RELIABILITY EVALUATION AND PREDICTION TECHNIQUES ARE DEPENDENT UPON A VALID METHODOLOGY FOR VERIFYING AND TESTING THE EXPERT SYSTEM. AN APPROACH IS PROPOSED THAT WILL PROVIDE AN INTEGRATION OF EXPERT SYSTEM VERIFICATION AND TESTING METHODOLOGIES WITH RELIABILITY MEASUREMENT AND PROJECTION. NEW TECHNIQUES WILL BE DEFINED AND EXISTING TECHNIQUES WILL BE REFINED THAT AS A UNIT

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ADEQUATELY VERIFY, TEST, AND DETERMINE THE RELIABILITY OF AN EXPERT SYSTEM. THE APPROACH WILL BE EMPIRICALLY ANALYZED USING EXPERIMENTAL DATA. THE PHASE I EFFORT WILL SPECIFY THE APPROACH, EMPIRICALLY ANALYZE THE APPROACH, AND PLAN FOR TESTING, FORMALIZATION, AND DOCUMENTATION OF THE APPROACH.

SPARTA INC
1104 CAMINO DEL MAR
DEL MAR, CA 92014
CONTRACT NUMBER: F33615-89-C-1102
JOHN J GLATZ
TITLE:
COMPLEX INTEGRATED CIRCUIT TECHNOLOGY - THERMAL MANAGEMENT MATERI
TOPIC# 86 OFFICE: AFWAL/AAOP IDENT#: 32822

SPARTA, INC. PROPOSES A PROGRAM TO ASSESS THE FEASIBILITY AND IMPLICATIONS OF USING ULTRA-HIGH THERMAL CONDUCTIVITY PITCH FIBERS (HIGH K) IN THE DISSIPATION OF VERY HIGH HEAT FLUXES GENERATED BY ADVANCED MICROCIRCUITS. THERE ARE THREE INNOVATIVE CONCEPTS TO THIS STUDY. FIRST, A SYSTEMS APPROACH WILL BE TAKEN TO ANALYZE THE PACKAGING REQUIREMENT (ELECTRICAL, THERMAL CONDUCTIVITY, DIELECTRIC CONSTANT) AND TRANSLATE THEM INTO MATERIAL PROPERTY GOALS. SECOND, GRAPHITE FIBER REINFORCED CERAMIC MATRIX COMPOSITES (CMC) AND GRAPHITE FIBER REINFORCED METAL MATRIX COMPOSITES (MMC) WITH CERAMIC COATINGS WILL BE CONSIDERED FOR MICROELECTRONIC PACKAGES MATERIALS. THIRD, MANUFACTURING FEASIBILITY STUDIES AND PROTOTYPE FABRICATION WILL BE CARRIED OUT TO ASSESS FABRICABILITY OF THESE NEW PACKAGING CONCEPTS. CMC AND MMC REINFORCED WITH HIGH K FIBER ARE IDEAL FOR THERMAL MANAGEMENT OF HIGH HEAT FLUX DEVICES. PACKAGES MADE FROM THIS MATERIAL WILL POSSESS VERY HIGH THERMAL CONDUCTIVITY (~400 W/M DEG C), LOW CTE (~4 ppm/DEG F) AND LOW DIELECTRIC CONSTANTS. FURTHERMORE, THE THERMAL CYCLING FATIGUE LIFE OF THE PACKAGE WILL BE EXTENDED DUE TO REDUCED CTE MIS-MATCH BETWEEN PACKAGE AND SUBSTRATE, AND REDUCED THERMAL GRADUENTS WITHIN THE PACKAGE. THE PROGRAM WILL CONSIST OF THE FOLLOWING BASIS: 1) IDENTIFICATION OF CANDIDATE COMPONENTS, 2) IDENTIFICATION OF CANDIDATE MATERIALS, 3) PARAMETRIC DESIGN ANALYSIS, 4) COMPOSITE MATERIAL CHIP CARRIER FABRICATION, 5) CERAMIC COATING OF CHIP CARRIER SPECIMEN, 6) DEPOSITION OF SILICON SUBSTRATE ON CERAMIC CHIP SURFACE, AND 7) TECHNOLOGY

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DEVELOPMENT PLAN.

SPARTA INC
23041 DE LA CARLOTA - STE 400
LAGUNA HILLS, CA 92653
CONTRACT NUMBER: F33615-89-C-3608
DR PIO DeFEO
TITLE:
METHODOLOGY DEVELOPMENT FOR VERIFICATION OF FLIGHT CRITICAL SYSTEM
SOFTWARE
TOPIC# 113 OFFICE: AFWAL/FIOP IDENT#: 33665

THE OBJECTIVE OF THE PROPOSED INNOVATION IS TO DEVELOP AN ENVIRONMENT WHICH SPECIFICALLY ADDRESSES THE TECHNOLOGY NEEDS OF HIGHLY INTEGRATED, FLIGHT CRITICAL SYSTEMS, LIKE THE VEHICLE MANAGEMENT SYSTEM (VMS), INCLUDING ARCHITECTURE DESIGN AND SOFTWARE REQUIREMENTS AND DESIGN. THE ENVIRONMENT INCLUDES SEVERAL PROMISING AND INNOVATIVE METHODS FOR: a) QUANTITATIVELY ASSESSING THE QUALITY OF THE SYSTEM ARCHITECTURE BY TAKING INTO ACCOUNT THE COMPLEXITY OF THE EMBEDDED SOFTWARE REQUIREMENTS AND DESIGN; b) ASSESSING THE SYSTEM REAL TIME PERFORMANCE BY MEASURING THE COMPUTATIONAL LOADS OF THE DISTRIBUTED PROCESSORS, THE EXECUTION AND TRANSMISSION TIMES, THE LENGTH OF TASKS QUEUE AND OTHER DYNAMIC AND STATISTICAL PARAMETERS; c) EVALUATING THE ADEQUACY OF THE TIME DISTRIBUTION OF COMPUTATIONAL AND TRANSPORT DELAYS AND VERIFYING THAT MAXIMUM DELAYS WHICH CAN DEVELOP DO NOT EXCEED VALUES BEYOND WHICH PERFORMANCE DEGRADATION MAY OCCUR; AND d) DEMONSTRATING THAT PARTITIONING IS ACHIEVED AMONG FUNCTIONS WITH DIFFERENT LEVELS OF CRITICALITY.

SPARTA INC
21 WORTHEN RD
LEXINGTON, MA 02173
CONTRACT NUMBER:
DR PHILIP D HENSHAW
TITLE:
COMPACT 4D OPTICAL NEURAL NETWORK ARCHITECTURE
TOPIC# 241 OFFICE: AFOSR/XOT IDENT#: 33984

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THIS PROPOSAL ADDRESSES THE DEVELOPMENT OF MASSIVE OPTICAL INTERCONNECT CAPABILITY IN A COMPACT CONFIGURATION FOR IMPLEMENTATION OF GENERAL PURPOSE NEURAL NETWORKS. THE METHOD DESCRIBED IN THIS PROPOSAL MAY BE ABLE TO ACHIEVE 10(12) INTERCONNECTS BETWEEN TWO FULLY-POPULATED PLANES OF 10(6) STATES. PSALTIS HAS PROPOSED USING VOLUME HOLOGRAMS FOR 3D OPTICAL INTERCONNECTS BETWEEN TWO PLANES. THIS METHOD IS SUBJECT TO AN IMPORTANT LIMITATION. AN INTERCONNECT VOLUME N WAVELENGTHS ON A SIDE HAS A MAXIMUM OF $N(3)$ "DEGREES OF FREEDOM" WHICH CAN BE USED TO SPECIFY INTERCONNECT WEIGHTS. THIS NUMBER IS LESS THAN THAT REQUIRED TO CONNECT TWO FULLY-POPULATED PLANES OF $N(2)$ ELEMENTS. PSALTIS HAS SOLVED THIS PROBLEM BY USING PARTLY-FILLED INPUT AND OUTPUT PLANES. WE PROPOSE THE USE OF LASER WAVELENGTHS AS A FOURTH DIMENSION. $N(4)$ INTERCONNECT WEIGHTS CAN BE WRITTEN IN A VOLUME MEDIUM PRODUCING THE DEGREE OF FREEDOM NEEDED TO CONNECT TWO TWO-DIMENSIONAL PLANES. OUR PHASE I GOAL WILL BE CHARACTERIZED THE PROPERTIES OF A 4D OPTICAL INTERCONNECT "BUILDING BLOCK" BASED ON CURRENT AND PROJECTED PROPERTIES OF SPECTRAL HOLE BURNING (SHB) MEDIA. THE PHASE II GOALS ARE (1) TO ADDRESS EXPERIMENTALLY THE KEY ISSUES ASSOCIATED WITH WRITING AND ERASING VOLUME HOLOGRAMS AT MULTIPLE WAVELENGTHS IN AN SHB MATERIAL, AND (2) TO DESIGN A COMPACT 4D INTERCONNECT DEVICE.

SPEC-TRAN CORP
50 HALL RD
STURBRIDGE, MA 01566
CONTRACT NUMBER:
DR DIPAK R BISWAS
TITLE:
NONLINEAR MATERIALS DEVELOPMENT FOR 0.8 AND 1.315 MICRONS
TOPIC# 200 OFFICE: AFWL/PRC IDENT#: 31853

STIMULATED PHOTON ECHOES HAVE BEEN RECOGNIZED AS MEANS BY WHICH PULSED COHERENT OPTICAL INFORMATION CAN BE STORED AND RETRIEVED USING FOUR-WAVEMIXING GEOMETRIES. STIMULATED ECHOES CAN BE TEMPORARILY AND SPATIALLY SEPARATED USING COUNTER-PROPAGATING EXCITATION GEOMETRIES, SUGGESTING THAT BACKWARD STIMULATED ECHOES CAN BE IMPLEMENTED IN OPTICAL PROCESSOR DESIGNS. THIS EFFECT IS UNIQUE TO INHOMOGENEOUSLY BROADENED ATOMIC SYSTEMS WHICH HAVE A FINITE NUMBER OF QUANTUM

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STATES COUPLED BY RESONANT INTERACTIONS, AND HAVE OFTEN BEEN OBSERVED IN OPTICALLY ACHIEVE RARE EARTH ION SYSTEMS. RECENTLY, FLUORIDE GLASSES HAVE SHOWN PARTICULAR PROMISE AS A HOST TO RARE EARTH IONS ACTIVE AT 1.3 MICRONS. THIS SUBMISSION PROPOSES USING A JUDD-OFELT ANALYSIS TO EXAMINE THE FEASIBILITY OF USING RESONANTLY DRIVEN RARE EARTH IONS DOPED IN HEAVY-METAL FLUORIDE GLASSES AS AN OPTICAL PROCESSOR MATERIAL AT 0.8 AND 1.315 MICRONS. IT WILL FOCUS ON THE ABILITY OF SELECTED HOSTS TO MEMORIZE PHASES OF THE CORRESPONDING OPTICAL FIELDS.

SPECTRAL SCIENCES INC
111 S BEDFORD ST
BURLINGTON, MA 01803
CONTRACT NUMBER:
DR ROBERT SUNDBERG
TITLE:
RV OPTICAL SIGNATURE PROGRAM
TOPIC# 220 OFFICE: BMO/MYSC IDENT#: 32641

THIS PROJECT ADDRESSES THE NEED FOR AN IMPROVED MODEL OF THE BODY-WAKE-PLUME OPTICAL SIGNATURE OF A REENTRY VEHICLE (RV). THE OVERALL OBJECTIVE OF PHASE I IS TO DEMONSTRATE THE FEASIBILITY OF ADAPTING EXISTING MODELS OF THE RV BODY SURFACE TEMPERATURE, BODY OPTICAL SIGNATURE AND NLTE RADIATIVE TRANSPORT INTO A ROBUST RV SIGNATURE PACKAGE. SPECIFIC PHASE I OBJECTIVES INCLUDE THE FOLLOWING IMPROVEMENTS TO RV SIGNATURE PREDICTION: (1) EXTENSION OF SIGNATURE PREDICTION CAPABILITY INTO THE NEAR IR, VISIBLE AND ULTRAVIOLET REGIMES, (2) INCORPORATION OF A NLTE RADIATIVE TRANSFER MODEL FOR HIGH ALTITUDES, AND (3) DEMONSTRATION OF A MORE ROBUST BODY OPTICAL SIGNATURE MODEL. THE INTEGRATION REQUIRED TO COMBINE THESE MODELS INTO A FULL BODY-WAKE-PLUME OPTICAL SIGNATURE MODEL WOULD BE PERFORMED IN PHASE II.

SPIRE CORP
PATRIOTS PARK
BEDFORD, MA 01730
CONTRACT NUMBER:
DR FERAYDOON NAMAVAR
TITLE:
VERY LOW DEFECT SIMOX FOR ANALOG DEVICES WITH NEUTRON TOLERANCE
TOPIC# 219 OFFICE: BMO/MYSC IDENT#: 32621

SUBMITTED BY

METHODS OF FORMING VIRTUALLY DEFECT-FREE SIMOX WAFERS (INCLUDING THICK EPITAXIAL Si LAYERS) FOR APPLICATION TO "TOTALLY RADIATION HARD" ANALOG INTEGRATED CIRCUITS WILL BE DEVELOPED. THE VERY THIN DEVICES REQUIRED FOR NEUTRON RADIATION HARDENED CIRCUITS POSE EVEN MORE STRINGENT Si QUALITY REQUIREMENTS THAN DO STANDARD ANALOG SUBSTRATE MATERIALS. PROGRAM EMPHASIS WILL BE ON PROVIDING SIMOX WAFERS TO A DESIGNATED RADIATION HARD ANALOG DEVICE FABRICATOR WHO WILL BUILD ANALOG CIRCUITS FOR TEST AND EVALUATION IN PERTINENT NEUTRON ENVIRONMENTS. SPIRE HAS DEVELOPED TWO METHODS OF REDUCING DISLOCATION DENSITY. THE FIRST PREVENTS FORMATION OF DISLOCATIONS, USING A MULTIPLE LOW DOSE IMPLANTATION AND HIGH TEMPERATURE ANNEALING PROCESS INSTEAD OF THE STANDARD SINGLE HIGH DOSE IMPLANTATION AND HIGH TEMPERATURE ANNEAL. MULTIPLE LOW DOSE IMPLANTATION REDUCES DISLOCATION DENSITY BY THREE TO FIVE ORDERS OF MAGNITUDE. THE SECOND METHOD REDUCES THE DENSITY OF ALREADY FORMED DISLOCATIONS BY IMPLANTATION OF Ge AND SUBSEQUENT SOLID PHASE EPITAXY REGROWTH; THIS DECREASES DISLOCATIONS AT THE Si SURFACE OF STANDARD SIMOX WAFERS BY TWO TO THREE ORDERS OF MAGNITUDE. WORK AT SPIRE HAS ALSO RESULTED IN THE DEVELOPMENT OF A PROCESS TO GROW HIGH QUALITY EPITAXIAL Si ON THE Si TOP LAYER OF SIMOX WAFERS.

SPIRE CORP
PATRIOTS PARK
BEDFORD, MA 01730
CONTRACT NUMBER:
DR NASSER KARAM
TITLE:
InP ON SIMOX FOR MONOLITHIC INTEGRATION OF RADIATION HARD DEVICES
TOPIC# 219 OFFICE: BMO/MYSC IDENT#: 32622

THE OBJECTIVE OF THE PROPOSED RESEARCH PROGRAM IS TO DEVELOP A PROCESS FOR HETEROEPITAXIAL DEPOSITION OF InP ON SILICON-ON-INSULATOR WAFERS BY METALORGANIC CHEMICAL VAPOR DEPOSITON (MOCVD). InP IS AN EXCEPTIONALLY PROMISING SEMICONDUCTOR MATERIAL FOR RADIATION-HARD, HIGH-SPEED, AND OPTOELECTRONIC DEVICES. ITS PROMISE STEMS FROM HIGH ELECTRON SATURATION VELOCITY, RADIATION RESISTANCE, AND ROOM TEMPERATURE DEFECT ANNEALING QUALITIES. SIMOX (SEPARATION BY IMPLANTATION OF OXYGEN) IS CAPABLE OF PRODUCING LARGE AREA, HIGH-

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FORCE BY PERMITTING RAPID NONDESTRUCTIVE EVALUATION OF NOZZLES NOT ONLY AT ALL STAGES OF MANUFACTURING AND ASSEMBLY, BUT ALSO IN OPERATIONAL UNITS. THIS WILL BE REFLECTED IN COST AND WEIGHT SAVINGS ARISING FROM SMALLER DESIGN MARGINS AND FROM DISCOVERY OF FLAWED MATERIAL EARLY IN THE MANUFACTURING CYCLE, AND IN GREATER MISSION-READINESS OF DEPLOYED NOZZLES. BECAUSE GAMMA SCATTERING IS AN EASILY ADAPTED GENERAL TECHNIQUE, MODIFIED VERSIONS OF THE SYSTEM PROPOSED HERE CAN FURTHER BENEFIT THE AIR FORCE AND ITS SISTER SERVICES AS AN INSPECTION TOOL FOR RELATED TYPES OF MATERIALS WHEREVER THEY ARE EMPLOYED. PHASE I WILL EXAMINE PERFORMANCE REQUIREMENTS AND TEST FOR FEASIBILITY, WITH EMPHASIS ON DEVELOPING A VERSATILE SYSTEM CAPABLE OF CHARACTERIZING SMALL DEFECTS AT VARYING DEPTHS. PENDING THE OUTCOME OF THESE TESTS, A PROTOTYPE INSPECTION SYSTEM WILL BE DEVELOPED AND TESTED IN PHASE II.

SPIRE CORP
PATRIOTS PK
BEDFORD, MA 01730
CONTRACT NUMBER: F33515-89-C-2933
MICHAEL J NOWLAN
TITLE:
LIGHTER MORE RADIATION RESISTANT GaAs SOLAR CELL ASSEMBLIES
THROUGH ELECTROSTATIC COVERGLASS BONDING
TOPIC# 139 OFFICE: AFWAL/POMP IDENT#: 33047

THE GOAL OF THIS PROGRAM IS TO DEVELOP A NOVEL ELECTROSTATIC BONDING (ESB) PROCESS FOR ATTACHING COVERGLASSES TO SPACE GALLIUM ARSENIDE (GaAs) SOLAR CELLS. IN THIS PROCESS, DIRECT CHEMICAL BONDS ARE FORMED BETWEEN THE GLASS AND THE TOP SURFACE OF THE CELL. SUCCESSFUL COMPLETION WOULD LEAD TO THE WORLD'S FIRST ADHESIVE-FREE GaAs CELL-GLASS ASSEMBLIES. SUCH ASSEMBLIES PROMISE TO PROVIDE SUBSTANTIAL IMPROVEMENTS IN RADIATION HARDNESS AND THERMAL STABILITY OVER CONVENTIONALLY GLASSED CELLS. DIRECT BONDING IS ALSO AMENABLE TO CERTAIN TECHNIQUES FOR REDUCING CELL POWER LOSS DUE TO FRONT SURFACE METALLIZATION SHADOWING. SURFACE GROOVES FORMED IN THE GLASS CAN BE USED TO REFLECT OR REFRACT LIGHT ONTO THE CELL'S ACTIVE AREA, THEREBY INCREASING CELL CONVERSION EFFICIENCY. RESEARCH IN PHASE I WILL TEST FEASIBILITY OF THE ESB PROCESS BY EXPERIMENTALLY INVESTIGATION THE BOND FORMATION PROCESS, TESTING THE BOND'S

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FORCE BY PERMITTING RAPID NONDESTRUCTIVE EVALUATION OF NOZZLES NOT ONLY AT ALL STAGES OF MANUFACTURING AND ASSEMBLY, BUT ALSO IN OPERATIONAL UNITS. THIS WILL BE REFLECTED IN COST AND WEIGHT SAVINGS ARISING FROM SMALLER DESIGN MARGINS AND FROM DISCOVERY OF FLAWED MATERIAL EARLY IN THE MANUFACTURING CYCLE, AND IN GREATER MISSION-READINESS OF DEPLOYED NOZZLES. BECAUSE GAMMA SCATTERING IS AN EASILY ADAPTED GENERAL TECHNIQUE, MODIFIED VERSIONS OF THE SYSTEM PROPOSED HERE CAN FURTHER BENEFIT THE AIR FORCE AND ITS SISTER SERVICES AS AN INSPECTION TOOL FOR RELATED TYPES OF MATERIALS WHEREVER THEY ARE EMPLOYED. PHASE I WILL EXAMINE PERFORMANCE REQUIREMENTS AND TEST FOR FEASIBILITY, WITH EMPHASIS ON DEVELOPING A VERSATILE SYSTEM CAPABLE OF CHARACTERIZING SMALL DEFECTS AT VARYING DEPTHS. PENDING THE OUTCOME OF THESE TESTS, A PROTOTYPE INSPECTION SYSTEM WILL BE DEVELOPED AND TESTED IN PHASE II.

SPIRE CORP
PATRIOTS PK
BEDFORD, MA 01730
CONTRACT NUMBER: F33515-89-C-2933
MICHAEL J NOWLAN

TITLE:
LIGHTER MORE RADIATION RESISTANT GaAs SOLAR CELL ASSEMBLIES
THROUGH ELECTROSTATIC COVERGLASS BONDING
TOPIC# 139 OFFICE: AFWAL/POMP IDENT#: 33047

THE GOAL OF THIS PROGRAM IS TO DEVELOP A NOVEL ELECTROSTATIC BONDING (ESB) PROCESS FOR ATTACHING COVERGLASSES TO SPACE GALLIUM ARSENIDE (GaAs) SOLAR CELLS. IN THIS PROCESS, DIRECT CHEMICAL BONDS ARE FORMED BETWEEN THE GLASS AND THE TOP SURFACE OF THE CELL. SUCCESSFUL COMPLETION WOULD LEAD TO THE WORLD'S FIRST ADHESIVE-FREE GaAs CELL-GLASS ASSEMBLIES. SUCH ASSEMBLIES PROMISE TO PROVIDE SUBSTANTIAL IMPROVEMENTS IN RADIATION HARDNESS AND THERMAL STABILITY OVER CONVENTIONALLY GLASSED CELLS. DIRECT BONDING IS ALSO AMENABLE TO CERTAIN TECHNIQUES FOR REDUCING CELL POWER LOSS DUE TO FRONT SURFACE METALLIZATION SHADOWING. SURFACE GROOVES FORMED IN THE GLASS CAN BE USED TO REFLECT OR REFRACT LIGHT ONTO THE CELL'S ACTIVE AREA, THEREBY INCREASING CELL CONVERSION EFFICIENCY. RESEARCH IN PHASE I WILL TEST FEASIBILITY OF THE ESB PROCESS BY EXPERIMENTALLY INVESTIGATION THE BOND FORMATION PROCESS, TESTING THE BOND'S

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QUALITY SUBSTRATES SUITABLE FOR HIGH-SPEED RADIATION-HARD DEVICES. COMPARED TO InP, SIMOX WAFERS HAVE VERY HIGH STRENGTH-TO-WEIGHT RATIO AND THERMAL CONDUCTIVITY. COMBINING THE TWO MATERIALS GROWING ON A SINGLE SUBSTRATE WOULD RESULT IN A HETEROSTRUCTURE WITH ALL THE POTENTIAL STRATEGIC MILITARY ADVANTAGES OF BOTH InP-ON-Si AND SOI. THIS RESEARCH EFFORT WILL DEVELOP A DEPOSITION PROCESS TO YIELD DEVICE QUALITY SINGLE CRYSTAL InP-ON-SIMOX, LEADING TO ADVANCED, RADIATION-HARD (NEUTRON TOLERANT) SUBSTRATES SUITABLE FOR FABRICATION OF RELIABLE ANALOG DEVICES. PHASE I WILL DEPOSIT SINGLE CRYSTALLINE InP ONTO SIMOX WAFERS AND CHARACTERIZE STRUCTURAL AND ELECTRICAL PROPERTIES OF THE FILMS. THIS WILL BE ACHIEVED BY COUPLING SPIRE'S EXPERIENCE IN PRODUCING HIGH-QUALITY SIMOX WAFERS WITH THAT OF DEPOSITING HIGH-QUALITY GaAs ON DIMOX AND InP-ON-Si. PHASE II WILL DEAL WITH OPTIMIZATION OF GROWTH PARAMETERS, DEMONSTRATION OF DEVICE QUALITY InP/SIMOX MATERIALS, AND FABRICATION OF InP/SIMOX MESFETS THAT CAN BE TESTED UNDER NEUTRON IRRADIATION FOR COMPARISON WITH THOSE FABRICATED DIRECTLY ON SILICON.

SPIRE CORP
PATRIOTS PK
BEDFORD, MA 01730
CONTRACT NUMBER:
DR CHARLES C BLATCHLEY
TITLE:
NDE OF ROCKET NOZZLES BY GAMMA RAY BACKSCATTERING
TOPIC# 228 OFFICE: BMO/MYSC IDENT#: 32696

EFFECTIVE NONDESTRUCTIVE EVALUATION (NDE) METHODS ARE NEEDED TO DETECT CRACKS, POROSITY, VOIDS, AND OTHER ANOMALIES IN ROCKET NOZZLES. NOZZLE MATERIALS HAVE DEMONSTRATED INCONSISTENT MECHANICAL PROPERTIES, FORCING RELIANCE ON LARGE DESIGN MARGINS OF SAFETY AND EXPENSIVE PROOF TESTING. OBJECTIVE OF THE PROPOSED RESEARCH IS TO REMEDY THIS WITH GAMMA RAY BACKSCATTER COUNTING. UNLIKE CONVENTIONAL RADIOGRAPHY OR RADIOMETRY, GAMMA BACKSCATTERING REQUIRES ACCESS TO JUST ONE SURFACE, AND THROUGH PROPER COLLIMATION CAN BE MADE TO IGNORE SURFACE FEATURES AND SENSE ONLY DEFECTS BURIED IN A COMPOSITE STRUCTURE. RUGGED DETECTORS AND ELECTRONICS SIMILAR TO THOSE REQUIRED FOR A HAND-HELD INSPECTION UNIT HAVE BEEN SUCCESSFULLY BOOSTED INTO SPACE. SUCCESSFUL DEVELOPMENT OF THIS NOVEL INSPECTION SYSTEM WILL BENEFIT THE AIR

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INTEGRITY AND STABILITY, AND MEASURING THE POST-BOND CELL PERFORMANCE. PHASE II WILL INVESTIGATE ASPECTS OF THE PROCESS REQUIRING MORE IN-DEPTH RESEARCH, AS IDENTIFIED IN THE PHASE I PROGRAM.

SPIRE CORP
PATRIOTS PK
BEDFORD, MA 01730
CONTRACT NUMBER: F33615-89-C-2934
DR CHARLES C BLATCHLEY
TITLE:
FLIGHT TEST ABLATION MONITORING OF NATIONAL AERO-SPACE PLANE (NAS
ENGINE COMPONENTS BY SURFACE LAYER ACTIVATION
TOPIC# 145 OFFICE: AFWAL/POMP IDENT#: 33142

DEVELOPMENT OF ENGINES CAPABLE OF PROPELLING VEHICLES AT HYPERSONIC SPEED REQUIRES MATERIALS AND DESIGNS CAPABLE OF PERFORMING IN EXTREME THERMAL ENVIRONMENTS. IN A PROTOTYPE VEHICLE IT WILL BE NECESSARY TO NON-OBTRUSIVELY INSTRUMENT THE ENGINE TO MONITOR PERFORMANCE, DURABILITY, AND STRUCTURAL INTEGRITY OF NEW COMPONENTS. SEVERAL TECHNIQUES FOR PRECISE IN-FLIGHT REMOTE MONITORING OF SURFACE LOSS WERE DEVELOPED BY SPIRE IN THE EARLY 1970s TO MEASURE ABLATION OF MISSILE NOSE CONES DURING REENTRY. ONE APPROACH, TERMED SURFACE LAYER ACTIVATION (SLA), USES RADIONUCLIDES PRODUCED BY PARTICLE ACCELERATOR BOMBARDMENT AS SURFACE MARKERS. ACTIVITY REDUCTION REMOTELY MEASURED BY A MINIATURIZED GAMMA RAY DETECTION SYSTEM IS USED TO DEDUCE THE AMOUNT OF SURFACE MATERIAL REMOVED WHILE IN FLIGHT IN REAL TIME. THIS APPROACH HAS SINCE BEEN FOUND TO BE IDEAL FOR UNOBTRUSIVE MEASUREMENT OF MICROMETER-SCALE WEAR IN OPERATING SYSTEMS, WITH SUCCESSFUL APPLICATION TO ENGINE COMPONENTS SUCH AS PISTONS, CYLINDERS, RINGS, LINERS, BEARINGS, CAMS, AND GEARS. THE PROPOSED RESEARCH WILL INVESTIGATE THE FEASIBILITY OF ADAPTING SLA TO IN-FLIGHT MONITORING OF CRITICAL ENGINE COMPONENTS IN HYPERSONIC VEHICLES.

SPIRE CORP
PATRIOTS PK
BEDFORD, MA 01730
CONTRACT NUMBER: F33615-89-C-3209
DR PIRAN SIOSHANSI
TITLE:
IMPROVED ELEVATED-TEMPERATURE FATIGUE LIFE BY ION BEAM PROCESSES
TOPIC# 110 OFFICE: AFWAL/FIOP IDENT#: 33627

SUBMITTED BY

ION IMPLANTATION IS AN EFFECTIVE PROCESS TO CREATE COMPRESSIVE STRESS IN THE SUBSURFACE REGIONS OF METALLIC COMPONENTS AND THEREBY ENHANCE THEIR RESISTANCE TO FATIGUE-INITIATED FAILURES. ION IMPLANTATION OF LIGHT INTERSTITIAL IONS (SUCH AS BORON, CARBON, OR NITROGEN) INTO TITANIUM-BASED ALLOYS (OR FERROUS ALLOYS) IS A MICROSCOPIC SHOT PEENING PROCESS THAT TENDS TO REMOVE THE GRAIN BOUNDARIES AND CREATES TREMENDOUS COMPRESSIVE STRESS ON THE SURFACE OF TREATED COMPONENTS. THE CHANGES IN CRYSTAL STRUCTURE AND THE RESIDUAL STRESS ARE THE UNDERLYING REASONS FOR THE SLOWDOWN IN THE CRACK INITIATION PHASE AND CRACK PROPAGATION MODE. THE FATIGUE-RESISTANCE INITIATED BY ION IMPLANTATION IS STABLE AT HIGH TEMPERATURES. IN ADDITION THE PROCESS HAS BEEN SHOWN TO BE VERY EFFECTIVE TO MINIMIZE GALLING, FRETTING FATIGUE (ESPECIALLY IN TITANIUM BASED ALLOYS) AND NOTCH CREATION (IN HANDLING OF TITANIUM ALLOYS) THAT CAN GIVE RISE TO FATIGUE FAILURE. CONVENTIONAL ALPHA AND BETA TITANIUM ALLOYS AND ESPECIALLY THE HIGH TEMPERATURE ALUMINIDE (TiAl AND Ti(3)Al) ALLOYS WILL BE ION IMPLANTED IN THIS PROGRAM. CHANGES IN COMPRESSIVE STRESS WILL BE QUANTITATIVELY EVALUATED. FATIGUE PROPERTIES WILL BE MEASURED AS WELL AS ANY CHANGES IN OTHER MECHANICAL AND CHEMICAL PROPERTIES.

SPIRE CORP
PATRIOTS PK
BEDFORD, MA 01730
CONTRACT NUMBER: F04701-89-C-0054
PING-HUNG LU
TITLE:
PERSONAL ALARM THIN-FILM CONDUCTING-POLYMER HYDRAZINE EXPOSURE
SENSOR (PATCHES)
TOPIC# 171 OFFICE: AFSTC/OLAB IDENT#: 34363

A SENSING DEVICE IS REQUIRED FOR THE DETECTION OF TOXIC HYPERGOLIC PROPELLANTS (HYDRAZINE, MONOMETHYL HYDRAZINE, UNSYMMETRICAL DIMETHYLHYDRAZINE) FOR THE SAFETY PROTECTION OF PROPELLANT HANDLERS WHO WORK ON SPACE LAUNCH OPERATIONS. SPIRE CORPORATION PROPOSES TO DEVELOP A TOXIC VAPOR DETECTOR BASED ON REAGENT-INDUCED CONDUCTIVITY MODIFICATION OF A DOPED, CONDUCTING POLYTHIOPHENE LANGMUIR-BLODGETT THIN FILM. THE GOAL IS A STABLE, INEXPENSIVE, MICRO-SIZED DEVICE WITH THE POTENTIAL OF ELECTROCHROMIC DISPLAY THAT CAN SENSITIVELY

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AND SELECTIVELY DETECT TOXIC HYPERGOLIC PROPELLANT COMPONENTS. THE PROPOSED PATCHES INSTRUMENT WOULD CONSIST OF TWO COMPLEMENTARY MODULES: (1) A SUPPORTED CONDUCTING POLYMER WITH APPROPRIATE ELECTRICAL CONNECTIONS, AND (2) AN ELECTRICAL MEASUREMENT AND DATA ANALYSIS UNIT. THE BASIC OPERATIONAL PRINCIPLE IS THE EXPOSURE OF DOPED POLYMERS TO SPECIFIC CHEMICAL REAGENTS PRODUCES A CONDUCTIVITY CHANGE PROPORTIONAL TO BOTH REAGENT CONCENTRATION AND LENGTH OF EXPOSURE. PHASE I WOULD PROVIDE A LABORATORY PROOF-OF-CONCEPT DEMONSTRATION OF THE PATCHES AND ESTABLISH THE DESIGN PARAMETERS FOR A BREADBOARD PATCHES INSTRUMENT TO BE CONSTRUCTED IN PHASE II.

SRS TECHNOLOGIES
1500 QUAIL ST - STE 350
NEWPORT BEACH, CA 92660
CONTRACT NUMBER:
DR MICHAEL SHORT
TITLE:
WARHEAD VERIFICATION USING X-RAY TECHNIQUES UNDER START
TOPIC# 209 OFFICE: BMO/MYSC IDENT#: 32568

ON-SITE VERIFICATION HAS EMERGED AS AN INTEGRAL PART OF ANY AGREEMENT REACHED BETWEEN THE UNITED STATES AND THE SOVIET UNION UNDER THE STRATEGIC ARMS REDUCTION TALKS (START). THIS IS AN ESPECIALLY IMPORTANT CONSIDERATION WHEN FORMULATING OPERATIONAL PROCEDURES FOR THE IMPLEMENTATION OF REENTRY VEHICLE (RV) COUNTING RULES. CONFIRMATION OF THE NUMBER OF RVs ON A DEPLOYED MISSILE SYSTEM REQUIRES PHYSICAL INSPECTION OF THE FINAL STAGE PROVIDING FIRST-HAND KNOWLEDGE OF RV SHAPE, SIZE AND MATERIAL COMPOSITION, AS WELL AS INFORMATION OF OTHER SUBSYSTEMS. USE OF A REMOTE SENSING INSTRUMENT WHICH COULD SCAN WEAPON SYSTEMS TO DETECT AND COUNT THE NUMBER OF NUCLEAR WARHEADS PRESENTS AN ADVANTAGEOUS ALTERNATIVE FOR RV VERIFICATION. THIS INSTRUMENT WOULD PERFORM FUNCTIONAL TESTING WITHOUT REQUIRING DISASSEMBLY OF THE WEAPON SYSTEM AND COULD BE SUFFICIENTLY SIMPLE SO AS TO NOT ALTER THE WEAPON SYSTEM ALERT STATE. IT WOULD FIT WITHIN THE FRAMEWORK OF CURRENT PROPOSALS, ACCOMPLISH VERIFICATION CHEAPLY AND EASILY AND WOULD PROVIDE A PERMANENT DATA RECORD OF EACH VERIFICATION MEASUREMENT.

SSG INC
150 BEAR HILL RD
WALTHAM, MA 01760
CONTRACT NUMBER: F04701-89-C-0058
WALLACE K WONG
TITLE:
INNOVATIVE CONCEPTS FOR IMPROVED SPACE OBJECT SURVEILLANCE AND CLASSIFICATION
TOPIC# 176 OFFICE: AFSTC/OLAB IDENT#: 34395

SUBMITTED BY

SSG, INC. PROPOSES TO INVESTIGATE THE ISSUES ASSOCIATED WITH STRAYLIGHT REJECTION FOR A SPACE-BASED, ON-AXIS, RE-IMAGING TELESCOPE FOR SPACE OBJECT SURVEILLANCE. THE INVESTIGATION WILL INCLUDE (1) REVIEW OF THE MISSION AND PLATFORM REQUIREMENTS TO VALIDATE THE VISIBLE SENSOR SYSTEM REQUIREMENTS AND CONCEPTUAL CENTERED TELESCOPE OPTICAL DESIGN; (2) OFVR ANALYSIS AND PREDICTION OF SUCH SYSTEM; (3) ASSESSMENT OF POTENTIAL TELESCOPE CONTAMINATION AND TECHNIQUES FOR CONTAMINANT DETECTION, PREVENTION, AND REMOVAL; (4) VISIBLE OFVR TESTING OF A BRASSBOARD TELESCOPE MODIFIED TO SIMULATE AN ON-AXIS TELESCOPE.

ST&E INC
1233 QUARRY LN - STE 145
PLEASANTON, CA 94566
CONTRACT NUMBER: F41622-89-C-0017
DR STANLEY M KLAINER
TITLE:
FIBER OPTIC CHEMICAL SENSORS (FOCS) FOR REAL TIME MONITORING OF
HYDRAZINE IN WATER
TOPIC# 70 OFFICE: HSD/SORT IDENT#: 34752

A FIBER OPTIC CHEMICAL SENSOR (FOCS) IS PROPOSED FOR IN-SITU DETECTION OF HYDRAZINE IN WATER. IN PHASE I, BOTH FLUORESCENCE AND ABSORBANCE TECHNIQUE WILL BE USED TO OBTAIN A PROTOTYPE WORKING SENSOR. IN THE FIRST METHOD, THE FLUORESCENCE OF YELLOW COLORED AZINE (EXCITATION 466 nm; EMISSION 546 nm) PRODUCED BY THE REACTION OF HYDRAZINE WITH 4-DIMETHYLAMINO BENZALDEHYDE WILL BE USED. IN THE SECOND METHOD, ABSORBANCE OF ORANGE YELLOW CUPROUS NEOCUPROINE CHELATE (MAX. 458 nm) THAT IS PRODUCED FROM HYDRAZINE - COPPER(II) NEOCUPROINE REACTION WILL BE MONITORED. IN BOTH APPROACHES, THE COLORED PRODUCTS ARE EXPECTED TO FOLLOW BEER'S LAW OF LINEARITY AND HENCE IT WILL BE POSSIBLE TO OBTAIN HYDRAZINE CONCENTRATIONS IN UNKNOWN SAMPLES USING A CALIBRATION CURVE. THE BEST WORKING OF THE ABOVE REACTIONS WILL BE CHOSEN FOR ADAPTATION TO SOLID STATE FOCS DURING PHASE II.

STATCON INC
2208 COUNTRYSIDE DR
SILVER SPRING, MD 20910
CONTRACT NUMBER:
MARK J BERAN
TITLE:
ANTENNA PULSE PATTERN SYNTHESIS IN A COMPLEX MEDIUM
TOPIC# 44 OFFICE: RADC/XPX IDENT#: 31492

SUBMITTED BY

WE PROPOSE TO STUDY TWO EFFECTS THAT RESULT FROM THE INTERACTION OF AN ELECTROMAGNETIC BEAM AND A MEDIUM WITH VARIABLE REFRACTIVE PROPERTIES. THE FIRST EFFECT IS THE BEAM SCATTERING THAT OCCURS BECAUSE THE INDEX OF REFRACTION IS A RANDOM FUNCTION OF POSITION AND TIME. THE SECOND EFFECT IS THE NONLINEAR INTERACTION THAT OCCURS WHEN A BEAM OF HIGH INTENSITY CAUSES THE MEDIUM TO LOCALLY CHANGE ITS INDEX OF REFRACTION. IN PHASE I THE TWO EFFECTS WILL BE STUDIED INDEPENDENTLY WHILE IN PHASE II THE MUTUAL INTERACTION WILL BE CONSIDERED. THE THEORY TO STUDY THE RANDOM SCATTERING IS WELL DEVELOPED FOR CW RADIATION. KNOWN RESULTS WILL BE SUMMARIZED TO SHOW HOW APERTURE DISTRIBUTIONS MAY BE SYNTHESIZED TO OVERCOME DEFOCUSING OF THE RANDOM MEDIUM. RESEARCH WILL BE UNDERTAKEN TO SHOW IF THE SAME TECHNIQUES CAN BE APPLIED TO FOCUS-WAVE PULSES. THE THEORY TO TREAT THE NONLINEAR INTERACTION IS STILL NOT TOO WELL DEVELOPED EXCEPT FOR VERY SIMPLE ASSUMPTIONS ABOUT THE INTERACTION. IN PHASE I WE SHALL SUMMARIZE THE CURRENT THEORY AND PRESENT CALCULATIONS FOR A SIMPLE TIME-INDEPENDENT INTERACTION. FINALLY, WE SHALL DETERMINE IF IT IS FEASIBLE TO DEVELOP A WORKABLE THEORY TO CONSIDER THE TIME-DEPENDENT INTERACTION.

STR CORP
10805 PARKRIDGE BLVD
RESTON, VA 22091
CONTRACT NUMBER: F41622-89-C-0021
DR W L GOODSON
TITLE:
NEURAL NETWORK FOR THE ASSESSMENT OF TACTICAL SITUATIONAL
AWARENESS IN THE AIR-TO-AIR MISSION
TOPIC# 77 OFFICE: HSD/SORT IDENT#: 34802

THE ABILITY TO ASSESS THE LEVEL OF SITUATION AWARENESS (SA) IN REAL TIME IS OF VITAL IMPORTANCE TO AVIATORS IN COMBAT, BECAUSE SA IS A KEY FACTOR IN RISK EVALUATION. NEURAL NETWORK TECHNOLOGY, WITH ITS ABILITY TO RAPIDLY ANALYZE NOISY MULTIVARIATE DATA, HOLDS GREAT PROMISE IN ENHANCING THE PROCESSING OF TACTICAL INFORMATION -- AND ULTIMATELY FOR ESTIMATING SA. THIS PROPOSAL DESCRIBES A METHODOLOGY FOR USING A HYBRID NEURAL NETWORK/EXPERT SYSTEM ENVIRONMENT TO CREATE A "TACTICS ADVISOR" SUBSYSTEM FOR THE MISSION MANAGEMENT SYSTEM OF AN

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ADVANCED TECHNOLOGY FIGHTER. THE TWO VERSUS TWO COMBAT INTERCEPT, THE CORNERSTONE OF AIR COMBAT MANEUVERING (ACM) EFFECTIVENESS, WILL BE THE TASK UNDER EXAMINATION. THE PROPOSED SYSTEM WILL INTEGRATE INFORMATION RECEIVED FROM MULTIPLE SOURCES, AND COMPARE THIS DATA WITH THE LEVEL OF INFORMATION JUDGED TO BE REQUIRED AT THAT POINT IN THE MISSION. AFTER ANALYSIS IS COMPLETE, THE LEVEL OF SITUATIONAL AWARENESS WILL BE ESTIMATED, AND A MISSION-SENSITIVE, TACTICAL RECOMMENDATION WILL BE GENERATED. A COMPLETE PROTOTYPE SIMULATION OF THIS PROCESS WILL BE PROGRAMMED IN THE C LANGUAGE ON A MINICOMPUTER. IN ADDITION, THE HUMAN FACTORS IMPLICATIONS OF THE RESEARCH WILL BE DISCUSSED.

STRATEGY TECHNOLOGY & SPACE INC
8 GALLERIA DR
SAN ANTONIO, TX 78257
CONTRACT NUMBER: F04701-39-C-0064
DR FRANCIS X KANE

TITLE:
INNOVATIVE CONCEPTS FOR FORCE SUPPORT FROM SPACE HIGH INTENSITY
CONFLICT IN NATO EUROPE
TOPIC# 179 OFFICE: AFSTC/OLAB IDENT#: 34493

ALTHOUGH SPACE SYSTEMS NOW PROVIDE SUPPORT FOR OPERATIONAL MILITARY FORCES, MUCH IMPROVEMENT IN THIS SUPPORT IS POSSIBLE AND NECESSARY IF AIR AND LAND BATTLE COMMANDERS ARE TO FIGHT OUTNUMBERED AND WIN. IN THE FINAL ANALYSIS, DECISIONS WHICH DETERMINED THE OUTCOME OF BATTLE ARE BASED ON INFORMATION PROVIDED TO THE COMMANDER. THE WAR FIGHTING CINCS AND THEIR SUBORDINATE COMMANDERS NEED IMPROVED MEANS OF DATA COLLECTION, DATA FUSION AND DISPLAY OF DATA TO FACILITATE THE COMMANDER'S DECISION-MAKING CAPABILITY. ALSO, THEY NEED DEDICATED SATELLITES AND RELATED GROUND-SUPPORT FACILITIES IN ADDITION TO THE MULTI-USER SATELLITE CURRENTLY AVAILABLE, SINCE THERE WILL BE COMPETING DEMANDS MADE ON THE LATTER BY MANY AGENCIES IN TIME OF WAR. A METHODOLOGY IS PROPOSED TO DEFINE CONCEPTS AND INSURE THAT RESULTING SYSTEMS ARE FEASIBLE, AFFORDABLE, AND USEFUL TO COMMANDERS.

STRESS TECHNOLOGY INC
1800 BRIGHTON-HENRIETTA TOWN LINE RD
ROCHESTER, NY 14623
CONTRACT NUMBER: F33615-89-C-2936
DR NEVILLE F RIEGER

TITLE:
COMPRESSOR SYSTEM DESIGN METHODOLOGY
TOPIC# 157 OFFICE: AFWAL/POMP IDENT#: 33245

SUBMITTED BY

A PROGRAM TO FURTHER THE DEVELOPMENT OF A COMPUTER BASED DESIGN ANALYSIS CODE FOR COMPRESSOR SYSTEMS IS PROPOSED TO ASSIST THE UNITED STATES AIR FORCE IDENTIFY NEXT GENERATION ENGINES WITH IMPROVED THRUST TO PERFORMANCE RATIOS. IN PHASE I, A METHODOLOGY FOR THE APPLICATION OF ADVANCED TECHNIQUES TO ACCURATELY DESCRIBE THE EFFECTS OF EXTERNAL FLOW RELATED PHENOMENA ON COMPRESSOR BLADE LIFE IS PRESENTED. PHASE I WILL DEMONSTRATE A METHODOLOGY USED TO CHARACTERIZE THE DYNAMIC RESPONSE OF COMPRESSOR BLADES TO THE FLOW FORCES OF THE SYSTEM GAS PATH. THE WORK REPRESENTS AN EXTENSION OF A COMPUTER PROGRAM DEVELOPED BY STI WHICH IS CAPABLE OF EVALUATING BLADE DESIGN RELIABILITY BASED ON DESIGN, MATERIALS AND LOADING. PHASE I WILL CONCLUDE WITH A DEMONSTRATION OF A BLADE DYNAMIC RESPONSE CAPABILITY USING AN AIR FORCE COMPRESSOR BLADE DESIGN PRE-PROCESSOR ALSO PREPARED BY STI. BASED ON THE SUCCESS OF THE DEMONSTRATION, PHASE II WILL EXTEND THE CONCEPTS AND TECHNIQUES DEMONSTRATED IN PHASE I BY AUTOMATING THE PROCEDURE AS A MENU-DRIVEN, STAND-ALONE PROGRAM FOR COMPRESSOR BLADE DESIGN EVALUATION AND LIFE PREDICTION. CODE VERIFICATION TECHNIQUES WITH TEST DATA WOULD BE INCLUDED AS PART OF THE SUBSEQUENT PHASE.

STRUCTURAL INTEGRITY ASSOCS
3150 ALMADEN EXPWY - STE 226
SAN JOSE, CA 95118
CONTRACT NUMBER: F33615-89-C-3213
AN-YU KUO

TITLE:
FATIGUE CRACK GROWTH RETARDATION/ACCELERATION EFFECTS IN ELEVATED
TEMPERATURE ENVIRONMENTS
TOPIC# 114 OFFICE: AFWAL/FIOP IDENT#: 33671

AN EFFORT IS PROPOSED TO DEVELOP A FRAMEWORK FOR THE MODELING OF FATIGUE CRACK GROWTH RETARDATION AND ACCELERATION IN THERMAL-MECHANICAL AEROSPACE FLIGHT ENVIRONMENTS. THE PROPOSED TASKS INCLUDE REVIEW OF EXPECTED LOAD/STRESS AND TEMPERATURE PATTERNS, CANDIDATE MATERIALS AND AVAILABLE MATERIAL PROPERTIES; DEVELOPMENT OF A CANDIDATE CRACK GROWTH MODEL; DEFINITION OF THE TEST PROGRAM NEEDED TO VALIDATE THE MODEL; AND DEVELOPMENT OF A SOFTWARE SPECIFICATION TO INCORPORATE THE MODEL INTO CURRENT ANALYTICAL TOOLS.

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THE END PRODUCT OF THE RESEARCH, PHASE I AND II, WILL BE A SOFTWARE PACKAGE FOR PREDICTING FATIGUE CRACK GROWTH BEHAVIOR THAT ACCOUNTS FOR THE EFFECTS OF CRACK GROWTH RETARDATION AND ACCELERATION IN ELEVATED TEMPERATURE, THERMO-MECHANICAL ENVIRONMENTS.

STRUCTURED SYSTEMS & SOFTWARE INC (3S)
23141 PLAZA POINTE DR
LAGUNA HILLS, CA 92653
CONTRACT NUMBER:
JAMES DANAHER
TITLE:
GPS TRANSLATOR RECORD RELAY AND INTERFACE
TOPIC# 183 OFFICE: SAMTO/XO IDENT#: 31705

S3 WILL RESEARCH LOWER COST WAYS OF RECORDING, RELAYING AND INTERFACING GPS TRANSLATOR DATA AT CONVENTIONAL TELEMETRY RECEIVER/RECORD SITES. THE SUCCESS OF THE PROPOSED RESEARCH WILL RESULT IN GROUND PROCESSING OF GPS TRANSLATOR SIGNALS THAT WILL COST A SMALL FRACTION OF CURRENT SYSTEMS. LOWER COST HANDLING OF GPS TRANSLATOR DATA WILL BE OF IMPORTANCE TO A WIDE VARIETY OF POTENTIAL GOVERNMENT USERS FOR GPS TRANSLATOR DATA. THE PHASE I EFFORT WILL RESULT IN A COMPLETE DESIGN FOR A SYSTEM THAT WILL PERFORM GPS TRANSLATOR SIGNAL RECEIVE, RELAY, RECORD AND INTERFACE. THE RECORD CAPABILITY WILL USE CONVENTIONAL ANALOG TELEMETRY RECORDERS THAT ARE TYPICALLY AVAILABLE AT MOST TEST RANGES. A MICROWAVE RELAY OF TRANSLATOR DATA WILL BE SUPPORTED OVER A CHANNEL THAT HAS A 7.5 MHZ SUB-CARRIER, 1.3 MHZ BANDWIDTH AND 3 DEGREE PHASE JITTER.

SUNOL SCIENCES CORP
6400 VILLAGE PKWY
DUBLIN, CA 94568
CONTRACT NUMBER:
P S SPANGLER
TITLE:
SHOCK FOCUSING IN SPIKE NOSE-TIPS
TOPIC# 209 OFFICE: BMO/MYSC IDENT#: 32529

SPIKE NOSE-TIPS CAN GREATLY IMPROVE THE REENTRY PERFORMANCE OF

SMALL BUSINESS INNOVATION RESEARCH (SBIR) PROGRAM - PHASE 1
BY SERVICE
FISCAL YEAR 1989
AF

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SUBMITTED BY

ADVANCED REENTRY VEHICLES AND/OR ASSOCIATED PENETRATION AIDS. HOWEVER, EXPOSURE TO A NUCLEAR ENVIRONMENT CAN PRODUCE RADIA STRESSES WHICH CAN BE MAGNIFIED BY A FACTOR OF 10 OR MORE AS THESE STRESSES PROPAGATE TOWARD THE SPIKE AXIS. AN INNOVATIVE ANALYTIC TECHNIQUE IS PROPOSED WHICH YIELDS A CLOSED-FORMS SOLUTION FOR THE PEAK RADIAL STRESSES NEAR THE AXIS. THIS SOLUTION IS BASED ON FIRST PHYSICAL PRINCIPLES AND WILL COMPUTE THE RADIAL STRESS WITH A PRECISION DEPENDENT ONLY ON THE KNOWLEDGE OF THE MATERIAL PROPERTIES. THIS TECHNIQUE WILL PROVIDE A CLEAR PHYSICAL PICTURE OF THE SHOCK-FOCUSING PROCESS AND A DIRECT IDENTIFICATION OF KEY MATERIAL PROPERTIES AND DIMENSIONS WHICH AFFECT SURVIVABILITY.

SURFACE OPTICS CORP
PO BOX 261602 - 9929 HIBERT ST/STE C
SAN DIEGO, CA 92131
CONTRACT NUMBER: F40600-89-C-0011
DR JOHN T NEU
TITLE:
IN SITU OPTICAL PROPERTY MEASUREMENT SYSTEM
TOPIC# 26 OFFICE: AEDC/PKP IDENT#: 38867

SURFACE OPTICS CORPORATION PROPOSES A STUDY PROGRAM LEADING TO THE DEVELOPMENT OF A PORTABLE REFLECTOMETER SUITED FOR IN SITU MEASUREMENTS OF SURFACES UNDER FIELD CONDITIONS, SUCH AS THOSE OF AIRCRAFT, ARMORED VEHICLES, BUILDINGS AND BACKGROUND OBJECTS. THE INSTRUMENT IS ENVISIONED TO CONSIST OF A CONTROL STATION AND ONE OR MORE MEASUREMENT HEADS TO PROVIDE THE HEMISPHERICAL EMITTANCE AND BIDIRECTIONAL REFLECTANCE DISTRIBUTION FUNCTION (BRDF) OVER THE WAVELENGTH RANGE FROM 2.0 TO 9.0 MICROMETERS. THE INSTRUMENT WILL BE AUTOMATED AND CONTROLLED BY A COMPUTER LOCATED IN A CONTROL STATIONS. PHASE I OF THE PROPOSED EFFORT WILL FOCUS ON THE CONCEPTUAL DESIGN OF THE INSTRUMENT, THE RESOLUTION OF TECHNICAL PROBLEMS, AND ON AN EVALUATION OF TRADEOFFS. WHILE THE DESIGN OF THE BRDF INSTRUMENT MEASUREMENT HEAD IS STRAIGHTFORWARD AND MAY BE ADAPTABLE FOR HEMISPHERICAL EMITTANCE MEASUREMENTS, THE LATTER MAY BE MORE READILY ACCOMPLISHED BY A SEPARATE HEAD. OTHER TRADEOFFS INVOLVE THE QUESTION OF WHETHER TO MEASURE EMITTANCE DIRECTLY, OR MEASURE REFLECTANCE AND DERIVE HEMISPHERICAL EMITTANCE THEREFROM. PHASE I WILL CONCLUDE WITH THE PREPARATION OF A FINAL REPORT, INCLUDING

SUBMITTED BY

DRAWINGS AND A FABRICATION PLAN FOR PHASE II.

SYNCHRONETICS INC
PO BOX 793
HANOVER, MD 21076
CONTRACT NUMBER: F33615-89-C-5734
EDWIN R ADDISON
TITLE:
A NATURAL LANGUAGE INTERFACE FOR DISTRIBUTED HETEROGENEOUS
DATABASES FOR AIR FORCE APPLICATIONS
TOPIC# 134 OFFICE: AFWAL/MLK IDENT#: 33737

TO AUTOMATICALLY RESOLVE AND PROCESS DATA TO APPLICATIONS REGARDLESS OF THE SOURCE REQUIRES THE USE OF MULTIPLE DISPARATE DATABASES AND DISTRIBUTED INFORMATION SYSTEMS. TO STORE AND EXTRACT INFORMATION FROM SUCH SOURCES, INCLUDING RELATIONAL, HIERARCHIAL AND DISTRIBUTED DATABASES AS WELL AS OTHER SOURCE (I.E. TEXT FILES, HYPERMEDIA, SPREADSHEETS), USERS ARE FORCED TO LEARN A PLETHORA OF DIFFERENT LANGUAGES AND ACCESS METHODS. TO ALLEVIATE THIS DIFFICULTY, WE PROPOSE A COMMON TRANSPORTABLE NATURAL LANGUAGE INTERFACE (TNLI) WHICH WILL TRANSLATE ENGLISH LANGUAGE USER REQUESTS TO STORE OR RETRIEVE RELAVANT INFORMATION VIA NETWORKING TO OR FROM ALL THE DATABASES. THE OBJECTIVE IS TO MAKE AVAILABLE LARGE VOLUMES OF DISPARATE INFORMATION IN A USER-FRIENDLY MANNER. THIS APPROACH RENDERS THE ENTIRE INFORMATION SYSTEM A "VIRTUAL COMMON MEMORY DATA PROCESSOR"--THERE IS ABSOLUTELY NO NEED FOR A CUSTOM MACHINE TO BE BUILT. A TRANSPORTABLE FRONT END INDEPENDENT OF THE DATABASES WILL PRODUCE LOGICAL FORM FRAGMENTS (LFFs) THAT ARE FED TO A PLANNER. THEN THE PLANNER USES KNOWLEDGE OF THE DATABASE SEMANTICS AND THE LFF TO DIRECT QUERIES TO EACH APPLICABLE DATAPASE.

SYSTEMS EVALUATION LAB IN FLIGHT CORP
PO BOX 7836
VAN NUYS, CA 91409
CONTRACT NUMBER:
PHILIP ROGERS
TITLE:
AIRBORNE TESTING OF ACTIVE APERTURE ARRAYS
TOPIC# 46 OFFICE: RADC/XPX IDENT#: 31503

SUBMITTED BY

A PRELIMINARY DESIGN STUDY IS PROPOSED TO CREATE A PALLETIZED ACTIVE APERTURE ARRAY TEST INSTALLATION IN A WIDEBODY AIRCRAFT. SYSTEMS EVALUATION LABORATORY IN FLIGHT CORP. (SELF) IS AN AEROSPACE TECHNOLOGY COMPANY PLANNING TO PROVIDE AN L-1011 AIRCRAFT FOR USE AS A FLYING LABORATORY FOR SYSTEM TEST AND EVALUATION. SELF CORP. HAS DEVELOPED A UNIQUE CONCEPT FOR PALLETIZING SENSOR SYSTEMS, SUCH AS ANTENNAS USING EXISTING DOORS AND OTHER OPENINGS TO ALLOW EASY INSTALLATION AND REMOVAL OF OUTERSKIN MATERIALS AND CONFIGURATIONS TO SUIT THE ANTENNA REQUIREMENTS BY ELIMINATING THE NEED FOR THE SKIN TO CARRY PRESSURE LOADS. THIS PHASE I STUDY WILL DEFINE THE REQUIREMENTS FOR ACTIVE APERTURE ARRAY INSTALLATION AND RESULT IN A PRELIMINARY DESIGN OF THE PALLETIZED INSTALLATION.

SYSTEMS TECHNOLOGY INC
13766 S HAWTHORNE BLVD
HAWTHORNE, CA 90250
CONTRACT NUMBER:
WARREN F CLEMENT

TITLE:

FIELD-OF-VIEW REQUIREMENTS FOR NON-INSTRUMENTED LANDINGS
TOPIC# 256 OFFICE: AFSC/NAT IDENT#: 31312

RESEARCH IS REQUIRED TO IDENTIFY THE MINIMUM EXTERNAL FIELD OF VIEW REQUIRED BY THE PILOT FOR MANUALLY CONTROLLED APPROACHES TO AND LANDINGS ON RUNWAYS USING ONLY AIRCRAFT PERFORMANCE INDICATORS AND EXTERNAL VISUAL CUES DERIVED FROM RUNWAY SITE GEOMETRY TOGETHER WITH EXTERNAL VISUAL APPROACH AND LANDING AIDS. THERE IS AN ALREADY DEVELOPED, COMPREHENSIVE METHOD FOR INVESTIGATING FIELD-OF-VIEW REQUIREMENTS FOR APPROACH AND LANDING. THAT METHOD, PROPOSED HEREIN, INVOLVES FOUR CLEARLY DEFINED ANALYTICAL STEPS IN PHASE I PRIOR TO EXPERIMENTAL VALIDATION IN PHASE II. THE FOUR STEPS ADDRESS: (a) KINEMATIC REPRESENTATION OF AIRCRAFT APPROACH AND LANDING TRAJECTORIES, (b) PILOT-AIRCRAFT DYNAMIC GUIDANCE AND CONTROL PERFORMANCE, (c) VISUAL ELEMENT MOTION ANALYSIS, AND (d) FIELD-OF-VIEW REQUIREMENTS. THE ACTIVITIES IN PHASE I WILL CONCLUDE WITH THE PREPARATION OF AN EXPERIMENTAL PLAN FOR VALIDATION OF FIELD-OF-VIEW REQUIREMENTS AND A FINAL REPORT. A CONSIDERABLE LIBRARY OF RELATED RESEARCH AND EXAMPLES OF ASSESSMENT, REVIEWED HEREIN, WILL PROVIDE

SUBMITTED BY

RESOURCES FOR DEVELOPING FIELD-OF-VIEW REQUIREMENTS FOR THE INTENDED APPLICATION.

SYSTEMS TECHNOLOGY INC
13766 S HAWTHORNE BLVD
HAWTHORNE, CA 90250
CONTRACT NUMBER: F33615-89-C-3609
ROGER H HOH

TITLE:
A PROPOSAL TO DEVELOP MISSION ORIENTED FLYING QUALITIES DESIGN
PARAMETERS AND CRITERIA
TOPIC# 118 OFFICE: AFWAL/FIOP IDENT#: 33697

THE CURRENT FIXED-WING MILITARY FLYING QUALITIES SPECIFICATION, MIL-STD-1797, HAS CERTAIN LIMITATIONS WITH RESPECT TO THE CONNECTION BETWEEN SPECIFIC ELEMENTS OF THE MISSION(S), AND THE CRITERIAL. A SPECIFICATION FORMAT AND METHODOLOGY IS PROPOSED TO IMPROVE THIS SHORTCOMING. THE FOLLOWING ISSUES ARE ADDRESSED: DEVELOP MISSION-TASK-ELEMENTS, DEVELOP RESPONSE-TYPES, SPECIFY PROPER RESPONSE-TYPE FOR EACH MISSION-TASK-ELEMENT, QUANTIFY THE EFFECT OF PILOTS VISUAL CUEING (OUTSIDE CUES AND DISPLAYS) ON REQUIRED HANDLING QUALITIES, QUANTIFY EFFECTS OF DIVIDED ATTENTION, AND DEVELOP CRITERIA FOR MODERATE AMPLITUDE, AGGRESSIVE MANEUVERING. THE FOLLOWING MISSIONS SHALL BE ADDRESSED, AS A MINIMUM: LOW ALTITUDE BOMBING TO ACHIEVE PRECISE SOLUTIONS QUICKLY, LOW ALTITUDE AUTOMATIC FLIGHT CONTROL OPERATION ADDRESSING PILOT ADJUSTMENT OF AUTOMATIC INPUTS, PILOT OVERRIDE OF AUTOMATIC SYSTEMS, AND SYSTEM DISENGAGEMENT TRANSIENT. RIDE QUALITIES IN THIS ENVIRONMENT WILL ALSO BE CONSIDERED. THE PHASE I ACTIVITY WILL IDENTIFY THE CRITICAL MISSION AND THE FLYING QUALITIES PARAMETERS WHICH IMPACT MISSION PERFORMANCE CAPABILITY.

SYSTEMS WEST INC
27880 DORRIS DR
CARMEL, CA 93923
CONTRACT NUMBER: F04701-89-C-0057
KENNETH W RUGGLES

TITLE:
TRANSMISSION PROCESSING AND COMPOSITE MAPPING SEA SURFACE
TEMPERATURE AND OCEAN COLOR FOR TACTICAL USE
TOPIC# 175 OFFICE: AFSTC/OLAB IDENT#: 34392

SUBMITTED BY

THE PURPOSE OF THIS RESEARCH IS TO EXAMINE TECHNIQUES TO PROVIDE NEAR-ALL-WEATHER HIGH RESOLUTION VISUAL AND THERMAL SEA AND SEA-ICE DATA TO AN AFLOAT TACTICAL OPERATOR. THE RESEARCH WILL FOCUS ON SUPPORTING FACILITIES USING ON-BOARD SPACECRAFT PROCESSING, SIMPLE DOWNLINKING, AND SHIPBOARD PROCESSING. THE RESEARCH BUILDS ON A SUCCESSFUL COMMERCIAL TECHNOLOGY BASE DEVELOPED BY SYSTEMS WEST, INC.

TACAN CORP
2111 PALOMAR AIRPORT RD
CARLSBAD, CA 92009
CONTRACT NUMBER: F19628-89-C-0124
DR MICHAEL M SALOUR
TITLE:
OPTICAL SWITCHING FOR NONSINUSOIDAL RADAR APPLICATIONS
TOPIC# 31 OFFICE: ESD/AVP IDENT#: 31640

WE PROPOSE TO INVESTIGATE HIGH-SPEED, OPTICAL SWITCHING FOR NONSINUSOIDAL RADAR APPLICATIONS. THE TECHNOLOGY IS BASED ON SWITCHING WITH PICOSECOND LASER PULSES IN DOUBLE OR MULTIPLE TRANSMISSIONS LINES. THE PROPOSED TECHNIQUE HAS SEVERAL ADVANTAGES WHEN USED WITH WIDEBAND RADAR TRANSMITTERS. THESE ADVANTAGES INCLUDE RELIABLE SOLID STATE TECHNOLOGY, PULSE CODING, HIGH-REPETITION RATE SIGNALS, FAST RISETIMES, HIGH VOLTAGE SWITCHING, AND IMPEDANCE MATCHING TO ANTENNAS. DURING PHASE I WE WILL DEVELOP A THEORETICAL MODEL OF THE OPTICAL SWITCHING THAT WILL BE USED TO UNDERSTAND THE FUNDAMENTAL LIMITATIONS, CHARACTERISTICS AND FEASIBILITY OF THE PROPOSED SWITCHING METHOD.

TAU CORP
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LOS GATOS, CA 95032
CONTRACT NUMBER: F33615-89-C-1100
PETER ROTHMAN
TITLE:
PARALLEL PROCESSING FOR ARTIFICIAL INTELLIGENCE (AI) APPLICATIONS
TOPIC# 82 OFFICE: AFWAL/AAOP IDENT#: 32749

SUBMITTED BY

KNOWLEDGE-BASED SYSTEMS PROVIDE THE POTENTIAL TO DEVELOP NEW CAPABILITIES FOR AVIONICS SOFTWARE SYSTEMS. KNOWLEDGE-BASED SYSTEMS CAN INTELLIGENTLY ADAPT TO THEIR ENVIRONMENT, FOCUS RESOURCES ON INTERESTING EVENTS, FILTER AND SUMMARIZE COMPLEX INPUT DATA, AND CAN BE EASILY AND RAPIDLY MODIFIED TO ACCOUNT FOR CHANGES IN ENEMY TACTICS OR OTHER ASPECTS OF THE TACTICAL ENVIRONMENT. THESE BENEFITS CAN ONLY BE ACHIEVED IF RULE-BASED SYSTEMS ARE MADE OF THE PRACTICAL. FOR AVIONICS APPLICATIONS, THIS "PRACTICALITY" LITERALLY TRANSLATE INTO SPEED. TO ACHIEVE REAL-TIME OPERATION OF THESE TYPES OF SYSTEMS, ONE MUST DEVELOP TECHNIQUES FOR "PARALLELIZING" WHAT WE INTRINSICALLY SEQUENTIAL INFERENCING PROCESSES, AND FOR IMPLEMENTING THESE TECHNIQUES ON PARALLEL PROCESSING ARCHITECTURES. THE PURPOSE OF THE PROPOSED WORK IS TWO-FOLD: (1) TO IDENTIFY SUCH "PARALLELIZING" TECHNIQUES AND OTHER TECHNIQUES FOR ACHIEVING REAL-TIME AI FOR AVIONICS; AND (2) TO SELECT A PREFERRED PARALLEL ARCHITECTURE THAT HAS GREATEST POTENTIAL FOR ACHIEVING THE DESIRED SPEEDS. PHASE II WILL FOLLOW BY ACTUALLY IMPLEMENTING THESE CONCEPTS IN THE CONTEXT OF A REAL-TIME DEMONSTRATION.

TAU CORP
485 ALBERTO WY
LOS GATOS, CA 95032
CONTRACT NUMBER: F33615-89-C-1096
NICHOLAS J PEKELSMA
TITLE:
AN INTELLIGENT APPROACH TO TERRAIN FOLLOWING/TERRAIN AVOIDANCE AN
THREAT MANAGEMENT
TOPIC# 97 OFFICE: AFWAL/AAOP IDENT#: 32948

THIS PROJECT WILL INTEGRATE THE OPERATION OF THREAT WARNING SENSORS WITH THE SUBSEQUENT THREAT MANAGEMENT RESPONSES THAT MIGHT BE EMPLOYED IN LOW-ALTITUDE MISSIONS. ADVANCES IN THREAT WARNING SENSORS AND IN ASSOCIATED DATA FUSION ARE OCCURRING IN "INNEWS" AND RELATED PROGRAMS. "THREAT MANAGEMENT" REFERS TO A SET OF OFFENSIVE AND DEFENSIVE REAL-TIME COUNTERMEASURES THAT THE PENETRATOR AIRCRAFT MIGHT EMPLOY FOLLOWING DETECTION, CLASSIFICATION, AND LOCALIZATION OF THREATS BY THE THREAT WARNING SENSORS. SUCH OPTIONS NEED TO BE INTEGRATED WITH TF/TA, WHICH ITSELF CAN BE TREATED AS A LOW-ALTITUDE

SUBMITTED BY

MANEUVERING RESPONSE TO THE THREAT(S). WE HAVE DESIGNED AN EFFICIENT, HYBRID SYSTEM TO ACHIEVE THE ABOVE: AN EXPERT SYSTEM-BASED MANAGER SELECTS THE RIGHT COMBINATION OF REAL-TIME RESPONSE OPTIONS; THE RESPONSES ARE THEN COMPUTED USING CONVENTIONAL TECHNIQUES. PAST AIR FORCE PROGRAMS SUPPORT THE SYSTEM ARCHITECTURE SPECIFICATION, NOTABLY PAVE PILLAR AND RELATED PROGRAMS. WE MAKE USE OF EXISTING MISSION PLANNING, TF/TA, AND DATA FUSION SOFTWARE TOOLS TO ACHIEVE A RAPID PROTOTYPE TO DEMONSTRATE SYSTEM OPERATION.

TECHNOLOGY APPLICATIONS GP
351 W COUNTRY HILLS DR
La HABRA, CA 90631

CONTRACT NUMBER:

DARYL T BUTCHER

TITLE:

RADIATION HARD SEMICONDUCTOR DEVICES ON ADVANCED SUBSTRATES FOR REENTRY SYSTEM APPLICATIONS

TOPIC# 219 OFFICE: BMO/MYSC IDENT#: 32617

THIS R&D PROJECT IS DIRECTED TOWARD THE IDENTIFICATION OF SOI/SIMOX CIRCUIT HARDENING TECHNIQUES FOR REENTRY SYSTEM LINEAR ELECTRONICS. CRITICAL GENERIC LINEAR CIRCUIT FUNCTIONS WILL BE SELECTED FOLLOWING A REVIEW OF PRESENT REENTRY SYSTEM LINEAR REQUIREMENTS. SELECTED CIRCUITS WILL BE DESIGNED USING CMOS/SOI ELECTRICAL AND LAYOUT GROUND RULES. PRELIMINARY LAYOUTS WILL BE PERFORMED TO IDENTIFY GEOMETRIC PARAMETERS. COMPUTER SIMULATIONS OF CIRCUIT RESPONSE TO PERMANENT RADIATION EFFECTS AND PROMPT AND WIDE PULSE IONIZATION WILL BE PERFORMED, HARDNESS LEVELS PREDICTED AND CIRCUIT HARDENING TECHNIQUES EVALUATED. THE PROPOSED APPROACH WILL RESULT IN EXTREME NEUTRON DAMAGE AND SEU AND IONIZING RADIATION UPSET TOLERANCE. TOTAL DOSE HARDNESS WILL BE ADDRESSED BY DESIGN WHILE TAKING ADVANTAGE OF THE RECENT TECHNOLOGY HARDNESS IMPROVEMENTS.

TECHNOLOGY DEVELOPMENT ASSOCS INC
992 OLD EAGLE SCHOOL RD - STE 910
WAYNE, PA 19087

CONTRACT NUMBER:

NICHOLAS J DISPENZIERS

TITLE:

INTEGRATED CASE STRUCTURE/EXTERNAL PROTECTION

TOPIC# 231 OFFICE: BMO/MYSC IDENT#: 32721

SUBMITTED BY

FUTURE MISSILE SYSTEMS WILL REQUIRE IMPROVED STRUCTURE/EXTERNAL PROTECTION MATERIALS IN ORDER TO COUNTER NEW AND EMERGING THREATS. DIRECT ENERGY THREATS, INCLUDING THERMAL OR IMPULSE LASERS, PARTICLE BEAMS, AND KINETIC ENERGY WEAPONS, ARE OF PARTICULAR IMPORTANCE. THIS PROGRAM WILL IDENTIFY INTEGRAL STRUCTURE/EXTERNAL PROTECTION MATERIAL CONCEPTS THAT CAN BE USED TO PROVIDE PROTECTION FOR ADVANCED SYSTEMS.

TECHNOLOGY SYSTEMS INC
PO BOX 85
NORTH EDGECOMB, ME 04556
CONTRACT NUMBER: F33615-89-C-1101
CHARLES J BENTON

TITLE:
ANALYSIS AND DEVELOPMENT OF A PARALLEL PHIGS PRIMITIVE CAPABILITY
TOPIC# 82 OFFICE: AFWAL/AAOP IDENT#: 32752

ANALYSIS AND DEVELOPMENT OF A PARALLEL PHIGS PRIMITIVE CAPABILITY IS POSSIBLE USING AVAILABLE PARALLEL ARCHITECTURES AND SOFTWARE TOOLS. EVALUATION OF THE PHIGS PRIMITIVES, IDENTIFICATION OF POSSIBLE METHODS OF IMPLEMENTATION USING PARALLEL ARCHITECTURES, SELECTION OF A PHASE I APPROACH, THEORETICAL ANALYSIS OF THE SELECTED APPROACH, EMPIRICAL ANALYSIS OF THE SELECTED APPROACH, APPROACH VALIDATION, APPROACH DOCUMENTATION, AND THE PERFORMANCE OF PRELIMINARY GROUNDWORK LEADING TO INFLUENCE OF FUTURE PHIGS EXTENSIONS IS PROPOSED. SPECIAL FOCUS IS GIVEN TO THE AREAS OF PROBLEM DECOMPOSITION AND TASK SYNCHRONIZATION. PARALLELISM WITHIN THE CONTEXT OF PHIGS PRIMITIVES AND SUB-PRIMITIVES WILL BE INVESTIGATED; THIS WILL LEAD TO THE DEVELOPMENT OF OPTIMUM METHODS OF IMPLEMENTATION. DOCUMENTATION OF THESE METHODS WILL PROVIDE A BASIS FOR INPUT TO THE PHIGS EXTENSION WORK JUST NOW STARTING WITHIN ANSI AND ISO.

TECHNOMICS INC
5290 OVERPASS RD - STE 206
SANTA BARBARA, CA 93111
CONTRACT NUMBER: F04701-89-C-0067
W EUGENE WALLER

TITLE:
TECHNIQUES TO PERFORM MILITARY SPACE CAPABILITY MODELING AND COST ESTIMATION MODELING
TOPIC# 180 OFFICE: AFSTC/OLAB IDENT#: 34512

SUBMITTED BY

THE OBJECTIVE OF THE PROPOSED EFFORT IN PHASE I IS TO ASSESS THE FEASIBILITY OF DEVELOPING AN AUTOMATED METHOD THAT BOTH MODELS SATELLITE ARCHITECTURES AND CONSTELLATION DESCRIPTIONS TO MINIMIZE DEPLOYMENT COSTS AS WELL AS ESTIMATES SPACE SYSTEM COSTS BASED ON THE SYSTEM REQUIREMENTS. THIS MODEL MUST BE APPLIED BEFORE THE DESIGN PHASE FOR THE SYSTEM SO THAT THE COST IMPLICATIONS OF THE GIVEN REQUIREMENT CAN BE ESTABLISHED. THE APPROACH EMPLOYED IN ACHIEVING THIS OBJECTIVE INVOLVES THE USE OF A NON-LINEAR CONSTRAINED OPTIMIZATION TECHNIQUE TO BALANCE COST AND OPERATION REQUIREMENTS IN A MANNER WHICH MINIMIZES COST TO ACHIEVE A GIVEN LEVEL OF MISSION EFFECTIVENESS. A CASE STUDY WILL BE CONDUCTED TO ASSESS THE FEASIBILITY OF APPLYING THIS TECHNIQUE TO A COMPLEX MISSION, ENABLING AN INVESTIGATION OF THE COMPLEXITY OF THE PROBLEM BY DEVELOPING MATHEMATICAL RELATIONSHIPS AND A PROTOTYPE OF THE TOOL. THE MODEL WILL CONSIST OF LARGE NUMBER OF RELATIONSHIPS WHICH RELATE MISSION REQUIREMENTS, PERFORMANCE REQUIREMENTS, DESIGN CHARACTERISTICS AND COST TO EACH OTHER.

THOMAS/SCIFERS INC
111 N SEPULVEDA BLVD - STE 330
MANHATTAN BEACH, CA 90266
CONTRACT NUMBER: F04701-89-C-0062
DR L V SCIFERS
TITLE:
AN INNOVATIVE SATELLITE SURVIVABILITY CONCEPT
TOPIC# 178 OFFICE: AFSTC/OLAB IDENT#: 34468

A NOVEL AND INNOVATIVE ACTIVE COUNTERMEASURE TO ENHANCE SATELLITE SURVIVABILITY IS INTRODUCED.

TOPICAL TESTING INC
1220 E 3900 SOUTH - STE 1-E
SALT LAKE CITY, UT 84117
CONTRACT NUMBER:
HERVE A MARTIN
TITLE:
A BIOLOGICAL MODEL OF THE EFFECTS OF TOXIC SUBSTANCES
TOPIC# 243 OFFICE: AFOSR/XOT IDENT#: 34026

SUBMITTED BY

DUE TO THE BASIC NATURE OF MILITARY OPERATIONS, IT IS SOMETIMES NECESSARY FOR AIR FORCE PERSONNEL TO BE EXPOSED TO TOXIC CHEMICALS IN THEIR WORK ENVIRONMENT EITHER AS A PROTRACTED LOW-LEVEL EXPOSURE OR AS A HIGH-LEVEL, ACUTE EXPOSURE. THE APPLICATION HEREIN PROPOSES TO USE THE ANTERIOR EYE (CORNEA AND CONJUNCTIVA) AND ITS SENSORY INNERVATION AS AN ASSAY OF TOXIC EFFECTS. THE ANTERIOR EYE HAS UNIQUE CHARACTERISTICS: ITS EXTENSIVE USE IN TOXICOLOGY, PERMEABILITY, THE RELATIVE EASE OF OBSERVATION, AND IMPORTANCE TO THE INPUT OF VISUAL INFORMATION. IN ADDITION, THE EYE IS UNIQUE IN THAT RECEPTORS INNERVATING THE CORNEA DIFFER FROM THOSE INNERVATING CONJUNCTIVA AND HENCE COMPARISONS OF THESE POPULATIONS WILL LIKELY BE USEFUL TO ASSAY FOR DEFICITS IN PERFORMANCE OF DIFFERENT TYPES OF SENSORY NEURONS. THE PERSONNEL OF TOPICAL TESTING HAVE EXPERTISE IN GROWING (AND RECORDING FROM) NEURAL TISSUE IN CULTURE, AS WELL AS THE DESIGN AND FABRICATION OF SPECIALIZED EQUIPMENT USED IN SUCH STUDIES. THIS PHASE I FEASIBILITY STUDY WILL INVESTIGATE THE USE OF AN OCULAR-NEURONAL MODEL AS AN INDICATOR OF TOXIC INSULT. PHASE II DEVELOPMENT WILL INVESTIGATE THE MECHANISM OF SPECIFIC TOXIC CHEMICALS WITH THE GOAL OF ENHANCING NATURAL DETOXIFICATION THROUGH CONVERSION OF TOXIC AGENTS INTO NON-TOXIC METABOLITES.

TUSKEGEE RESEARCH INSTITUTE
5739 BRIDLE PATH CT
MONTGOMERY, AL 36116

CONTRACT NUMBER:

JOHN FOSTER

TITLE:

VOICE/DATA COMMUNICATIONS USING VECTOR QUANTIZATION

TOPIC# 31 OFFICE: ESD/AVP IDENT#: 31625

THE GOAL OF THIS RESEARCH PROJECT IS THE DEVELOPMENT OF A VOICE AND/OR DATA COMMUNICATIONS SYSTEM USING VECTOR QUANTIZATION (VQ). VECTOR QUANTIZATION HAS TRADITIONALLY BEEN USED AS A SOURCE CODING ALGORITHM FOR DIGITAL CODING SYSTEMS. BY REVERSING THE ORDER OF THE ENCODER AND DECODER, VQ CAN BE USED TO TRANSMIT DIGITAL VOICE OR DATA IN A LOCALLY OPTIMUM MANNER. VQ ALSO OFFERS THE ADVANTAGE OF PROVIDING LOCALLY OPTIMUM SIGNAL SETS FOR A GIVEN TRANSMISSION SYSTEM, THEREBY COMING CLOSER TO THE SHANNON CHANNEL CAPACITY LIMIT

SUBMITTED BY

FOR ANALOG CHANNELS. USING THE VQ DESIGN ALGORITHM, SIGNAL SETS CAN BE DESIGNED WHICH YIELD LOWER PROBABILITY OF BIT ERRORS AT A GIVEN BIT RATE THAN TRADITIONAL MODULATION SCHEMES. DUE TO THE UNIQUENESS OF THE CODEBOOK, VQ ALSO OFFERS AN INHERENT COVERTNESS NOT AVAILABLE WITH OTHER MODULATION SCHEMES. THE PHASE I PROPOSED RESEARCH WILL BE COMPOSED OF THE FOLLOWING STAGES: i) COMPUTER MODELING OF THE VQ MODULATION SYSTEM, ii) SYSTEM SIMULATION AND SNR/BIT-RATE PERFORMANCE BOUNDS, AND iii) REAL-TIME IMPLEMENTATION FOR A ADDITIVE WHITE GAUSSIAN NOISE CHANNEL. ONCE THE BASIC PRINCIPLES OF PHASE I HAVE BEEN ESTABLISHED, PHASE II & III EFFORTS WILL INCORPORATE FULL-SCALE DEVELOPMENTAL EFFORTS TOWARDS AN OPERATIONAL SYSTEM.

U.S. COMPOSITES CORP

105 JORDAN RD
TROY, NY 12180
CONTRACT NUMBER:
AUGUST H KRUESI

TITLE:

INNOVATIVE DESIGN AND PROCESSING OF HIGH TEMPERATURE COMPOSITE FASTENERS

TOPIC# 251 OFFICE: AFSC/NAT IDENT#: 31284

THE NATIONAL AERO-SPACE PLANE AND ADVANCES IN PROPULSION SYSTEMS WILL REQUIRE NEW COMPOSITE MATERIALS WITH IMPROVED PERFORMANCE IN EXTREME HIGH TEMPERATURE ENVIRONMENTS. RECENT EXPERIENCE WITH COMPOSITES IN AIRFRAMES HAS INDICATED THAT STRESS CONCENTRATIONS DUE TO FASTENERS AND CUT-OUTS IS THE LIMITING FACTOR IN MANY COMPOSITE STRUCTURES. U.S. COMPOSITES WILL APPLY INNOVATIVE PROCESSING TECHNOLOGY BASED ON COMPUTER CONTROLLED BRAIDING AND ON-LINE IMPREGNATION TO DEVELOP PROTOTYPE HIGH TEMPERATURE FASTENERS. FIBER PLACEMENT TECHNIQUES WILL BE EVALUATED AND OPTIMIZED WITH FINITE ELEMENT ANALYSIS. A PROTOTYPE FASTENERS WILL BE MADE OF CARBON-CARBON MATERIALS. THE PHASE I RESEARCH WILL INCLUDE AN EVALUATION OF FUTURE EXTENSIONS OF THE TECHNOLOGY TO CERAMIC AND OTHER MATRIX MATERIALS AND MODIFIED IMPREGNANTS WITH IMPROVED OXIDATION PROTECTION.

ULTRAMET

12173 MONTAGUE ST
PACOIMA, CA 91331
CONTRACT NUMBER: F04611-89-C-0047
MARK J DELA-ROSA

TITLE:

HYDROGEN STORAGE IN METAL HYDRIDE

TOPIC# 191 OFFICE: AFAL/TSTR IDENT#: 38863

SUBMITTED BY

AS SPACECRAFT PERFORMANCE REQUIREMENTS BECOME MORE RIGOROUS, MATERIALS AND PARTS SPECIFICATIONS BECOME MORE DIFFICULT TO MEET. HIGH PERFORMANCE MUST BE COMBINED WITH LIGHTWEIGHT TO DERIVE THE MAXIMUM BENEFIT FROM SPACECRAFT COMPONENTS. SIMPLICITY IS ALSO ESSENTIAL IN AVOIDING MAJOR REDESIGN AND INCREASED COSTS FOR COMPLICATED SYSTEMS. CURRENT AND FUTURE SPACECRAFT SPECIFICATIONS REQUIRE A METHOD TO SAFELY STORE HYDROGEN. IN THIS PHASE I PROGRAM, ULTRAMET PROPOSES TO DEMONSTRATE THE FEASIBILITY OF INFILTRATING A CARBON FOAM WITH A HYDROGEN-ABSORBING MAGNESIUM COMPOUND BY CHEMICAL VAPOR INFILTRATION (CVI), A VARIATION OF THE CHEMICAL VAPOR DEPOSITION (CVD) PROCESS. THE RESULTANT COMPOSITE FOAM STRUCTURE WILL MEET THE REQUIREMENTS OF BEING LIGHTWEIGHT, HAVING A HIGH SURFACE AREA WITH WHICH TO STORE HYDROGEN, AND BEING SIMPLE IN BOTH DESIGN AND USE.

UNIVERSAL ENERGY SYSTEMS INC
4401 DAYTON-XENIA RD
DAYTON, OH 45432
CONTRACT NUMBER: F33615-89-C-2944
RABI BHATTACHARVA
TITLE:
SELF-LUBRICATING SURFACES BY ION-BEAM PROCESSING
TOPIC# 151 OFFICE: AFWAL/POMP IDENT#: 33220

HIGH TEMPERATURE SOLID LUBRICATION IS OF INTEREST TO TODAY'S GAS TURBINE ENGINE TECHNOLOGY. FOR EXAMPLE, THE VARIABLE STATOR VANE, BUSHINGS AND THRUST REVERSAL BEARINGS IN GAS TURBINE ENGINES REQUIRE HIGH TEMPERATURE SELF-LUBRICATING HARD COATINGS. THE COMMON WAY OF LAYING DOWN SELF-LUBRICATED SURFACES ARE PLASMA SPRAY, VACUUM AND THERMAL DEPOSITIONS. THE COATINGS DEVELOPED BY THESE PROCEDURES ARE GENERALLY POROUS AND DO NOT ADHERE WELL TO THE SUBSTRATE. WE PROPOSE TO DEVELOP SELF-LUBRICATING COATINGS THROUGH A COMBINED PROCESS OF ELECTRON BEAM EVAPORATION AND ION IMPLANTATION. A COMPOSITE $BaF(2)/CaF(2)/Ag$ WILL BE SYNTHESIZED IN THE NEAR SURFACE REGION OF $Si(3)N(4)$ THROUGH ION IMPLANTATION OR ION-BEAM MIXING. ALSO, LUBRICIOUS OXIDES, CdO AND $TiO(2)$, WILL BE SYNTHESIZED IN THE NEAR SURFACE REGION OF STEEL. THE COATINGS WILL BE ANALYZED FOR COMPOSITION, MICROSTRUCTURE, FRICTION AND WEAR USING SUITABLE

SUBMITTED BY

TECHNIQUES.

UNIVERSAL SENSORS
5258 VETERANS BLVD - STE D
METAIRIE, LA 70006
CONTRACT NUMBER: F08635-89-C-0346
AHMAD A SULEIMAN
TITLE:
PASSIVE PIEZOELECTRIC HYDROGEN CHLORIDE MONITOR
TOPIC# 60 OFFICE: AFESC/RDXP IDENT#: 31993

SEVERAL ABSORBENTS WILL BE USED AS COATINGS FOR PIEZOELECTRIC CRYSTAL MONITORS AND THE PERFORMANCE OF THE DEVICE FOR THE IDENTIFICATION AND DETERMINATION OF HCl GAS WILL BE EVALUATED. THE DETECTOR, AND EACH ABSORBENT WILL BE EVALUATED WITH RESPECT TO SENSITIVITY, SELECTIVITY, ACCURACY, SIMPLICITY OF DESIGN, EFFICIENCY OF HCl ADSORPTION AND LIFETIME. THE FEASIBILITY OF THE USE OF PIEZOELECTRIC CRYSTAL PASSIVE DEVICE FOR HCl WILL BE DEMONSTRATED IN PHASE I. THE DEVICE WILL BE CONSTRUCTED, TESTED AND DEMONSTRATED FOR A HOST OF APPLICATIONS IN PHASE II.

VATELL CORP
PO BOX 66
CHRISTIANSBURG, VA 24073
CONTRACT NUMBER: F33615-89-C-2947
LAWRENCE W LANGLEY
TITLE:
HEAT FLUX MICROSENSOR DEVELOPMENT
TOPIC# 156 OFFICE: AFWAL/POMP IDENT#: 33248

VATELLE OFFERS TO BUILD AND TEST PROTOTYPE HEAT FLUX MICROSENSORS TO DETERMINE THEIR CHARACTERISTICS AND POTENTIAL UTILITY FOR THE MEASUREMENT OF HEAT FLUX IN ADVERSE ENVIRONMENTS. THE SENSOR IS A COMBINATION OF THIN FILM LAYERS APPLIED DIRECTLY TO THE SURFACE WHOSE HEAT TRANSFER IS TO BE MEASURED. IT WILL USE MATERIALS SELECTED FOR OPERATION AT 1000 DEG C, AND PERFORMANCE WILL BE TESTED AT THAT TEMPERATURE. THE FEATURES OF THE SENSOR WHICH DISTINGUISH IT FROM

SUBMITTED BY

PWIOR DEVICES AND ESTABLISH ITS POTENTIAL UTILITY ARE: (1) HIGH TEMPERATURE CAPABILITY, MAKING MEASUREMENTS POSSIBLE IN HARSH ENVIRONMENTS; (2) SMALL THICKNESS, ENABLING HEAT TRANSFER MEASUREMENTS TO BE MADE WITH LITTLE OR NO DISTURBANCE OF FLOWS; (3) RAPID RESPONSE, FACILITATING MEASUREMENT OF HEAT TRANSFER IN BOILING, IN TURBULENT FLOWS OR IN OTHER RAPIDLY CHANGING CONDITIONS, (4) LOW THERMAL DROP, WHICH DOES NOT DISTURB HEAT FLUX DISTRIBUTION, MAKING RESULTS MORE PRECISE AND ACCURATE; (5) HIGH HEAT FLUX RATE CAPACITY, MAKING MEASUREMENTS POSSIBLE IN HIGHLY ENERGETIC SYSTEMS; AND (6) ABILITY TO BE CALIBRATED ON THE OBJECT WHOSE HEAT TRANSFER IS TO BE MEASURED, THUS MINIMIZING INSTRUMENTATION ERRORS CAUSED BY BONDING OF A SENSOR TO A SURFACE AFTER THE SENSOR IS CALIBRATED ELSEWHERE.

VECTOR RESEARCH INC (VRI)
PO BOX 1506
ANN ARBOR, MI 48106
CONTRACT NUMBER: F33657-89-C-2234
STANLEY L SPAULDING

TITLE:
DECISION SUPPORT SYSTEM TO EVALUATE ALTERNATIVE ATT DESIGN CONCEPT
BASED ON CONTRIBUTION TO SUPPORT FORCE WARFIGHTING EFFECTIVENESS
TOPIC# 162 OFFICE: ASD/XRX IDENT#: 32414

THE OBJECTIVE OF THE PROPOSED RESEARCH IS TO DEVELOP A PRELIMINARY DESIGN FOR A DECISION SUPPORT SYSTEM WHICH CAN BE USED BY ASD IN CONNECTION WITH ADVANCED TRANSPORT TECHNOLOGY R&D PLANNING. THE SYSTEM WILL EXPLOIT EXISTING RESULTS PRODUCED BY THE VECTOR-3 AIRLAND CAMPAIGN MODEL AND WILL PERMIT EVALUATION OF THE RELATIVE CONTRIBUTION OF ALTERNATIVE TACTICAL TRANSPORT CONCEPT DESIGNS TO THE WARFIGHTING CAPABILITIES OF THE SUPPORTED FORCE. PRODUCTS OF THE PHASE I RESEARCH WILL INCLUDE THE PRELIMINARY DESIGN OF THE DECISION SUPPORT SYSTEM AND A DATA BASE OF RESULTS EXTRACTED FROM EXISTING VECTOR-3 RUNS.

VERITAY TECHNOLOGY INC
PO BOX 305 - 4845 MILLERSPORT HWY
EAST AMHERST, NY 14051
CONTRACT NUMBER: F08635-89-C-0378
EDWARD B FISHER

TITLE:
IMPROVED TECHNOLOGY FOR PROPELLANT CONSOLIDATION
TOPIC# 1 OFFICE: AD/PMR IDENT#: 31061

SUBMITTED BY

THE AIR FORCE HAS MADE A MAJOR COMMITMENT TO CASED TELESCOPED AMMUNITION AS THE BALLISTIC CONCEPT OF THE NEAR FUTURE. THIS AMMUNITION CONCEPT, WHICH CONSISTS OF A CONSOLIDATED CHARGE WITH A MECHANICALLY SEQUENCED IGNITION SYSTEM, COMMONLY ACHIEVES PROJECTILE VELOCITIES OF 5000 FT/SEC. THE CONSOLIDATED PROPELLANT FOR THIS SYSTEM IS CURRENTLY MADE BY SOLVATING CONVENTIONAL PROPELLANT WITH A MIXTURE OF ACETONE AND ALCOHOL, A COSTLY AND TIME-CONSUMING PROCESS (BECAUSE OF DRYING TIME AND SOLVENT RECOVERY REQUIREMENTS) THAT ULTIMATELY IMPACTS QUALITY CONTROL, SHELF LIFE, AND UNIT COST. THE OBJECTIVE OF THE PROPOSED EFFORT IS TO INTRODUCE A NEW TECHNIQUE FOR PRODUCING CONSOLIDATED CHARGES THAT MAY OFFER SIGNIFICANT BENEFITS OVER THE CURRENT TECHNIQUES. THIS NEW TECHNIQUE INVOLVES COATING PROPELLANT WITH A MATERIAL THAT PERMITS THERMAL CONSOLIDATION WITHOUT USING SOLVENTS. PRELIMINARY FINDINGS INDICATED THAT THIS CONSOLIDATION TECHNIQUE HOLDS PROMISE FOR ADEQUATE STRENGTH, EXCELLENT DIMENSIONAL STABILITY, IMPROVED QUALITY CONTROL, INCREASED SHELF LIFE, AND REDUCED COST. PROPELLANT WILL BE CONSOLIDATED USING THE THERMAL TECHNIQUE DURING PHASE I AND AMMUNITION WILL BE ASSEMBLED AND FIRED AT ROOM TEMPERATURE, HOT AND COLD CONDITIONS TO DEMONSTRATE THE BASIC FEASIBILITY OF THIS TECHNIQUE FOR USE IN CASED TELESCOPED AMMUNITION.

VERITAY TECHNOLOGY INC
PO BOX 305 - 4845 MILLERSPORT HWY
EAST AMHERST, NY 14051
CONTRACT NUMBER: F08635-89-C-0373
EDWARD B FISHER

TITLE:

A DYNAMIC CHARGING SYSTEM FOR THE RAM ACCELERATOR FOR HYPERVELOCITY APPLICATIONS

TOPIC# 12 OFFICE: AD/PMR IDENT#: 31185

THE RAM ACCELERATOR IS A NEW CHEMICAL METHOD FOR ACHIEVING ULTRAHIGH PROJECTILE LAUNCH VELOCITIES. INITIAL DEVELOPMENT WORK PERFORMED AT THE UNIVERSITY OF WASHINGTON HAS SUCCESSFULLY ACHIEVED FINAL PROJECTILE VELOCITIES IN EXCESS OF 2.0 km/s WHEN APPLYING THE ACCELERATOR CONCEPT, BASED ON RAMJET PRINCIPLES, TO A PROJECTILE WITH AN INITIAL VELOCITY OF ABOUT 1.0 km/s. WORK TO DATE HAS

SUBMITTED BY

INCORPORATED AN ACCELERATOR TUBE CHARGED TO A SPECIFIED PRESSURE WITH A COMBUSTIBLE GAS MIXTURE. THE TUBE IS SEALED WITH A DIAPHRAGM AT EITHER END WHICH IS RUPTURED BY THE PROJECTILE AS IT PASSES THROUGH THE TUBE. THIS TEST CONFIGURATION IS USEFUL FOR TECHNOLOGY DEVELOPMENT TESTING UNDER LABORATORY CONDITIONS AND FOR EVENTUAL SINGLE-SHOT APPLICATIONS. TO SATISFY RAPID-FIRE REQUIREMENTS, A METHOD MUST BE DEvised TO RAPIDLY FILL THE ACCELERATOR TUBE IN A WAY THAT ELIMINATES THE NEED FOR DIAPHRAGMS. THE PROPOSED CHARGING CONCEPT COMBINES GAS FLOW SYSTEMS AND UNSTEADY GASDYNAMICS TO PERMIT THE TUBE TO BE CHARGED WITH THE COMBUSTIBLE GASES AT THE DESIRED PRESSURE AND FAVORABLE FLOW CONDITIONS. THIS PROPOSAL CONTAINS A DESCRIPTION OF THE DYNAMIC CHARGING CONCEPT AND A PHASE I PLAN TO DESIGN, EVALUATE AND DETERMINE THE FEASIBILITY OF THIS CONCEPT.

VIGYAN RESEARCH ASSOCS INC
30 RESEARCH DR
HAMPTON, VA 23666
CONTRACT NUMBER: F33615-89-C-3007
DR D M RAO
TITLE:

LOW-SPEED EXPERIMENTAL INVESTIGATIONS OF VORTEX CONTROL CONCEPTS
A GENERIC CHINE FOREBODY/DELTA WING CONFIGURATION AT HIGH ANGLES
TOPIC# 109 OFFICE: AFWAL/FIOP IDENT#: 33625

AN EXPERIMENTAL FEASIBILITY STUDY IS PROPOSED OF TWO SEPARATE AERODYNAMIC CONCEPTS FOR DIRECT AND INDEPENDENT CONTROL OF CHINE FOREBODY VORTICES AT HIGH ANGLES OF ATTACK AND IN SIDESLIP: (a) LONGITUDINALLY HINGED CHINES THAT CAN BE MOVED TO VARIABLE DIHEDRAL OR ANHEDRAL ANGLE; AND (b) SPANWISE JET-SHEET BLOWN HORIZONTALLY FROM SLOTS LOCATED ALONG THE CHINE EDGE. BOTH APPROACHES ENVISAGE CONTROLLING STRENGTH AND TRAJECTORY OF THE SHED CHINE VORTEX PAIR, EITHER IN UNISON OR DIFFERENTIALLY, TO MODIFY THE MERGER AND BREAKDOWN OF THE VORTEX SYSTEM OVER THE WING AND THEREBY CONTROL THE WING LIFT CHARACTERISTICS PARTICULARLY IN THE C(L) MAX AND POST-STALL REGIME. IN A LOW-SPEED WIND TUNNEL STUDY OF THE TWO CONCEPTS APPLIED TO A COMMON GENERIC HINE FOREBODY/55 DEG DELTA WING CONFIGURATION, WING UPPER-SURFACE SUCTION PRESSURE MEASUREMENTS AND SUPPORTING SMOKE FLOW VISUALIZATIONS WILL BE OBTAINED FOR AN INITIAL QUANTITATIVE EVALUATION OF CONTROL EFFECTIVENESS AND ASSOCIATED

SUBMITTED BY

VORTICAL FLOW CHARACTERISTICS, AT ANGLES OF ATTACK UP TO 60 DEG. AND
SIDE-SLIP ANGLES TO +/- 20 DEG.

VOSS SCIENTIFIC
416 WASHINGTON ST SE - STE 1-C
ALBUQUERQUE, NM 87108
CONTRACT NUMBER:
DR DONALD E VOSS
TITLE:
MOBILE AUTOMATED HIGH POWER MICROWAVE DIAGNOSTIC SYSTEM
TOPIC# 202 OFFICE: AFWL/PRC IDENT#: 31866

THE ADVENT OF MULTI-Hz REP-RATED HPM SOURCES FOR EFFECTS TESTING PLACES SEVERE DEMANDS ON HPM DIAGNOSTIC SYSTEMS, ESPECIALLY IN FIELD USE. INCREASED EMPHASIS ON HIGH SHOT RATES AND THE DIFFICULTY OF QUICKLY SETTING UP AND DEBUGGING THE NECESSARY DIAGNOSTIC INSTRUMENTATION RESULTS IN FIELD EXPERIMENTS THAT OFTEN RECORD ONLY THE MOST BASIC DIAGNOSTIC INFORMATION, SUCH AS POWER DENSITY ENVELOPE AND FREQUENCY MEASURED ONLY OVER A NARROW TIME WINDOW. FAR MORE DETAILED INFORMATION IS NEEDED FOR IMPROVED QUALITY SUSCEPTIBILITY STUDIES. DUE TO RECENT ADVANCES IN INSTRUMENTATION, NEW OPPORTUNITIES FOR IMPROVEMENTS EXIST. WE PROPOSE THE DEVELOPMENT OF A PORTABLE, SELF-CONTAINED, AUTOMATED HPM DIAGNOSTIC SYSTEM, INCORPORATING STATE-OF-THE-ART BROADBAND DIAGNOSTIC SENSORS, SIGNAL PROCESSING METHODS MAXIMIZING INFORMATION CONTENT, AND A NOVEL COMPUTER-CONTROLLED RF SWITCHING SYSTEM ALLOWING DYNAMIC "REWIRING" OF THE DIAGNOSTIC PACKAGE, EVEN BETWEEN PULSES OF MULTI-Hz RATES. SOPHISTICATED SOFTWARE, MAKING FULL USE OF COMPUTER CONTROLLED DIAGNOSTICS AND USER-SUPPLIED HPM DEVICE INFORMATION, WILL ACQUIRE, ARCHIVE, REDUCE, AND DISPLAY DATA IN A MANNER MAXIMIZING BOTH QUALITY AND TIMELINESS OF INFORMATION AVAILABLE TO THE TEST OPERATOR, AND PROVIDING SIGNIFICANT ASSISTANCE IN CONDUCT OF THE TEST.

WAGNER D H ASSOCS INC
27 W QUEENS WAY - STE 301
HAMPTON, VA 23669
CONTRACT NUMBER: F19628-89-0109
DR JOSEPH H DISCENZA
TITLE:
E-3 SENSOR DATA FUSION ALGORITHM RESEARCH
TOPIC# 34 OFFICE: ESD/AVP IDENT#: 31700

SUBMITTED BY

ALGORITHMS NEEDED TO SOLVE DATA FUSTION IN THE E-3 ENVIRONMENT ARE GROUPED INTO FIVE CATEGORIES FOR THIS RESEARCH. THE PROPOSAL DESCRIBES TECHNICAL APPROACHES IN DETAIL FOR EACH: (1) TRACKING; THE USE OF THE DUAL-VELOCITY INTEGRATED ORNSTEIN-UHLENBECK MOTION MODEL KAMAN FILTER; (2) CORRELATION, THE USE OF STATISTICAL SCORING AND A UNIQUE SEQUENTIAL SOLUTION TO AN INTEGER PROGRAMMING FORMULATION OF THE MULTI-HYPOTHEIS, TRACK-TO-TRACK CORRELATION PROBLEM; (3) GRIDLOCK, THE USE OF A LEAST SQUARES SOLUTION METHODOLOGY FOR ESTIMATING BIAS ERRORS IN ALL REPORTING UNITS; (4) ERROR MANAGEMENT, THE USE OF OUTLIER DETECTION AND PROVISIONAL TRACKS; AND (5) USER INTERACTION, THE DISPLAY OF SINGLE-HYPOTHESIS DATA WHILE MAINTAINING MULTIPLE HYPOTHESIS INTERNALLY.

WESSON INTERNATIONAL INC
1439 CIRCLE RIDGE
AUSTIN, TX 78746
CONTRACT NUMBER: F19628-89-C-0149
DR ROBERT B WESSON
TITLE:
A LOW-COST SIMULATION-BASED ATC TRAINER
TOPIC# 31 OFFICE: ESD/AVP IDENT#: 31592

THE CONSTRUCTION OF AN IBM PC-COMPATIBLE AIR TRAFFIC CONTROL TRAINING SYSTEM WITH COMPLETE VOICE INPUT AND OUTPUT IS PROPOSED. THIS SYSTEM, BUILT UPON AN UNDER-\$10,000 HARDWARE PLATFORM, WILL BE CAPABLE OF DISPLAYING A REALTIME RADARSCOPE PICTURE OF ANY GEOGRAPHICAL SECTOR IN THE MILITARY OR CIVILIAN ENVIRONMENT. THE SIMULATOR WILL BE CAPABLE OF GENERATING REALISTIC TRAFFIC FLOWS FOR THE SECTOR CHOSEN, COMPLETE WITH "INTELLIGENT" PILOTS WHO TALK BACK USING A SYNTHESIZED VOICE. SPOKEN CONTROL COMMANDS IN STANDARD PHRASEOLOGY WILL BE UNDERSTOOD BY THE 1000-WORD VOCABULARY VOICE RECOGNITION SYSTEM IN REAL TIME AND REFLECTED IN THE BEHAVIOR OF THE SIMULATED AIRCRAFT ONSCREEN. PHASE II WORK WOULD INCLUDE INCREASING THE FIDELITY OF THIS SIMULATION SYSTEM, ADDING AN EXPERT SYSTEM TO ASSIST STUDENT CONFLICT RESOLUTIONS AND AUTOMATE ROUTINE ATC FUNCTIONS, EVALUATING THE SYSTEM FOR TRAINING AT A REAL-WORLD ATC FACILITY, AND DEPLOYING ONE OR MORE SYSTEMS ON A PERMANENT BASIS.

WICKMAN SPACECRAFT & PROPULSION CO
PO BOX 7179
CITRUS HEIGHTS, CA 95621
CONTRACT NUMBER:
JOHN H WICKMAN
TITLE:
SOLID ROCKET MOTOR INTERNAL INSULATION TESTING
TOPIC# 212 OFFICE: BMO/MYSC IDENT#: 32580

SUBMITTED BY

PHASE I OF THIS PROGRAM WILL RESULT IN THE DEVELOPMENT OF A LABORATORY TESTING METHOD WHICH WILL ACCURATELY SIMULATE SOLID ROCKET CHAMBER ENVIRONMENTS. THE FEASIBILITY OF USING PROPELLANT GAS GENERATOR CARTRIDGES AND OTHER KEY PARTS OF THE LABORATORY APPARATUS WILL BE DEMONSTRATED. AN INTERNAL INSULATION PERFORMANCE DATABASE WILL BE CREATED WHICH INCLUDES CURRENT AND PAST SOLID ROCKET MOTOR DATA.

WOVEN-WIRE CORP
PO BOX 5182 - 926 BACA ST
SANTA FE, NM 87502
CONTRACT NUMBER: F04701-89-0059
JAMES F DEMPSEY

TITLE:
INNOVATIVE CONCEPTS FOR SPACE SYSTEMS AND LAUNCH SYSTEMS COST REDUCTION
TOPIC# 177 OFFICE: AFSTC/OLAB IDENT#: 34437

THE EFFORT PROPOSED HEREIN WILL FOCUS ON DEVELOPING AND UNDERSTANDING IMPORTANT DESIGN PARAMETERS OF A COMPACT/HIGHLY EXPANDABLE, LIGHT WEIGHT STRUCTURAL WEAIVED JOINT WHICH CAN BE EMPLOYED INEXPENSIVELY AS A BASIC CONSTRUCTION ELEMENT FOR OPERATIONS IN SPACE. A 12" DIAMETER PROTOTYPE IS AVAILABLE AS A SUPPLEMENT TO THIS PROPOSAL IF REQUESTED. IT IS ANTICIPATED THAT THE USE OF THIS STRUCTURAL WEAVE FOR SPACE APPLICATIONS WILL PROVIDE HIGH ECONOMIC RETURN THROUGH COST SAVINGS IN PAYLOAD REDUCTION, MINIMIZED STORAGE/TRANSPORT VOLUME, HIGHLY EXPANDING STRUCTURES WITH POTENTIALLY HIGH LOAD CARRYING CAPACITIES AND RAPID DEPLOYMENT WITHOUT MECHANICAL ASSEMBLY IN THE SPACE ENVIRONMENT. THIS EFFORT FOCUSES UPON UNDERSTANDING THE MECHANICAL/STRUCTURAL BEHAVIOR OF TWO SELECTED STRUCTURAL WOVEN UNITS. FOUR (EIGHT TO 12 FOOT DIAMETER) ALUMINUM PROTOTYPES WILL BE FABRICATED AND STUDIED. FINITE ELEMENT ANALYSIS OF THESE STRUCTURES WILL THEN BE PERFORMED TO DETERMINE FORCE-DEFLECTION-STRESS RELATIONSHIPS AND CONSTRAINING TECHNIQUES. A FINAL REPORT AND (OPTIONALLY) TWO PROTOTYPES WILL BE DELIVERED.

XERAD INC
1526 - 14TH ST/#104
SANTA MONICA, CA 90404
CONTRACT NUMBER:
JOHN V LANDRY

TITLE:
EMPLOYMENT OF PBR PROPULSION AND SEEDED ULTRA-LIGHTWEIGHT MATERIA TO ENHANCE IBM PERFORMANCE AND SIGNATURES
TOPIC# 209 OFFICE: BMO/MYSC IDENT#: 32562

SUBMITTED BY

XERAD PROPOSES TO INVESTIGATE THE UTILIZATION OF THE ADVANCED NUCLEAR REACTOR TECHNOLOGY CONCEPT KNOWN AS THE PARTICLE BED REACTOR (PBR) WHICH WAS BASELINED FOR AN AIR FORCE ASTRONAUTICS LABORATORY (USAFAL) STUDY FOR AN ORBIT TRANSFER VEHICLE (OTV). THE STUDY FOCUSED ON HYDROGEN AS THE WORKING FLUID. FOR AN ICBM APPLICATION, AN ALTERNATE PROPELLANT SUCH AS AMMONIA, WILL BE EMPLOYED IN ATMOSPHERIC PHASES. THIS TECHNOLOGY COUPLED WITH UNIQUE ULTRA-LOW DENSITY COATING MATERIALS FROM ANOTHER SDIO PROGRAM SHOULD GREATLY ENHANCE SUPPRESSION OF BOOSTER SIGNATURES. ALSO, THE PBR TECHNOLOGY OFFERS LOWER MISSILE WEIGHT OR GREATER PAYLOAD FOR THE SAME WEIGHT. ALTERNATIVELY, THIS LATTER EXCESS PERFORMANCE CAN BE USED FOR DEPRESSED TRAJECTORIES AND/OR HYPERBALLISTIC SPEEDS. SCOPING ANALYSES AND CURSORY PRELIMINARY DESIGN WILL BE PERFORMED IN PHASE I WITH BASE CASE DESIGN AND DETAILED COST/EFFECTIVENESS STUDIES FOR PHASE II.

XERAD INC
1526 FOURTEENTH ST - #104
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CONTRACT NUMBER:
DR THOMAS P BAUER
TITLE:
HOT-HYDROGEN-POWERED SCRAMJET
TOPIC# 248 OFFICE: AFSC/NAT IDENT#: 37989

THE PROPOSED CONCEPT IS THE APPLICATION OF HOT HYDROGEN FROM A COMPACT, HIGH-POWER (CLASSIFIED) SOURCE TO MIX WITH, AND HEAT AMBIENT SUPERSONIC AIR IN A SCRAMJET DUCT TO HIGH TEMPERATURES. THE STUDY PROGRAM WILL CHARACTERIZE SUCH A SYSTEM, INVESTIGATING FLOW AEROTHERMODYNAMICS, INDUCTION OF HOT GAS INTO A SUPERSONIC AIR FLOW, MIXING TIMES AND DYNAMICS, AND DETERMINE THE PROSPECTIVE ISP FOR THIS TYPE OF SCRAMJET. PHASE II EFFORT WILL REFINE PHASE I CODES (SUCH AS FOR HYDROGEN/SUPERSONIC AIR FLOW MIXING), DO DETAILED PRELIMINARY DESIGN OF THE HOT GAS SCRAMJET -- PARTICULARLY OF THE INLET AND MIXING REGIONS, PERFORM BREAD-BOARD TESTING OF CRITICAL ISSUES, AND DEFINE THE POTENTIAL FOR MEANINGFUL PHASE III EXPERIMENTAL DEMONSTRATIONS.

XON-TECH INC
6862 HAYVENHURST AVE
VAN NUYS, CA 91406
CONTRACT NUMBER:
KURT GOLDEN
TITLE:
FAST PLASMA/ANTENNA BORESIGHT ERROR CODE
TOPIC# 220 OFFICE: BMO/MYSC IDENT#: 32638

SUBMITTED BY

ADVANCED REENTRY SYSTEM SIMULATIONS NEED COMPREHENSIVE FLOW FIELD PLASMA, AEROTHERMAL ANTENNA WINDOW HEATING AND ABLATION, AND REENTRY ANTENNA PREDICTION CAPABILITIES. THE ON-BOARD ELECTROMAGNETIC (EM) SENSORS AND COHERENT SIGNAL PROCESSING ARE DEGRADED BY THE HOT ABLATING ANTENNA WINDOW AND PROPAGATION THROUGH THE PLASMA ENVIRONMENT. THE PROPOSED PHASE I RESEARCH WILL DETERMINE IF EXISTING STATE OF THE ART CODES CAN BE INTEGRATED TOGETHER INTO AN INTERACTIVE SET OF FLOW FIELD/AEROTHERMAL/ANTENNA ANALYSES WHICH COULD BE DIRECTLY COUPLED INTO EXISTING HI-FEDELITY - SIX-DEGREE-OF-FREEDOM (6DOF) TERMINAL GUIDANCE OR RADAR HOMING SIMULATIONS. THE RESEARCH WILL DETERMINE THE INTEGRATION ARCHITECTURE, EXPECTED CODE PERFORMANCE (TIME AND ACCURACY), A SET OF TEST CALCULATIONS, AND MODULE SOFTWARE SPECIFICATION.

ZEGER-ABRAMS INC
1112 CLARK RD
PHILADELPHIA, PA 19118
CONTRACT NUMBER:
BURTON S ABRAMS
TITLE:
IMPROVED DEMODULATOR FOR SS CDMA C(3) SYSTEMS
TOPIC# 31 OFFICE: ESD/AVP IDENT#: 31583

AN IMPROVED DEMODULATOR STRUCTURE HAS BEEN CONCEIVED FOR SPREAD SPECTRUM CODE DIVISION MULTIPLE ACCESS COMMAND, CONTROL, AND COMMUNICATIONS NETWORKS. THIS STRUCTURE PROMISES MUCH GREATER SEPARABILITY OF THE CDMA SIGNALS THAN CAN BE ACHIEVED WITH A CONVENTIONAL DEMODULATOR. ITS BENEFITS WILL BE MOST NOTABLE IN BEING ABLE TO DEMODULATE VERY WEAK SIGNALS IN THE PRESENCE OF VERY STRONG SIGNALS (THE SO-CALLED NEAR/FAR PROBLEM), WHERE THE RATIO OF SIGNAL STRENGTHS MAY BE MUCH LARGER THAN THE BANDWIDTH SPREADING RATIO.

ZYW CORP
PO BOX 279
PRINCETON JCT, NJ 08550
CONTRACT NUMBER: F33615-89-C-2937
DR ARNOLD J KELLY
TITLE:
ELECTROSTATIC FUEL ATOMIZATION AND SPRAY DISPERSAL DEMONSTRATION
TOPIC# 148 OFFICE: AFWAL/POMP IDENT#: 33205

SUBMITTED BY

ELECTROSTATIC ATOMIZATION PROVIDES A NUMBER OF ADVANTAGES FOR CONTROLLING COMBUSTION THAT ARE NOT AVAILABLE FROM THE CONVENTIONAL, NON-CHARGED SPRAY SYSTEMS NOW IN USE. CHARGED SPRAYS ARE VIGOROUSLY SELF-DISPERSING, PROVIDE UNIFORM PATTERNATION AND HAVE NARROW SIZE DISTRIBUTIONS. THESE SPRAYS CAN BE GENERATED BY COMPACT DEVICES AT HIGH FLOW RATES WITH LOW INPUT POWER AT MODEST APPLIED VOLTAGES, AND ARE INHERENTLY INSENSITIVE TO FLUID PROPERTIES AND FLOW RATE. HOWEVER, NO PLUME PATTERNATION DATA ARE AVAILABLE. A SIX MONTH EFFORT IS PROPOSED TO OBTAIN QUANTITATIVE PATTERNATION AND DROPLET SIZE DISTRIBUTION DATA FOR CHARGED PLUMES. A LASER DOPPLER VELOCIMETER WILL BE USED TO OBTAIN DROPLET VELOCITY AND SIZE DATA TO TEST THE VALIDITY OF PLUME PATTERNATION MODELS. THIS WORK WILL PROVIDE BASELINE INFORMATION NECESSARY FOR THE EVALUATION OF THIS TECHNOLOGY FOR GAS TURBINE ENGINE USE AND FOR THE DESIGN OF THE HIGH FLOW RATE CHARGE INJECTION NOZZLES THAT WILL BE USED FOR THE ENGINE APPLICATIONS OF ULTIMATE INTEREST.

AF

TOTAL NUMBER OF AWARDS: 337