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April 16, 1985

## PREFACE

On August 1, 1984, Secretary of Defense Caspar W. Weinberger announced the selection of 370 small business firms whose proposals under Phase I of the Fiscal Year (FY) 1984 Department of Defense (DoD) Small Business Innovation Research (SBIR) Program will be funded upon successful completion of negotiations.

The selection, from small business research and development (R&D) contractors, was made from 3,014 proposals received by the Military Departments, the Defense Advanced Research Projects Agency (DARPA) and the Defense Nuclear Agency (DNA) in response to the FY 1984 solicitation distributed on October 1, 1983 with a closing date of January 12, 1984.

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 the abstracts of those proposals which have resulted in contract awards. Further, the name and address of the firm performing the work are given for those who may desire additional information about the project.

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

## INTRODUCTION

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

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. (There are twelve government agencies meeting this requirement.) Beginning in FY 1983, DoD must make available the following percentages of its extramural R&D budget for this program:

|                   | <u>FY 1983</u> | <u>FY 1984</u> | <u>FY 1985</u> | <u>FY 1986</u> | <u>FY 1987</u> | <u>FY 1988</u> |
|-------------------|----------------|----------------|----------------|----------------|----------------|----------------|
| Percentage        | 0.1            | 0.3            | 0.5            | 1.0            | 1.25           | 1.25           |
| Estimated Dollars | 16.7M          | 43M            | 79M            | 160M           | 240M           | 262M           |
| Actual Awards     | \$20.6M        | 44.6M          |                |                |                |                |

### Objectives:

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



The SBIR Program consists of three distinct phases. Under Phase I, DoD Components make awards to small businesses, 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 prerequisite for further DoD support in Phase II.

Phase II awards will be made only to firms on the basis of results from the Phase I effort, and the scientific and technical merit of the Phase II proposal. In addition, proposals which identify a follow-on Phase III funding commitment from non-Federal sources will be given special consideration. Phase II awards will typically cover two to five man-years of effort over a period generally not to exceed 24 months, also subject to negotiation. The number of Phase II awards will depend upon the success rate of the Phase I effort and 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 were 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.

Reviewers based their conclusions only on information contained in the proposal. Final funding decisions were made on the basis of the criteria stated above along with considerations of such factors as duplication with other ongoing work and the overall program balance.

### FY 1983 Program

For the FY 1983 Phase I SBIR program, the three Services and the Defense Agencies selected more than 400 R&D topics which were included in the solicitation. The following is a breakout of the proposals received and the number of proposals selected on which Phase I contracts were awarded.

|           | <u>Number of Topics</u> | <u>Proposals Received</u> | <u>Phase I Awards</u> |
|-----------|-------------------------|---------------------------|-----------------------|
| Army      | 182                     | 1121                      | 96                    |
| Navy      | 131                     | 944                       | 67                    |
| Air Force | 75                      | 496                       | 100                   |
| DARPA     | 8                       | 128                       | 12                    |
| DNA       | <u>10</u><br>406        | <u>88</u><br>2777         | <u>8</u><br>283       |

From these FY 1983 Phase I awards, the following Phase II awards are anticipated: Army - 30 to 35, Navy - 39, Air Force - 40 to 45, DARPA - 6 and DNA - 2. Funds for the two-year Phase II effort will be made available incrementally.

### FY 1984 Program

The DoD FY 1984 solicitation contained 566 topics. Approximately 42,000 solicitation brochures for the FY 1984 DoD SBIR Phase I contract program were mailed. The announcement of proposals selected for negotiations was made by the Secretary of Defense on August 1, 1984.

|           | <u>Number of Topics</u> | <u>Proposals Received</u> | <u>Selected for Negotiations</u> |
|-----------|-------------------------|---------------------------|----------------------------------|
| Army      | 111                     | 761                       | 81                               |
| Navy      | 147                     | 847                       | 99                               |
| Air Force | 283                     | 1212                      | 163                              |
| DARPA     | 17                      | 107                       | 15                               |
| DNA       | <u>8</u><br>566         | <u>80</u><br>3007         | <u>12</u><br>370                 |

**Summary**

*This document is a bibliography*  
~~Presentation of the~~ technical abstracts which describe the nature of the funded FY 1984 Phase I SBIR projects. ~~is the main purpose of this report.~~ Proprietary information is not provided in these abstracts, therefore, technical details may be missing. For this reason, the report supplies the names of individuals in the small business firms who may be contacted should more information be needed on a specific project. *Some abstracts*

*to the sponsor, responsible party, title, location of project, and amount of funding.*

FISCAL YEAR 1984

| SUBMITTED BY<br>-----  | DEPT<br>----- | AWARDED<br>AMOUNT<br>----- |
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| ABANTI RESEARCH AND DEVELOPMENT COMPANY<br>ROUTE 1 BOX 157B<br>TENN RIDGE, TN 37178<br>DAVID R. P. SIMPKINS<br>TITLE:<br>IMPROVED SHIPBOARD (SUBMARINE) VELOCITY AND SEA ENVIRONMENT SENSORS<br>TOPIC: 80 OFFICE: NSWC | NAVY          | \$ 49,970                  |

A RESEARCH PROJECT TO DETERMINE THE FEASIBILITY OF DEVELOPING A SUBMARINE SEA ENVIRONMENT SENSOR (WAVE HEIGHT, SEA STATE), AND RELATIVE SPEED ACROSS AND DECK UTILIZING MICRO-CELL STRAIN SENSORS AND FIBER OPTIC DATA TRANSMISSION SYSTEMS.

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| ABARIS<br>1254 ST. ALBERTS<br>RENO, NV 89053<br>W. L. MURPHY<br>TITLE:<br>APPLICATION OF COMPOSITE MATERIALS TO LIGHT WEIGHT MUNITION DISPENSER STRUCTURE<br>TOPIC: 226 OFFICE: DLXB | AF | \$ '3,265 |
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THIS PROJECT IS TO EXAMINE THE STRUCTURAL REQUIREMENTS OF A MUNITIONS DISPENSER, AND IDENTIFY COMPOSITE MATERIALS AND THEIR APPLICATION TO DESIGNS THAT WOULD REDUCE PARASITIC STRUCTURAL WEIGHT BY 30%. THERE ARE A VARIETY OF FIBERS, RESINS, AND MANUFACTURING PROCESSES THAT HAVE THE POTENTIAL FOR ACHIEVING SIGNIFICANT WEIGHT REDUCTION. AS THE PROPERTIES AND COSTS OF COMPLETED COMPONENTS VARY WITH MANUFACTURING PROCESSES, IT IS NECESSARY TO EXAMINE THE QUANTITY REQUIRED, AND MANUFACTURING CONCEPTS, AS WELL AS THE AVAILABLE MATERIALS. COMMONLY USED MATERIAL SYSTEMS SUCH AS THERMOSET EPOXY RESINS AND CARBON OR KEVLAR FIBERS WILL BE ANALYZED FOR THEIR APPLICABILITY. ONE AREA OF EMERGING TECHNOLOGY IS IN HIGH PERFORMANCE THERMOPLASTICS SUCH AS POLYETHERESTHERKETONE (PEEK). PEEK, AS WELL AS OTHER NEW THERMOPLASTICS, WILL BE EXAMINED TO DETERMINE THEIR APPLICABILITY. AVAILABLE MATERIAL SYSTEMS SUCH AS THERMOSET EPOXY RESINS AND CARBON OR KEVLAR FIBERS WILL BE ANALYZED FOR THEIR FEASIBILITY.

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| ADVANCED COMPOSITE PRODUCTS, INC.<br>37 WASHINGTON AVENUE<br>EAST HAVEN, CT 06512<br>DAVID MAASS<br>TITLE:<br>DESIGN AND MANUFACTURING PLAN FOR A COMPOSITE LOW ALTITUDE DISPENSER (LAD)<br>TOPIC: 226 OFFICE: DLXB | AF | \$ 69,997 |
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COMPOSITE MATERIALS SUCH AS GRAPHITE/EPOXY AND KEVLAR/EPOXY OFFER THE

SMALL BUSINESS INNOVATION RESEARCH (SBIR) PROGRAM - PHASE I PAGE 2

FISCAL YEAR 1984

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COMPOSITE MATERIALS SUCH AS GRAPHITE/EPOXY AND KEVLAR/EPOXY OFFER THE POTENTIAL TO REDUCE WEIGHT, RADAR CROSS SECTION (RCS), AND MANUFACTURED COSTS IN FLIGHT VEHICLE STRUCTURES. THIS PROGRAM IS DESIGNED TO APPLY THESE BENEFITS TO AFAL'S LOW ALTITUDE DISPENSER (LAD). AT THE SAME TIME THE CURRENT 11" PAYLOAD BAY WOULD BE INCREASED TO 12" TO INCREASE PAYLOAD VOLUME AND EFFICIENT MUNITIONS PACKING. AFTER A REVIEW OF PRIOR LAD WORK ON THE ALUMINUM VEHICLES, THREE COMPOSITE AIRFRAME CONCEPTS ARE DERIVED. ONE OF THESE CONCEPTS IS SELECTED ON THE BASIS OF WEIGHT, RCS, COST AND PRODUCEABILITY CONSIDERATIONS. A PRELIMINARY STRUCTURAL DESIGN AND WEIGHT ESTIMATE ARE THEN CONDUCTED. MANUFACTURING FEATURES ARE ALSO ADDRESSED IN SUFFICIENT DETAIL TO DETERMINE DEVELOPMENT AND UNIT COSTS. A FINAL REPORT IS PROVIDED WHICH SUMMARIZES THIS EFFORT AND PROVIDES GUIDELINES FOR FURTHER PHASE II DEVELOPMENT.

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| ADVANCED FUEL RESEARCH INC<br>87 CHURCH ST<br>EAST HARTFORD, CT 06108<br>PETER R. SOLOMON<br>TITLE:<br>INTEGRATED, COMPUTERIZED, PORTABLE SYSTEM FOR COAL CHARACTERIZATION<br>TOPIC: 64 OFFICE: CERL-PP | ARMY | \$ 58,782 |
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SIGNIFICANT SAVINGS IN COST AND DISPLACEMENT OF VALUABLE PETROLEUM FUEL CAN BE ACHIEVED BY BURNING COAL WHEN APPROPRIATE FOR DOD POWER GENERATION REQUIREMENTS. THIS PROPOSAL OFFERS A COST EFFECTIVE, PORTABLE, COMPUTER CONTROLLED AND INTEGRATED COAL ANALYSIS SYSTEM FOR ASSESSING A COAL'S COMBUSTION PERFORMANCE. THE PROPOSED SYSTEM FOR COAL ANALYSES IS AN INTEGRATED THERMOGRAVIMETER ANALYZER (TGA), EVOLVED GAS ANALYZER (EGA) AND FOURIER TRANSFORM INFRARED SPECTROMETER (FT-IR). THE OVERALL GOAL OF THE PHASE I PROGRAM IS TO DEMONSTRATE THAT AN INTEGRATED TGA/EGA/FT-IR CAN PROVIDE ALL THE DATA REQUIRED TO DETERMINE THE COMBUSTION PERFORMANCE OF COAL SAMPLES. AFR HAS RECENTLY ENTERED INTO AN AGREEMENT WITH A MAJOR INSTRUMENT COMPANY TO DEVELOP AN INSTRUMENT WHICH WOULD BE THE CORE OF THE PROPOSED SYSTEM. IT IS ANTICIPATED THAT PHASE I WILL DEMONSTRATE THE CAPABILITY OF OBTAINING QUANTITATIVE AND REPRODUCIBLE DATA ON A PROTOTYPE TGA/EGA/FT-IR FOR THE FOLLOWING QUANTITIES: PROXIMATE ANALYSIS, ELEMENTAL ANALYSIS, MINERAL COMPOSITION, VOLATILE COMPOSITIONS AND VOLATILE KINETICS. PHASE I WILL FURTHER ASSESS THE FEASIBILITY OF COMPUTING FROM THESE DATA

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THE IMPORTANT COMBUSTION PARAMETERS INCLUDING: CALORIFIC VALUE, FLAMABILITY INDEX, FREE SWELLING INDEX AND ASH FUSION TEMPERATURE. THE PROGRAM WILL ALSO ASSESS THE FEASIBILITY OF USING THE DATA TO IDENTIFY SIMILAR COALS IN A REFERENCE LIBRARY FOR WHICH ADDITIONAL COMBUSTION PERFORMANCE DATA ARE AVAILABLE.

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| ADVANCED RESEARCH & APPLICATIONS CORP<br>1223 E. ARQUES AVE.<br>SUNNYVALE, CA 94086<br>J. L. CHAMBERS<br>TITLE:<br>TECHNOLOGY FOR IMPROVED ECCM INSTRUMENTATION<br>TOPIC: 18 OFFICE: DRDEL-CT-R | ARMY | \$ 49,876 |
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ECCM TECHNOLOGY HAS A GROWING NEED FOR IMPROVED HIGH-STABILITY TIME-FREQUENCY STANDARDS. THE MAIN STANDARDS CURRENTLY IN COMMON USE UTILIZE QUARTZ-CRYSTAL OSCILLATORS CUT TO THE AT ORIENTATION. A PRIMARY CANDIDATE FOR MEETING THE REQUIREMENT FOR IMPROVED TIME/FREQUENCY STANDARDS IS SC-CUT QUARTZ, WHICH OFFERS MAJOR IMPROVEMENTS IN STABILITY AND PERFORMANCE OVER AT-CUT QUARTZ OSCILLATORS. UNFORTUNATELY, X-RAY ORIENTATION EQUIPMENT OF THE TYPE USED FOR THE LAST 30 YEARS IN MANUFACTURE OF THE SIMPLER AT-CUT CRYSTALS IS INADEQUATE FOR PRODUCTION OF SC-CUT CRYSTALS, WHICH REQUIRE PRECISE ORIENTATION ABOUT EACH OF TWO AXES (I.E., ARE "DOUBLY ROTATED"). THE PROPOSED PROGRAM HAS AS ITS OBJECTIVES PROOF OF FEASIBILITY OF A NOVEL X-RAY TECHNIQUE TO PERMIT BOTH MEASUREMENT AND CORRECTION OF THE ANGLES OF CUT OF DOUBLY ROTATED QUARTZ-CRYSTAL PLATES, SUCH AS THE SC, IN A PRODUCTION ENVIRONMENT, AND DELIVERY OF A CONCEPTUAL DESIGN FOR A COMPLETE ORIENTATION MEASUREMENT INSTRUMENT. FEASIBILITY WILL BE DETERMINED FROM CALCULATIONS AND FROM EXPERIMENTS UTILIZING MODIFICATIONS TO A PROTOTYPE LASER-ASSISTED LAUE DIFFRACTOMETER, AN INSTRUMENT SIMILAR IN GEOMETRY TO THAT PROPOSED.

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| ADVANCED RESEARCH & APPLICATIONS CORP<br>1223 EAST ARQUES AVENUE<br>SUNNYVALE, CA 94086<br>JAMES H. STANLEY<br>TITLE:<br>A NEW RADIOGRAPHIC CORROSION INSPECTION CAPABILITY<br>TOPIC: 70 OFFICE: AFWAL/XRPM | AF | \$ 49,968 |
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CORROSION OF EQUIPMENT AND MATERIAL IS AN UNBIQUITOUS NATIONAL

FISCAL YEAR 1984

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PROBLEM COSTING THE U.S. ECONOMY OVER \$70 BILLIONS ANNUALLY. REAL-TIME RADIOGRAPHY HAS BEEN IDENTIFIED AS ONE OF SEVERAL PROMISING NEW NDE TECHNOLOGIES BECAUSE OF ITS POTENTIAL ABILITY TO SOLVE A SIGNIFICANT NUMBER OF EXISTING CORROSION INSPECTION PROBLEMS. YET, IN SPITE OF ITS POTENTIAL ADVANTAGES, REAL-TIME RADIOGRAPHY HAS NOT YET DEMONSTRATED A SIGNIFICANTLY BETTER ABILITY THAN OTHER COMPETING MODALITIES TO DETECT THE EARLY STAGES OF CORROSION WHEN CORRECTIVE ACTIONS CAN MOST EFFICIENTLY BE TAKEN. A DUAL-ENERGY RADIOGRAPHIC TECHNIQUE IS PROPOSED WHICH WILL SIGNIFICANTLY ENHANCE THE CORROSION DETECTION AND DAMAGE ASSESSMENT CAPABILITIES OF REAL-TIME SYSTEMS. THE MAIN ADVANTAGE OF THE PROPOSED METHOD IS THAT IT IMPROVES THE CONSPICUITY OF DETAIL IN A DIGITAL IN A DIGITAL RADIOGRAPHY BY GREATLY REDUCING THE STRUCTURAL NOISE IN THE IMAGE. THE IMPROVED SENSITIVITY OFFERED BY DUAL-ENERGY METHODS COULD ALTERNATIVELY BE TRADED FOR AN EQUIVALENT DETECTIBILITY AT A MUCH LOWER DOSE LEVEL, AN IMPORTANT CONSIDERATION FOR ON-BOARD OR IN-SITU INSPECTIONS. IN ADDITION, THE DUAL-ENERGY RADIOGRAPHY ALSO ALLOWS THE USER TO IDENTIFY MATERIALS IN THE OBJECT UNDER EXAMINATION.

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| ADVANCED RESEARCH & APPLICATIONS CORP.<br>1223 EAST ARQUES AVENUE<br>SUNNYVALE, CA 94086<br>T. J. MAGEE<br>TITLE:<br>IMPROVED PROCESS TECHNOLOGY FOR VHSIC SOS WAFERS<br>TOPIC:           5           OFFICE: OAAM | DNA | \$ 48,813 |
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COMMERCIAL SAPPHIRE SURFACES CONTAIN BURIED DAMAGE WHICH HAS A DELETERIOUS INFLUENCE ON SOS LAYERS GROWN THEREON. THE DEFECTS IN THE SILICON LAYERS RESULT IN A REDUCED YIELD OF DEVICES AND PERFORMANCE LIMITATIONS. MUCH OF THE DAMAGE IN THE SAPPHIRE SURFACE IS PRODUCED BY THE POLISHING STEP, WHICH EMPLOYS AN ABRASIVE PAD IN CONTACT WITH THE SAPPHIRE SURFACE. AN IMPROVED POLISHING PROCESS HAS BEEN EVALUATED WHICH DOES NOT REQUIRE CONTACT WITH THE SAPPHIRE SURFACE. AN EVALUATION OF SI FILMS GROWN ON SAPPHIRE SUBSTRATES POLISHED BY THIS NON-CONTACT PROCEDURE REVEALS THAT DISLOCATION AND STACKING FAULTS DENSITIES ARE SUBSTANTIALLY REDUCED COMPARED TO THE BEST COMMERCIAL SOS WAFERS. THE LABORATORY APPARATUS ASSEMBLED FOR THE INITIAL EXPERIMENTS IS INADEQUATE FOR PRODUCTION APPLICATIONS SINCE THE THROUGHPUT IS VERY LOW AND OPERATION REQUIRES CONSIDERABLE ATTENTION.

FISCAL YEAR 1984

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WE PROPOSE TO EVALUATE THE FEASIBILITY OF A LARGER PRODUCTION-ORIENTED MACHINE, TO CONDUCT DESIGN TRADEOFFS AND TO PREPARE A FINAL CONCEPTUAL DESIGN OF A CAPABILITY AUTOMATED MACHINE WITH A MULTIPLE-SUBSTRATE.

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| ADVANCED RESEARCH AND APPLICATIONS CORP<br>1223 EAST ARQUES AVE<br>SUNNVALE, CA 94086<br>LOUIS N KOPPEL | DNA | \$ 49,116 |
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TITLE:  
DIGITAL INTERFACE MODULES FOR ACTIVE READOUT X-RAY SPECTROMETERS  
TOPIC:           3           OFFICE: OAAM

FOR THE CLASS OF DNA NUCLEAR WEAPONS EFFECTS SIMULATOR KNOWN AS THE PLASMA RADIATING SOURCE (PRS), HIGH RESOLUTION X-RAY SPECTROSCOPY DIAGNOSTIC MEASUREMENTS PROVIDE CRITICAL INFORMATION BOTH FOR CHARACTERIZATION OF THE TEST-OBJECT RADIATION ENVIRONMENT AND FOR OPTIMIZATION OF THE SOURCE. PRESENT PRS HIGH RESOLUTION X-RAY SPECTROMETERS RECORD DATA ON PHOTOGRAPHIC FILM, THE PROCESSING AND ANALYSIS OF WHICH IS UNACCEPTABLY LABOR AND TIME INTENSIVE. THE PROPOSED PROJECT WILL ADAPT HIGH RESOLUTION ELECTRO-OPTIC DETECTORS TO THE TASK OF ELECTRONICALLY RECORDING SPECTRA IN EXISTING DNA SPECTROMETERS. DIGITAL INTERFACE HARDWARE MODULES, CONFORMING TO CAMAC AND GPIB INTERFACE PROTOCOLS, WILL INTERFACE THE NEW SENSORS INTO THE DNA INSTRUMENTATION UPGRADE SYSTEMS STRATEGY. PHASE I EFFORT WILL ADDRESS THE DESIGN OF RETROFITTABLE SPECTROMETER DETECTOR PACKAGES, PRELIMINARY DESIGN OF ANALOG SIGNAL PROCESSING AND DIGITAL INTERFACE ELECTRONICS COMPONENTS, AND SPECIFICATION AND PRELIMINARY DESIGN OF INSTRUMENT CONTROL, DATA ACQUISITION, AND DATA ANALYSIS SOFTWARE MODULES.

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| ADVANCED RESEARCH AND APPLICATIONS CORP<br>1223 EAST ARQUES AVENUE<br>SUNNYVALE, CA 94086<br>G. R. WOOLHOUSE | AF | \$ 48,864 |
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TITLE:  
SCANNING PHOTOVOLTAGE TECHNIQUE FOR NON-DESTRUCTIVE CHARACTERIZATION OF SEMICONDUCTORS WITH RESOLUTION DOWN TO 1um  
TOPIC:           70           OFFICE: AFWAL/XRPM

NEAR-SURFACE DEFECTS IN SEMICONDUCTORS HAVE A PRIMARY INFLUENCE

FISCAL YEAR 1984

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UPON DEVICE PROPERTIES, PARTICULARLY THE YIELD. IT WOULD BE VERY USEFUL TO BE ABLE TO MAP SPATIALLY THE DENSITY AND TYPE OF DEFECTS NEAR A SEMICONDUCTOR SURFACE EITHER AS A WAFER QUALITY CONTROL STEP OR TO SUPPORT DEVICE PHYSICAL EXPERIMENTS. CONVENTIONAL TECHNIQUES USED FOR THIS PURPOSE SUFFER FROM ONE OR MORE OF THE FOLLOWING LIMITATIONS: THEY ARE DESTRUCTIVE; THEY CAN ONLY IDENTIFY DEFECTS THAT INTERSECT THE SURFACE OR THEY HAVE INADEQUATE RESOLUTION. THIS PROPOSAL DISCUSSES A RESEARCH AND DEVELOPMENT PROGRAM LEADING TO THE DEVELOPMENT AND TESTING OF A SCANNING PHOTOVOLTAGE (SPV) INSTRUMENT FOR THE NON-DESTRUCTIVE IDENTIFICATION AND MAPPING OF NEAR-SURFACE DEFECTS IN SEMICONDUCTORS. ARACOR HAS DEVELOPED AN SPV TECHNIQUE WHICH SHOWS PROMISE OF BEING USEFUL FOR THIS PURPOSE IN SEMI-INSULATING MATERIAL SUCH AS GaAs, SILICON-ON-SAPPHIRE AND InP. THE EXISTING TECHNIQUE IS INAPPROPRIATE, HOWEVER, FOR DEVELOPMENT INTO A USEFUL INSTRUMENT BECAUSE THE RESOLUTION LIMIT 10 μm. IN THIS PROPOSAL, WE DESCRIBE PLANS FOR UPGRADING THIS TECHNIQUE IN TWO WAYS: (1) BY UTILIZING DIFFRACTION-LIMITED OPTICS AT A LASER WAVELENGTH OF 500nm, COMBINED WITH A MODIFIED STAGE WITH 0.5 μm RANGE; (2) BY ADOPTING A MULTIPLE WAVELENGTH APPROACH IN COMBINATION WITH MINICOMPUTER DATA REDUCTION, WE WILL IMPROVE THE SENSITIVITY OF THE TECHNIQUE SO AS TO (a) DIFFERENTIATE BETWEEN SURFACE AND BULK DEFECTS, AND (b) APPLY THE METHOD OF DOPED CONDUCTIVE SUBSTRATES.

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| ADVANCED TECHNOLOGY AND RESEARCH, INC.<br>3933 SANDY SPRING ROAD<br>BURTONSVILLE, MD 20866<br>DR. JIGIEN CHEN<br>TITLE:<br>DETECTING UNBOUNDS IN LARGE BONDED COMPONENTS<br>TOPIC: 86 OFFICE: NSWC | NAVY | \$ 49,748 |
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A SYSTEM IDENTIFICATION TECHNICAL IS PROPOSED FOR NON-DESTRUCTIVE TEST TO DETECT UNBOUNDS IN LARGE BONDED COMPONENTS. THE TECHNIQUE USES THE SYSTEM'S TIME RESPONSE DATA DUE TO RANDOM INPUT EXCITATION. SYSTEM'S EIGENVALUES AND EIGENVECTORS ARE RETRIEVED FROM THE TIME RESPONSES AND USED FOR THE CONSTRUCTION OF ACCURATE SYSTEM MATHEMATICAL MODELS. SYSTEM'S CHANGE DUE TO CRACKS, VOIDS, UNBONDS BETWEEN MATERIALS CAN BE DETECTED BY MONITORING THE PARAMETERS APPEARING IN THE MATHEMATICAL MODEL. TO ACCURATELY IDENTIFY SYSTEM'S

FISCAL YEAR 1984

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PARAMETERS, ADVANCED SIGNAL PROCESSING TECHNIQUES WILL BE EMPLOYED. THESE INCLUDE THE RANDOM DECREMENT PROCESS TO OBTAIN THE FREE DECAY RESPONSE, THE TIME DOMAIN AND FREQUENCY DOMAIN CURVE FITTING PROCESS FOR THE DETERMINATION OF SYSTEM'S EIGENVALUES AND EIGENVECTORS. COMPUTER ALGORITHMS WILL BE DEVELOPED TO ACCOMMODATE ALL THESE PROCESSING TECHNIQUES. TO EVALUATE THE ACCURACY AND EFFECTIVENESS OF THE SYSTEM IDENTIFICATION TECHNIQUE, EXPERIMENTS WILL BE PERFORMED ON A BONDED CANTILEVER BEAM. THREE TYPES OF DAMAGES WILL BE INDUCED IN THE TESTS: DELAMINATION BETWEEN THE DIFFERENT LAYERS OF THE COMPOSITE MATERIAL, CRACKS ON ONE LAYER OF THE COMPOSITE MATERIAL, AND DEBONDING BETWEEN THE BEAM AND THE METAL SUPPORT.

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| ADVANCED TECHNOLOGY AND RESEARCH, INC.<br>3933 SANDY SPRING ROAD<br>BURTONSVILLE, MD 20866<br>DR. JACKSON YANG<br>TITLE:<br>COMPOSITE PRESSURE VESSEL DAMAGE ASSESSMENT<br>TOPIC: 91            OFFICE: NSWC | NAVY | \$ 49,926 |
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METHODS ARE DESPERATELY NEEDED TO DISCERN THE STRUCTURAL INTEGRITY OF CRITICAL COMPONENTS OF WEAPON SYSTEMS SUCH AS PRESSURE VESSEL CASES. AT THIS TIME, NO TECHNIQUE EXISTS WHICH PERMITS A GLOBAL MONITORING OF THE OPERATIONAL READINESS OF ANY STRUCTURES, INCLUDING COMPOSITE MOTOR CASES. THE RANDOMDEC PROCEDURE, WHICH IS PLANNED TO BE UTILIZED UNDER THIS PROPOSED STUDY, APPEARS TO HAVE THE CAPABILITY OF INTERPRETING THE STRUCTURAL INTEGRITY OF COMPOSITE CASES WITH A MINIMAL NUMBER OF SENSORS. THE METHOD HAS HAD THE BENEFIT OF OBJECTIVE ASSESSMENT AND VERIFICATION FOR SIMPLER TYPE STRUCTURES SUCH AS FRAMEWORKS AND SIMPLE PLATE STRUCTURES, BUT ALL MADE OF METALLIC MATERIALS. UNDER THE TASK PROPOSED HERE, THESE CAPABILITIES WOULD BE EXTENDED TO COMPOSITE STRUCTURES, AND, SPECIFICALLY, MOTOR CASES WITH KEVLAR AND GRAPHITE EPOXY TYPE MATERIALS. DAMPING PROPERTIES WOULD ALSO BE MEASURED AS A FUNCTION OF FREQUENCY UNDER THIS EFFORT SO THAT COMPOSITE WING STRUCTURES COULD ALSO FALL UNDER THE SCOPE OF THIS EFFORT WITH RESPECT TO THEIR AEROLASTICITY PROPERTIES.

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| ADVANCED TECHNOLOGY, INC.<br>544 10TH STREET<br>PALISADES PARK, NJ 07650<br>DR. JOSEF INTRATER<br>TITLE:<br>PYROLYTIC GRAPHITE REPLACEMENT FOR COPPER<br>TOPIC: 4            OFFICE: ASD/AE | AF | \$ 49,560 |
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PROPOSER, WHO HAS PATENTS FOR BONDING METAL TO GRAPHITE, WILL BOND

FISCAL YEAR 1984

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TO PYROLYTIC ANISOTROPIC GRAPHITE, USING TIN COMPOSITE MATERIAL,  
IN ORDER TO FIND SUBSTITUTE FOR COPPER.

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| AERODYNE RESEARCH, INC.<br>45 MANNING ROAD<br>BILLERICA, MA 01821<br>H. J. CAULFIELD<br>TITLE:<br>HIGH SPEED HOLOGRAPHIC SWITCH FOR VLSI INTERCONNECT<br>TOPIC: 4            OFFICE: DARPA | DARPA | \$ 49,671 |
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THIS PROPOSAL IS TO DEMONSTRATE THE FEASIBILITY OF SWITCHABLE HOLOGRAMS IN RAPID (~ NANOSECOND) REPROGRAMMING OF VLSI CHIPS. THE CONCEPT WAS CHOSEN FOR HIGH SPEED, LOW SIZE, LOW COST, LOW POWER CONSUMPTION, AND MINIMUM WIRING. IT WILL RESULT IN HIGH FLEXIBILITY AND VERY RAPID REPROGRAMMING BUT WILL NOT BE AS FLEXIBLE AS A CROSS BAR SYSTEM. THE FINAL SYSTEM SHOULD SERVE REAL NEEDS, E.G. CHIP COMPUTERS, EARLY AND THUS PAVE THE WAY FOR LATER, MORE COMPLICATED SYSTEMS. THE BASIC CONCEPT IS TO ADDRESS IN PARALLEL MANY HOLOGRAMS EACH GIVING A UNIQUE "WIRING DIAGRAM". A SINGLE WIRE TO THE HOLOGRAM OF INTEREST "ACTIVATES" IT. IN PARTICULAR STRONTIUM BARIUM NIOBATE HOLOGRAMS ARE KNOWN TO BE ELECTRONICALLY SWITCHABLE. PHASE I WILL AIM AT THE LOW SIZE, LOW COST ASPECTS OF THE DESIGN AND USE PHOTOGRAPHIC HOLOGRAMS. PHASE II WOULD AIM AT FULL IMPLEMENTATION.

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| AERODYNE RESEARCH, INC.<br>45 MANNING ROAD<br>BILLERICA, MA 01821<br>H. J. CAULFIELD<br>TITLE:<br>IMAGING INFRARED SCENE PROJECTOR<br>TOPIC: 29            OFFICE: NESC | NAVY | \$ 49,462 |
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A TOTALLY NEW APPROACH TO HIGH QUALITY FLICKER-FREE IR MOVIE PROJECTION INVOLVING GRATING ENCODED REFLECTIVE IMAGES ON FILM IS DESCRIBED. THIS APPROACH IS DEMONSTRATED AND CAPABLE OF MEETING EACH OF THE REQUIREMENTS OF TOPIC NO. 29 AS WELL AS GIVING NATURAL (NOT "MONOCHROME") SPECTRAL SHAPES, EXTREMELY

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>----- | AWARDED<br>AMOUNT<br>----- |
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LARGE DYNAMIC RANGE, INDEPENDENT CONTROL OF DIFFERENT SCENE AREAS, AND READY EXTENSION TO CONCURRENT VISIBLE TO 14 UM DISPLAY. PHASE I WILL DEMONSTRATE THE FEASIBILITY CONCLUSIVELY, WHILE PHASE II WILL CONSTRUCT A FULL BRASSBOARD DEMONSTRATOR. AERODYNE RESEARCH, INC. IS WELL QUALIFIED TO PURSUE THIS PROPRIETARY INVENTION AND THE PROPOSED PRINCIPAL INVESTIGATOR IS INTERNATIONALLY ACCLAIMED FOR HIS WORK IN THE KEY RELATED AREA OF HOLOGRAPHY.

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| AEROMET, INC.<br>P.O. BOX 571030<br>TULSA, OK 74157<br>D. RAY BOOKER<br>TITLE:<br>A METEOROLOGICAL SAMPLING SYSTEM FOR UNMANNED AIRCRAFT<br>TOPIC: 252      OFFICE: BMO/PMX | AF | \$ 48,653 |
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THIS PROPOSAL DESCRIBES THE EVALUATION OF REQUIREMENTS FOR REMOTE WEATHER SAMPLING SYSTEMS APPLIED TO A SPECIFIED UNMANNED METEOROLOGICAL RECONNAISSANCE AIRCRAFT. DATA TO BE GATHERED INCLUDE CLOUD STATISTICS, WATER CONTENT AND PARTICLE SIZE, DENSITY AND WIND. LIQUID WATER CONTENT MEASUREMENT IS CONSIDERED BASED ON USING EXISTING INSTRUMENTS AND THE PROPOSER'S CONCEPTUAL DESIGN OF A NEW INSTRUMENT.

DISCUSSION IS GIVEN TO MODIFYING CURRENT INSTRUMENT SYSTEMS FOR THE MOST ECONOMICAL AND EFFICIENT USE ON UNMANNED AIRCRAFT. INSTRUMENTS TO BE STUDIED INCLUDE 2D PROBES WITH REAL TIME IMAGE PROCESSING FOR DATA COMPRESSION, HUMIDITY SENSORS, INFRARED RADIOMETERS FOR SENSING CLOUD TEMPERATURES, AND WIND MEASUREMENTS USING EXISTING SOFTWARE FOR FLIGHT TRACK INFORMATION.

SYSTEMS ALSO CONSIDERED INCLUDE REAL TIME DISPLAY VIDEO CAMERAS, VERSIONS OF SLOWSCAN AIRBORNE RADARS, MINIATURIZED REFRACTIVE INDEX INSTRUMENTS, AND POSSIBLE USE OF DROPSONDES.

ATTENTION IS GIVEN TO MONITORING AND CONTROL SYSTEMS REQUIRED FOR EACH INSTRUMENT. A DIGITAL DATA ACQUISITION SYSTEM IS DESCRIBED. THE SYSTEM USES MICROPROCESSORS TO SUPPLY DIGITAL AND ANALOG INFORMATION TO A MASTER MICROPROCESSOR FOR TIMING, DATA ASSEMBLY AND TRANSMISSION TO THE GROUND. NAVIGATION DATA IS HANDLED BY THE SAME SYSTEM ALONG WITH METEOROLOGICAL DATA, AND A COLOR-CODED FLIGHT TRACK IS GENERATED AT THE GROUND STATION.

FISCAL YEAR 1984

| SUBMITTED BY<br>-----  | DEPT<br>---- | AWARDED<br>AMOUNT<br>----- |
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| AEROMET, INC.<br>P.O. BOX 571030<br>TULSA, OK 74157<br>D. RAY BOOKER<br>TITLE:<br>THE DEVELOPMENT OF A VERSATILE ABSOLUTE LIQUID WATER CONTENT<br>METER<br>TOPIC: 252            OFFICE: BMO/PMX | AF           | \$ 48,605                  |

THE LIQUID WATER CONTENT OF CLOUDS IS ONE OF THE MOST FUNDAMENTAL QUANTITIES IN THE ATMOSPHERE. YET, NO INSTRUMENT HAS BEEN DEVELOPED FOR MEASURING LIQUID WATER CONTENT IN BOTH LIQUID AND SOLID PHASE CLOUDS.

THIS IS A PROPOSAL TO DEVELOP THE PRELIMINARY DESIGN OF AN AIRBORNE INSTRUMENT FOR MEASURING LIQUID WATER IN ALL NATURAL CLOUDS, WITH EITHER LIQUID OR ICE CLOUD PARTICLES. THE SYSTEM WILL FEATURE THE NOVEL APPROACH OF USING A COMPRESSOR TURBINE TO ACHIEVE ISOKINETIC SAMPLING AND COMPLETE EVAPORATION OF THE CLOUD SAMPLE. THE LIQUID WATER CONTENT WILL BE DETERMINED BY A DIFFERENTIAL MEASUREMENT OF THE SPECIFIC HUMIDITY OF THE EVAPORATED CLOUD SAMPLE AIR AND THE AMBIENT AIR. THE SYSTEM WILL BE DESIGNED FOR MINIMAL ELECTRICAL POWER REQUIREMENTS AND COMPATIBILITY WITH HIGH SPEED DIGITAL DATA RECORDING OR TELEMETRY SYSTEMS. THE SYSTEM WILL BE DESIGNED FOR APPLICATION TO A SPECIFIED UNMANNED METEOROLOGICAL RECONNAISSANCE AIRCRAFT. CAREFUL CONSIDERATION WILL BE GIVEN TO MINIMIZING SYSTEM WEIGHT, VOLUME, ELECTRICAL POWER AND WIRING REQUIREMENTS, SYSTEM MOUNTING, AND COMMONALITY OF SYSTEM/AIRCRAFT FUEL. THERE WILL BE NO RESTRICTIONS ON MOUNTING THE SYSTEM ON LIGHT CIVIL OR MILITARY MANNED AIRCRAFT.

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| AEROPHYSICS RESEARCH CORPORATION<br>P.O. BOX 187<br>BELLEVUE, WA 98009<br>D. S. HAGUE<br>TITLE:<br>PERFORMANCE METHODS FOR MULTI-BODY SEPARATION<br>TOPIC: 68            OFFICE: AFWAL/XRPF | AF | \$ 64,161 |
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MILITARY SYSTEMS DEVELOPMENT EFFORTS ARE IN PROGRESS WHICH INVOLVE

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>---- | AWARDED<br>AMOUNT<br>----- |
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THE SEPARATION OF ONE VEHICLE FROM ANOTHER IN AREAS WHERE AERODYNAMIC FORCES MAY HAVE IMPORTANT EFFECTS. THESE EFFORTS INCLUDE ADVANCED MILITARY SPACECRAFT CAPABILITY AND ADVANCED AEROCONFIGURED MISSILES. SAFE SEPARATION OF THE VEHICLES IN THE FIRST FEW SECONDS OF FLIGHT IS ESSENTIAL TO THE DEVELOPMENT OF THESE CONCEPTS AND YET THE CRITERIA WHICH DETERMINE A SAFE SEPARATION IS NOT WELL ESTABLISHED. EXISTING SEPARATION DYNAMICS COMPUTER PROGRAMS, WHEN USED ON A PARTICULAR CONCEPT, CONTAIN VARIATIONS IN THE ASSUMPTIONS USED. THIS EFFORT WILL DEVELOP A GENERALIZED TWO BODY SEPARATION COMPUTER PROGRAM THAT CAN BE USED TO SIMULATE THE FLIGHT PATHS OF VARIOUS CONCEPTS ON A COMMON GROUND CONSISTENT WITH EXISTING AFWAL SINGLE BODY SIX-DEGREE-OF-FREEDOM (SDF) COMPUTER CODE. THIS EFFORT WILL LEAD TO SIGNIFICANT ADVANCES IN COMPUTATIONAL PERFORMANCE METHODOLOGY AND IN COMPUTER GRAPHICS TECHNIQUES INCLUDING COLOR DISPLAY TECHNOLOGY.

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| AETA CORPORATION<br>117 SILVER STREET<br>DOVER, NH 03820<br>THOMAS LOVELL<br>TITLE:<br>LIQUID-VAPOR FLOW REGIME TRANSITIONS FOR USE IN DESIGN OF HEAT<br>TRANSFER LOOPS IN SPACECRAFT<br>TOPIC: 43            OFFICE: AFWAL/XRPF | AF | \$ 49,638 |
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LOW SPEED, TWO PHASE (VAPOR-LIQUID) FLOW REGIMES ARE IMPORTANT TO SEVERAL SIGNIFICANT HEAT TRANSFER PROBLEMS IN SPACECRAFT. LOW SPEED FLOW RATES ALSO CREATE THE MOST GRAVITY-AFFECTED FLOW REGIMES. HIGH SPEED FLOW RATES CREATE FLOW REGIMES THAT ARE AFFECTED LITTLE BY GRAVITY. FEW STUDIES EXIST WHICH GIVE AN OVERVIEW OF FLOW REGIMES IN ZERO GRAVITY. IN PARTICULAR, FEW STUDIES HAVE ATTEMPTED TO USE RECENT SUCCESSFUL AND LARGELY ANALYTICAL FLOW REGIME MODELS (WHICH INCLUDE GRAVITY) AS A STARTING POINT FOR FLOW REGIME MODELING IN ZERO GRAVITY. AETA PROPOSES TO CONDUCT TWO PHASE FLOW REGIME LAB TESTS ON EARTH WHICH ELIMINATES EFFECT OF GRAVITY BY USING FLOW OF WATER AND OIL OF EQUAL DENSITY. IN ADDITION, WE WILL:

USE TWO RECENT, NEARLY ANALYTICAL FLOW REGIME PREDICTION MODELS TO INDICATE PROBABLE FLOW REGIMES IN VERY REDUCED (AND ALSO ZERO) GRAVITY. ONE OF THESE MODELS HAS ALREADY BEEN COMPUTERIZED BY AETA AND USED TO OBTAIN PRELIMINARY LOW GRAVITY

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>---- | AWARDED<br>AMOUNT<br>----- |
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RESULTS.

TO CREATE A FIRST-ORDER ANALYTICAL MODEL TO PREDICT FLOW REGIMES IN ZERO GRAVITY, USING LAB AND SEMI-ANALYTICAL COMPUTER STUDIES.

TO SUGGEST AREAS FOR VERY FOCUSED TWO PHASE FLOW EXPERIMENTAL WORK IN TRUE GRAVITY CONDITIONS; TO SUGGEST AREAS FOR MORE FOCUSED ANALYTICAL EFFORT.

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| AKM ASSOCIATES<br>30 WEST POINT PLACE<br>SAN MATEO, CA 94402<br>DR. ASOK K. MUKHOPADHYAY<br>TITLE:<br>AUTOMATIC RECOGNITION<br>TOPIC:       2       OFFICE: DRSMC-RAM(D) | ARMY | \$ 48,577 |
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A NEED EXISTS FOR THE DEVELOPMENT OF AN ARTIFICIAL INTELLIGENCE (AI)-BASED COMPUTER PROGRAM (ALGORITHM) WITH A HEURISTIC DATA BASE, OPERATIVE ON A MILITARIZED 16-BIT MICROPROCESSOR, SUCH AS, INTEL 8086 WHICH WOULD BE RESIDENT ON A COMBAT VEHICLE, FOR THE AUTOMATIC RECOGNITION OF MILITARY TARGETS. TARGET IDENTIFICATION WHICH INVOLVES COMPLEX HUMAN DECISION MAKING IS NOT VERY RELIABLE WHEN SUCH DECISION IS MADE UNDER THE STRESS OF COMBAT ENGAGEMENT, EVEN THOUGH A DISTINCT AND UNAMBIGUOUS TARGET IMAGE MIGHT BE AVAILABLE. VISUAL OR IR IMAGE-BASED TARGET IDENTIFICATION IS HARDER, AND HENCE, LESS RELIABLE WHEN THE TARGETS ARE PARTIALLY OR WHOLLY OBSCURED BY CLOUDS WHICH DIMINISH TARGET CONTRAST WITH THE BACKGROUND OR BY BATTLEFIELD SMOKE OR DUST WHICH BLUR TARGET DEFINITIONS. THE PROPOSED RESEARCH WILL ADDRESS SEVERAL KEY ELEMENTS IN THE BATTLEFIELD DATA INTERPRETATION PROBLEM AND WILL INCLUDE AI DECISION TOOLS, SUCH AS, PERCEPTUAL REASONING TECHNIQUES AND EXPERT-RULE-BASED (ERB) SYSTEMS, SENSOR MODELING, HEURISTIC DATA BASE CREATION, AND SENSOR UTILIZATION STRATEGIES. THE RESEARCH WILL RESULT IN INTEGRATION, CORRELATION AND OPTIMIZATION ALGORITHMS FOR THE MULTIPLE SENSOR SYSTEM AND AN EVALUATION OF APPROPRIATE INFORMATION PROCESSING TECHNIQUES ALL IN THE CONTEXT OF CREATING AN AI-BASED AUTOMATIC TARGET RECOGNITION (ATR) PROGRAM.

FISCAL YEAR 1984

| SUBMITTED BY<br>-----   | DEPT<br>----- | AWARDED<br>AMOUNT<br>----- |
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| AKMAN ASSOCIATES INC<br>8555 16TH ST SUITE 800<br>SILVER SPRING, MD 20910<br>JOHN A TURLEY<br>TITLE:<br>STUDY TO ASSESS THE FEASIBILITY OF AN APPLICATION OF COMPUTER AIDED<br>DESIGN TECHNOLOGY TO PROJECTING MANPOWER AND SKILL REQUIREMENTS<br>TOPIC: 108                      OFFICE: PERI-PO | ARMY          | \$ 66,000                  |

THE PROPOSED EFFORT WILL ASSESS THE FEASIBILITY OF USING COMPUTER AIDED DESIGN TECHNOLOGY TO PROJECT SYSTEM RELATED MANPOWER REQUIREMENTS. MANPOWER AND SKILL DETERMINATIONS HAVE HISTORICALLY OCCURRED LATE IN THE DESIGN PROCESS AND THUS HAVE HAD LITTLE IMPACT UPON SYSTEM DESIGN DECISIONS. THE INCREASING SCARCITY OF MANPOWER RESOURCES REQUIRES THAT THEY BE GIVEN AN INTERACTIVE ROLE IN SYSTEM DEVELOPMENT. THE PROPOSED CAD/MAN SYSTEM WILL PROVIDE A CAPABILITY FOR REAL-TIME ASSESSMENT OF THE MANPOWER AND SKILL REQUIREMENTS ASSOCIATED WITH DESIGN AND EQUIPMENT DECISIONS. IT WILL ALLOW FOR ON-LINE COMPARISONS OF THE MANPOWER REQUIREMENTS ASSOCIATED WITH DESIGN OPTIONS AND WILL FACILITATE DEVELOPMENT OF SYSTEMS WHICH ARE THE MOST EFFICIENT USERS OF HUMAN RESOURCES. CAD/MAN WILL BE BUILT ON EXISTING COMPUTER AIDED DESIGN TECHNOLOGY COMBINED WITH QUANTITATIVE MANPOWER-DESIGN RELATIONSHIPS. THESE RELATIONSHIPS WILL BE DEVELOPED FROM EXISTING OPERATOR, MAINTENANCE AND SUPPORT DATA TO ESTABLISH THE LINKAGES BETWEEN EQUIPMENT DESIGN FEATURES AND MANPOWER AND SKILL REQUIREMENTS. THESE RELATIONSHIPS WILL PROVIDE THE BASIS FOR PROJECTING THE HUMAN RESOURCE REQUIREMENTS ASSOCIATED WITH NEW SYSTEM DESIGNS. THESE PROJECTIONS WILL BE SUITABLE FOR DEVELOPING PERSONNEL ACCESSION AND RETENTION PLANS, FOR CAREER FIELD MANAGEMENT AND RESTRUCTURING, FOR TRAINING PLANNING, AND FOR INSTRUCTIONAL SYSTEMS DEVELOPMENT.

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| ALAMABA CRYOGENIC ENGINEERING<br>P. O. BOX 2451<br>HUNTSVILLE, AL 35804<br>JOHN B. HENDRICKS<br>TITLE:<br>AN AUTOMATIC HEAT SWITCH FOR A REFRIGERATOR OPERATING AT 20 KELVIN<br>TOPIC: 202                      OFFICE: AFRPL/TSTR | AF | \$ 45,162 |
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THE DESIGN OF A MECHANICAL, AUTOMATIC HEAT SWITCH FOR USE WITH A

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>----- | AWARDED<br>AMOUNT<br>----- |
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REFRIGERATOR IS PROPOSED. EMPHASIS IS PLACED ON OBTAINING A HIGH SWITCH RATIO FOR THE SYSTEM. THE MAIN EFFORT WILL CONSIST OF A CAREFUL THERMAL DESIGN FOR LIMITING THE THERMAL RADIATIVE TRANSFER WHICH WOULD REDUCE THE OFF STATE THERMAL RESISTANCE.

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| ALPHA OPTICAL SYSTEMS, INC.<br>1611 GOVERNMENT STREET - P.O. BOX 669<br>OCEAN SPRINGS, MS 39564<br>R. A. IACOVAZZI<br>TITLE:<br>FEASIBILITY OF DURABLE MULTISPECTRAL ANTI-REFLECTION OPTICAL COATINGS<br>TOPIC: 44            OFFICE: DRXHE-SS | ARMY | \$ 51,317 |
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DEVELOPMENT OF A DURABLE, ENVIRONMENTALLY STABLE , LOW-STRESS ANTI-REFLECTION COATING FOR MULTI-SPECTRAL SYSTEMS.

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| ALPHA OPTICAL SYSTEMS, INC.<br>1611 GOVERNMENT STREET, P.O. BOX 669<br>OCEAN SPRINGS, MS 39564<br>ROBERT A. IACOVAZZI<br>TITLE:<br>ANTI-REFLECTIVE WINDOW COATINGS ADVANCED DEVELOPMENT<br>TOPIC: 104            OFFICE: NWS | NAVY | \$ 49,725 |
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DESIGN AND DEVELOPMENT OF A PROTOTYPE DURABLE, STABLE, ANTIREFLECTION COATING WITH EXTENDED WAVELENGTH CHARACTERISTICS, LOW ABSORPTION, AND HIGH TRANSMISSION, SUITABLE FOR EXTERNAL WINDOWS AND INTERNAL OPTICAL ELEMENTS OF STAR SENSOR AND OTHER WIDEBAND SYSTEMS.

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| ALPHATECH, INC.<br>2 BURLINGTON EXEC CTR, 111 MIDDLESEX TRN<br>BURLINGTON, MA 01803<br>DR. DOUGLAS P. LOOZE<br>TITLE:<br>ROBUST DECENTRALIZED CONTROL<br>TOPIC: 56            OFFICE: AFWAL/XRPF | AF | \$ 49,448 |
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ALPHATECH, INC. PROPOSES TO DEVELOP AN INTEGRATED DECENTRALIZED

FISCAL YEAR 1984

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MULTIVARIABLE CONTROL SYSTEM DESIGN METHODOLOGY FOR PROBLEMS RELATED TO THE ROBUST REAL-TIME CONTROL OF VERY LARGE FLEXIBLE SPACE STRUCTURES (VLFSS). A CRUCIAL NEED EXISTS FOR THE DEFINITION OF A SUPERIOR ARCHITECTURE OF SUCH CONTROL SYSTEMS AND THE REAL-TIME COORDINATION OF THE DECENTRALIZED MULTIVARIABLE CONTROLLERS. THE PROPOSED RESEARCH WILL USE BOTH STATE-SPACE AND FREQUENCY DOMAIN TOOLS; IT WILL INTEGRATE CONCEPTS FROM REGULAR PERTURBATION THEORY (WEAK DYNAMIC COUPLING), SINGULAR PERTURBATION THEORY (FREQUENCY SEPARATION BETWEEN RIGID-BODY AND FLEXURE MODES), AND SINGULAR-VALUE BASED STABILITY/-ROBUSTNESS ANALYSIS. THE THEORY WILL EXPLOIT THE UNIQUE PHYSICAL ATTRIBUTES OF A LARGE CLASS OF VLFSS, WITHOUT DEPENDING ON UNRELIABLE MODELS OF HIGH-FREQUENCY LIGHTLY-DAMPED MODES. THE RESULT OF THE PHASE I RESEARCH WILL BE A PRACTICAL DESIGN METHODOLOGY OF IMMEDIATE USE IN SEVERAL SPACE PROGRAMS.

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| AMERICAN ROBOT CORPORATION<br>121 INDUSTRY DRIVE<br>PITTSBURGH, PA 15275<br>SHAFI MOTIWALLA<br>TITLE:<br>USE OF ROBOTICS IN AUTOMATIC FACTORY ASSEMBLY<br>TOPIC: 70 OFFICE: NSWC | NAVY | \$ 50,000 |
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THIS PROJECT WILL INVESTIGATE THE TECHNICAL FEASIBILITY OF USING A CLUSTER CONTROLLER AND OFF-LINE PROGRAM DEVELOPMENT SYSTEM FOR A CLUSTER OF INDUSTRIAL ROBOTS, PROGRAMMABLE CONTROLLERS AND VISION SYSTEMS IN A FACTORY ENVIRONMENT FOR THE PURPOSE OF LOW VOLUME ASSEMBLY. THE FOLLOWING ISSUES WILL BE INVESTIGATED:

1. USE FLEXIBLE TOOLING/GRIPPERS/HANDS FOR ASSEMBLY TASKS USING ROBOT
2. USE OF IEEE 802 AS A NETWORK STANDARD FOR THE INTERCONNECTION OF A CAD SYSTEM TO A NETWORK OF INDUSTRIAL ROBOTS, PROGRAMMABLE CONTROLLERS AND VISION SYSTEMS IN A FACTORY.
3. USE OF THE CAD SYSTEM FOR THE ADDITIONAL PURPOSE OF SIMULATION AND SOLID MODELING OF THE ROBOT AND ITS WORK ENVIRONMENT FOR OFF-LINE PROGRAMMING.

SPECIFICALLY, A CAD SYSTEM BASED ON VAX-780 HARDWARE (DIGITAL EQUIPMENT CORPORATION) AND AMERICAN ROBOT'S MERLIN (TM) ROBOT AND FACTORY PROGRAMMABLE CONTROLLER AND MAGIC EYE (TM) VISION SYSTEM

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>---- | AWARDED<br>AMOUNT<br>----- |
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WILL BE USED IN THIS INVESTIGATION.

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| AMERICAN TECHNICAL SERVICES<br>245 LOMA CORTA DRIVE<br>SOLANA BEACH, CA 92075<br>BARRY MONS PH.D.<br>TITLE:<br>PURSUIT ENGAGEMENT ERROR METHODOLOGY STUDY<br>TOPIC: 34 OFFICE: DRSMI-ICDA | ARMY | \$ 43,755 |
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THE RESPONSIVENESS OF HOMING MISSILES CAN BE LIMITED BY THE REQUIREMENT TO MAINTAIN ADEQUATE STABILITY CHARACTERISTICS OF THE HOMING GUIDANCE LOOP IN THE PRESENCE OF GUIDANCE ERRORS INTRODUCED BY RADOME BORESIGHT ERRORS. DURING THE 1980'S AND BEYOND U.S. AIR-DEFENSIVE HOMING MISSILES WILL HAVE TO OPERATE IN AN INCREASINGLY MORE COMPLEX THREAT ENVIRONMENT. THE RADOME INDUCED PERFORMANCE LIMITATION WILL BECOME EVEN MORE RESTRICTIVE WHEN THE MISSILES ARE FORCED TO ENGAGE THREATS THAT HAVE GREAT SPEEDS AT HIGH ALTITUDES OR THAT ARE HIGHLY MANEUVERABLE AT LOW AND MODERATE ALTITUDES. THE PURSUIT ENGAGEMENT ERROR METHODOLOGY STUDY WILL DEVELOP ANALYTICAL METHODS THAT TRACE THE INFLUENCE OF THE SPATIAL RADOME BORESIGHT ERRORS ON HOMING PERFORMANCE, AND WILL DEMONSTRATE THE FEASIBILITY OF SPECIFYING BORESIGHT ERROR REQUIREMENTS THAT ARE BASED ON MAINTAINING AN ACCEPTABLE LEVEL OF MISSILE SYSTEM HOMING PERFORMANCE.

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| AMPTEK, INC.<br>6 DE ANGELO DRIVE<br>BEDFORD, MA 01730<br>JOHN PANTAZIS/ALAN HUBER<br>TITLE:<br>MULTIANGULAR ELECTROSTATIC ANALYZER READOUT SYSTEM<br>TOPIC: 206 OFFICE: AFGL/XOP | AF | \$ 67,265 |
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DEVELOPMENT OF A READOUT SYSTEM FOR MICROCHANNEL PLATES OR OTHER IMAGING DETECTORS FOR USE WITH MULTIANGULAR ELECTROSTATIC ANALYZER. THIS FILM DISCRETE ANODE ARRAYS WILL BE DEPOSITED ON CERAMIC SUBSTRATES INCORPORATING A MINIMUM OF 128 ELEMENTS. ENCODING

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>---- | AWARDED<br>AMOUNT<br>----- |
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ELECTRONICS AS WELL AS HYBRIDIZED CHARGE SENSITIVE PREAMPLIFIER-DISCRIMINATORS WILL MATE WITH THE ANODES. THE SYSTEM WILL BE COMPATIBLE WITH SPACE FLIGHT REQUIREMENTS OF HIGH RELIABILITY, COMPACTNESS AND LOW POWER DISSIPATION.

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| ANALYTICS INC<br>2500 MARYLAND RD<br>WILLOW GROVE, PA 19090<br>THOMAS MCCANN<br>TITLE:<br>MANUFACTURING SCHEDULING ANALYSIS/RISK ASSESSMENT SOFTWARE<br>TOPIC: 69            OFFICE: ASD/YZD | AF | \$ 46,571 |
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THIS PROJECT WILL INVOLVE THE DEVELOPMENT OF A COMPUTER PROGRAM WHICH WILL ENABLE PROGRAM OFFICES TO PERFORM SCHEDULE ASSESSMENTS. THE MODEL WILL BE DEVELOPED WITHIN THE CONTEXT OF SCHEDULING OF AIRCRAFT ENGINE PRODUCTION PROGRAMS. THE COMPUTER PROGRAM WILL BE IMPLEMENTED IN A USER FRIENDLY MODE AND WILL PROVIDE CAPABILITY FOR OPTIMIZING PRODUCTION SCHEDULES TO MINIMIZE RISKS AND COST FACTORS, AND PROVIDE "WHAT IF" CAPABILITY BASED UPON VARIABLE INPUT ASSUMPTIONS AND ANALYST EXPERIENCE LEVELS. THIS INITIAL DEVELOPMENT EFFORT WILL PROVIDE THE CAPABILITY TO MATCH ENGINE BUILD RATES TO AIRFRAME SCHEDULES. THE COMPLETED MODEL WILL PROVIDE MORE TIMELY, ACCURATE SCHEDULING INFORMATION THAT WILL GREATLY INCREASE THE PROBABILITY THAT ENGINE PRODUCTION AND TESTING ACTIVITIES CAN MEET PREDETERMINED TARGET DATES WITHOUT EXPENDITURE OF PREMIUM RESOURCES. THE COMPUTER MODEL, AS DEVELOPED, WILL PROVIDE THE KERNAL FOR A MORE GENERALIZED RESOURCE ANALYSIS MODEL THAT WILL HAVE THE CAPABILITY TO CONSIDER THE RELATIONSHIPS BETWEEN SCHEDULE AND PRODUCTION RESOURCES (PERSONNEL, EQUIPMENT, INVENTORY, ETC.) AND TO PROVIDE ANALYTICAL TREATMENT OF PRODUCTION DISRUPTIONS SUCH AS ENGINEERING CHANGE, SCHEDULE CHANGES, CHANGES IN BUSINESS STRUCTURE (MAKE OR BUY FOR EXAMPLE) AND FACILITY CHANGES.

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| ANALYTICS INCORPORATED<br>2500 MARYLAND ROAD<br>WILLOW GROVE, PA 19090<br>NORA HARRINGTON<br>TITLE:<br>SURVEY OF VISION TESTS<br>TOPIC: 103            OFFICE: SGRD-RMA | ARMY | \$ 63,981 |
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TESTS OF VISUAL FUNCTION SERVE AS AN IMPORTANT INDEX OF AVIATORS'

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>----- | AWARDED<br>AMOUNT<br>----- |
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VISUAL ABILITIES. ALTHOUGH THERE ARE MANY TESTS OF VISUAL ABILITY, THEY HAVE NEVER BEEN COLLECTED IN A SINGLE VOLUME BUT ARE SCATTERED IN VARIOUS TEXTS AND JOURNALS. A CATALOGUE OF VISION TESTS, CONTAINING A DESCRIPTION OF EACH TEST, AS WELL AS INFORMATION ON THE MANUFACTURER AND COST, WOULD BE A USEFUL TOOL WHEN UPDATING THE VISION STANDARDS FOR ARMY AVIATORS. THE PRIMARY OBJECTIVE OF THIS RESEARCH IS TO COLLECT, ORGANIZE, AND COMPILE PERTINENT INFORMATION CONCERNING TESTS OF HUMAN VISUAL FUNCTIONING. A LITERATURE REVIEW WILL BE CONDUCTED TO SEARCH FOR CLINICAL, PSYCHOPHYSICAL, AND PHYSIOLOGICAL RESEARCH METHODS. THIS WILL BE SUPPORTED AND SUPPLEMENTED BY INTERVIEWS WITH PROMINENT RESEARCHERS, BOTH IN UNIVERSITIES AND INDUSTRY.

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| ANCO ENGINEERS INC<br>9937 JEFFERSON BLVD<br>CULVER CITY, CA 90230<br>DR T. D. SCHARTON<br>TITLE:<br>INDIVIDUAL BLAST OVERPRESSURE DOSIMETER<br>TOPIC: 78 OFFICE: SGRD-RMA | ARMY | \$ 64,416 |
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A BLAST OVERPRESSURE DOSIMETER CONCEPT WILL BE STUDIED TO ASCERTAIN ITS FEASIBILITY FOR GENERAL USE AS AN INDIVIDUAL PROTECTIVE DEVICE. FEASIBILITY TESTING WILL BE PERFORMED IN THE CONTRACTOR'S FACILITY, USING A SHOTGUN TO GENERATE THE BLAST WAVES. THE BLAST OVERPRESSURE FIELD WILL BE MAPPED WITH AVAILABLE INSTRUMENTATION. RESULTS OF THE STUDY WILL BE USED TO ESTABLISH THE FEASIBILITY OF THE 10 TO 150 PSI INDIVIDUAL DOSIMETER. AN OPTIONAL ADDITION TO THE PROGRAM INCLUDES A FEASIBILITY STUDY OF A RELATED TECHNIQUE FOR MEASURING BLAST IMPULSF. INCLUSION OF THIS FEATURE WOULD ENHANCE THE VALUE OF THE OVERPRESSURE DOSIMETER.

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| ANRO ENGINEERING CONSULTANTS, INC<br>SIXTY THE GREAT ROAD<br>BEDFORD, MA 01730<br>GERALD F ROSS PH D<br>TITLE:<br>A RANGE GATED TIME DOMAIN REFLECTOMETER FOR AREA PROTECTION OF NUCLEAR STORAGE FACILITIES<br>TOPIC: 6 OFFICE: OAAM | DNA | \$ 49,667 |
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SINCE 1975, THE USAF HAS DEVELOPED THROUGH ITS FUZING BRANCH, EGLIN

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>----- | AWARDED<br>AMOUNT<br>----- |
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AFB, A NEW CLASS OF PROXIMITY DETECTORS KNOWN AS BASEBAND REFLECTO-METER (BAR) SYSTEMS. IN ADDITION TO HAVING EXCELLENT RESOLUTION (E.G. LESS THAN A FOOT), BAR SYSTEMS HAVE BEEN MADE IMMUNE TO MANY FORMS OF JAMMING AND HAVE BEEN USED AS ALTIMETERS IN TARGET ACTIVATED MUNITIONS (TAM) APPLICATIONS AS WELL AS SENSORS FOR PROXIMITY FUZES. BECAUSE OF THE WIDE ANGULAR COVERAGE INTRINSIC IN BAR OR CARRIER-FREE SHORT PULSE TRANSIENT) SYSTEMS, THE AF INVESTIGATED, AS PART OF ITS FUZING PROGRAM, ITS APPLICATION TO AREA SURVEILLANCE FOR PROTECTING PARKED AIRCRAFT CARRYING NUCLEAR WEAPONS. PRELIMINARY TESTS WERE EXTREMELY ENCOURAGING AND RECOMMENDATIONS WERE MADE TO CONTINUE RESEARCH. THE AF SUGGESTED THAT THE DNA SHOULD BE APPRISED OF THE TECHNIQUE BECAUSE OF THEIR CHARTER TO DO RESEARCH IN SECURITY SYSTEM APPLICATIONS. THE PURPOSE OF THE PROPOSAL PROGRAM IS TO CONTINUE THE RESEARCH FOR THE PURPOSE OF DEVELOPING A NEW CLASS OF COVERT, RANGE GATED SECURITY FENCE, FOR AREA COVERAGE AGAINST HUMAN INTRUDERS. THE BAR SENSOR APPEARS TO OFFER SIGNIFICANT IMPROVEMENT OVER CONVENTIONAL RADAR TECHNIQUES FOR DISTINGUISHING, FOR EXAMPLE, WIND BLOWN TREES FROM HUMAN TARGETS. EXPERIMENTAL EVIDENCE SUPPORTING THIS CONCLUSION IS PRESENTED.

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| ANVER BIOSCIENCE DESIGN, INC.<br>160 EAST MONTECITO AVENUE<br>SIERRA MADRE, CA 91024<br>ANTHONY J. VERBISCAR<br>TITLE:<br>CARBAMATE PROPHYLACTICS AGAINST CHOLINESTERASE INHIBITION<br>TOPIC: 87            OFFICE: SGRD-RMA | ARMY | \$ 47,580 |
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THE U.S. ARMY MEDICAL RESEARCH AND DEVELOPMENT COMMAND HAS THE RESPONSIBILITY FOR DISCOVERING AND DEVELOPING PHARMACEUTICALS THAT WILL PROTECT THE SOLDIER AGAINST NERVE GAS AGENTS THAT ARE A THREAT IN WARFARE. ONE CONCEPT UNDER CONSIDERATION CONSISTS IN ADMINISTRATION OF A PROTECTIVE DRUG PRIOR TO A NERVE GAS CHALLENGE. THE PRETREATMENT DRUG HAS A PROPHYLACTIC ACTIVITY PROTECTING THE SUBJECT AGAINST THE HARMFUL EFFECTS OF THE GAS. THE CARBAMATE DRUG PYRIDOSTIGMINE IS NOW BEING INVESTIGATED FOR THIS USE. PYRIDOSTIGMINE, A QUATERNARY, PROBABLY ACTS BY TEMPORARILY BLOCKING PERIPHERAL CHOLINESTERASE. IT WOULD BE USEFUL TO HAVE A HIGH ACTIVITY, LOW TOXICITY PROPHYLACTIC DRUG THAT WILL ACT IN THE CENTRAL NERVOUS SYSTEM AS WELL AS PERIPHERALLY, AS AN ALTERNATIVE

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>----- | AWARDED<br>AMOUNT<br>----- |
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TO PYRIDOSTIGMINE. THE DRUGS IN THIS PROJECT ARE DESIGNED TO PENETRATE INTO THE CNS WHERE THEY CAN PROVIDE ADDED PROTECTION AGAINST NERVE GAS AGENTS. FOUR NEW CARBAMATE TARGET CANDIDATES WILL BE SYNTHESIZED AND TESTED FOR PROTECTIVE ACTION AGAINST A CHALLENGE TO ACETYLCHOLINESTERASE BY AN ORGANOPHOSPHOROUS SUBSTRATE. HIGH PERFORMANCE LIQUID CHROMATOGRAPHY WILL BE USED TO MONITOR THE PROTECTIVE ACTION OF THE DRUG ON THE ENZYME. AN INHIBITION OF THE HYDROLYSIS OF THE SUBSTRATE BY THE ENZYME WILL INDICATE POTENTIAL IN VIVO PROPHYLACTIC ACTIVITY FOR THE NEW DRUG.

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| APPLICATIONS RESEARCH CORPORATION<br>330 SOUTH LUDLOW STREET<br>DAYTON, OH 45402<br>RODNEY B. BEACH | ARMY | \$ 50,324 |
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TITLE:  
UTOPIA (ULTRASONIC TRANSMISSIONS OPTIMIZED TO PRODUCE INTERFERENCE ANOMALIES  
TOPIC: 17 OFFICE: ERADCOM

THERE IS A DIRE NEED FOR AN EFFECTIVE OPTICAL COUNTERMEASURE TO PROTECT ARMY ASSETS FROM OPTICAL THREATS. THIS PROPOSED EFFORT IS DESIGNED TO INVESTIGATE THE EFFECTIVENESS OF A POTENTIAL OPTICAL COUNTERMEASURE THAT CAN BE USED BOTH IN THE AIR AND JOIN THE GROUND. THE INTERACTION OF ULTRASONIC RADIATION WITH LIGHT HAS BEEN STUDIED FOR A NUMBER OF YEARS. THE VISUAL OBSERVATION OF A TARGET IS COMPOSED OF A SERIES OF LIGHT RAYS THAT CAN BE ALTERED WHEN PASSING THROUGH AN ULTRASONIC RADIATION FIELD. THE APPLICATION OF THIS PRIOR RESEARCH TO NEW AND MODERN ULTRASONIC TECHNOLOGY MAY PRODUCE A SIGNIFICANT INTERFERENCE PATTERN WHICH CAN DEFRACT THE VISUALLY DIRECTED WEAPON AWAY FROM ITS TARGET. THE INTERFERENCE PATTERN, INDUCED BY THE COMPRESSIONS AND RARE-FRACTIONS OF THE AIR DUE TO THE ULTRASONIC RADIATION (PRESSURE WAVES), CREATE AN INVISIBLE DEFRACTION GRADING THAT DEFRACTS AND REFRACTS LIGHT IN ALL WAVELENGTHS. PRELIMINARY RESEARCH HAS SHOWN THE EFFECT, HOWEVER, THE PARAMETRIC VARIATION OF ULTRASONIC FREQUENCY AND AMPLITUDE MUST BE COMPLETELY DEFINED AND OPTIMIZED. IF THE APPLICATION IS SUCCESSFUL, A SIGNIFICANT STEP IN SELF-PROTECTION FOR BOTH AIRCRAFT AND TANKS CAN BE ACHIEVED.

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| APPLICATIONS RESEARCH CORPORATION<br>330 SOUTH LUDLOW STREET<br>DAYTON, OH 45402<br>THOMAS V. BROWN | AF | \$ 48,518 |
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TITLE:  
MOST EFFECTIVE APPLICATIONS OF ADA TO AIRCREW TRAINING DEVICES  
TOPIC: 10 OFFICE: ASD/ENO

THE OBJECTIVE OF THIS EFFORT IS TO EFFECTIVELY DEMONSTRATE THE

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>----- | AWARDED<br>AMOUNT<br>----- |
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APPLICABILITY OF ADA LANGUAGE TO THE ATD DEVELOPMENT PROCESS, AND REDUCE THE RISK ASSOCIATED WITH THE TRANSLATION OF THE ADA LANGUAGE FOR FUTURE ATD DEVELOPMENTS. THE PROJECT SUCCESS IS ENHANCED THROUGH THE UTILIZATION OF EXPERIENCED SOFTWARE ENGINEERS WHO HAVE DEVELOPED COMPLEX SIMULATION PROGRAMS COUPLED WITH AN EXPERT IN THE DEVELOPMENT AND APPLICATION OF THE ADA LANGUAGE. TO FULLY UTILIZE THIS CAPABILITY, THE PROPOSED EFFORT WILL DEMONSTRATE THE USE OF ADA ON SEVERAL ATD MODULES BEFORE ADA IS APPLIED ON A LARGER SCALE TO ATD SOFTWARE. THESE DEMONSTRATION CASES WILL UTILIZE THE SOFTWARE TOOLS WHICH ARE PART OF THE ADA PROGRAMMING SOFTWARE ENVIRONMENT (APSE). IN THIS WAY, THE DOD RESOURCES SPENT ON THE DESIGN OF THIS NEW LANGUAGE CAN BE BEST UTILIZED FOR ATD PURPOSES.

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| APPLIED RESEARCH CORPORATION<br>8201 CORPORATE DRIVE, SUITE 920<br>LANDOVER, MD 20785<br>DR. ANDREW S. ENDAL<br>TITLE:<br>THE ATMOSPHERIC EFFECTS OF AEROSOLS FOLLOWING A NUCLEAR CONFLICT<br>TOPIC: 8 OFFICE: OAAM | DNA | \$ 49,823 |
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APPLIED RESEARCH CORPORATION PROPOSES TO DEVELOP A SOFTWARE SYSTEM FOR ANALYZING THE ATMOSPHERIC EFFECTS OF NUCLEAR CONFLICT SCENARIOS. THE PHASE I EFFORT WILL CONCENTRATE ON THE EFFECTS OF AEROSOLS INJECTED INTO THE ATMOSPHERE BY NUCLEAR DETONATION AND THE ASSOCIATED FIRES. THESE EFFECTS WILL BE EXPLORED, USING A MULTI-COMPONENT SIMULATION CONSISTING OF THE FOLLOWING EXISTING COMPUTER CODES:

- A GENERAL CIRCULATION MODEL FOR AEROSOL DISPERSION;
- A RADIATIVE TRANSFER CODE; AND
- A SURFACE ENERGY BALANCE MODEL FOR CLIMATIC EFFECTS.

THE FEEDBACK AMONG THESE COMPONENTS WILL BE EVALUATED TO GUIDE THE DESIGN OF A COUPLED GENERAL MODEL INCORPORATING FEEDBACK EFFECTS.

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| APPLIED RESEARCH INC.<br>3930 FREEDOM CIRCLE<br>SAN CLARA, CA 95054<br>MICHAEL L. CONN<br>TITLE:<br>IN-THE-EAR TALK-THROUGH HEARING PROTECTION<br>TOPIC: 100 OFFICE: SGRD-RMA | ARMY | \$ 49,645 |
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BATTLEFIELD ENVIRONMENTS POSE CONFLICTING PERSONAL HEARING SENSITIVITY

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>---- | AWARDED<br>AMOUNT<br>----- |
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AND PROTECTION REQUIREMENTS. INTERPERSONAL VERBAL COMMUNICATIONS CAN IMPROVE THE EFFICIENCY OF MANNED OPERATIONS UNDER THESE ENVIRONMENTS; HOWEVER, TEMPORARY AND/OR PERMANENT HEARING DAMAGE CAN RESULT IF NO PROTECTIVE HEADGEAR IS WORN. ACTIVE, ELECTRONIC RELAY SUBSYSTEMS, INTEGRATED WITH PASSIVE BLOCKING, DAMPING, AND SUPPORTIVE STRUCTURES, ARE FORESEEN AS A SOLUTION TO THIS PROBLEM. A TECHNOLOGY ASSESSMENT WILL BE MADE TO YIELD QUANTIFIABLE BOUNDS ON PERFORMANCE REQUIREMENTS. CANDIDATE ELECTRONIC DESIGNS WILL BE EVALUATED AGAINST DERIVED CRITERIA AND PROTOTYPES WILL BE FABRICATED AND TESTED. CONCEPTS FOR ANALOG AND DIGITAL ELECTRONIC SIGNAL DETECTION, CONDITIONING, AND LIMITING ARE PROPOSED FOR ANALYSIS, DESIGN, PROTOTYPING, AND QUALITATIVE TESTING DURING PHASE I. PROMISING CANDIDATES WILL BE SELECTED FOR MORE SOPHISTICATED PACKAGING AND COMPREHENSIVE TESTING UNDER CONTROLLED CONDITIONS DURING PHASE II.

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| APPLIED RESEARCH, INC.<br>3930 FREEDOM CIRCLE<br>SANTA CLARA, CA 95054<br>DAVID E. ETTER<br>TITLE:<br>EARLY IDENTIFICATION OF MANPOWER AND SKILL LEVEL REQUIREMENTS IN WEAPON SYSTEM DEVELOPMENT<br>TOPIC: 108            OFFICE: PERI-PO | ARMY | \$ 68,175 |
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THE FEASIBILITY OF EARLY IDENTIFICATION OF MANPOWER AND SKILL LEVEL REQUIREMENTS IN WEAPON SYSTEM DEVELOPMENT IS EXAMINED. THE OVERALL GOAL WITH RESPECT TO THE TOTAL PROJECT IS A FORECASTING MODEL WITH A CREDIBLE BASIS FOR PROJECTING OPERATOR AND MAINTAINER REQUIREMENTS BASED ON CONCEPT DEVELOPMENT STAGE DATA AND INFORMATION. FOUR PHASE I OBJECTIVES ARE PURSUED: (1) TO DEFINE THE RELEVANT PARAMETERS OF THE EARLY IDENTIFICATION OF MANPOWER AND SKILL LEVEL REQUIREMENTS PROBLEM, (2) TO IDENTIFY CURRENT MODELS, METHODS AND TECHNIQUES BEING APPLIED IN MANPOWER FORECASTS AND SKILL LEVEL DETERMINATION, (3) TO STRUCTURE A BASELINE MANPOWER FORECASTING MODEL, AND (4) TO DISTINGUISH AMONG MAJOR, APPROPRIATE HARDWARE AND SOFTWARE ALTERNATIVES THAT WOULD SUPPORT A COMPUTER - BASED MANPOWER AND SKILL - LEVEL MODEL. STEPS LEADING TO THE COMPLETION OF EACH PHASE I OBJECTIVE ARE SPECIFIED. A WRITTEN REPORT WITH RESPECT TO EACH OF THE FOUR OBJECTIVES AND PHASE II WILL BE PROVIDED IN CONCLUDING PHASE I OF THE PROJECT.

SMALL BUSINESS INNOVATION RESEARCH (SBIR) PROGRAM - PHASE I PAGE 23  
FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>----- | AWARDED<br>AMOUNT<br>----- |
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PHASE I IS ESTIMATED A ONE-HALF, MAN-YEAR EFFORT TO TAKE PLACE DURING THE PERIOD JULY TO DECEMBER 1984.

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| APPLIED RESEARCH, INC.<br>5025 BRADFORD BLVD., P.O. BOX 11220<br>HUNTSVILLE, AL 35805<br>DR. JOHN MORRIS, JR.<br>TITLE:<br>INFRARED IMAGE PROCESSOR<br>TOPIC: 28 OFFICE: DRSMI-ICDA | ARMY | \$ 64,748 |
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PASSIVE INFRARED IMAGE DETECTION AND SIGNAL PROCESSING HAVE EXPERIENCED DIVERSE MILITARY AND COMMERCIAL APPLICATION OVER THE PAST SEVERAL DECADES. THIS DEVELOPING TECHNOLOGY HAS BEEN CONTENT WITH SIMPLE INCOHERENT DETECTION. THIS DETECTION MODE NEGLECTS POTENTIALLY USEFUL INFRARED SCENE INFORMATION. THIS PROPOSAL CONCERNS AN ANALYSIS AND MEASUREMENT PROGRAM TO INVESTIGATE THE FEASIBILITY OF A UNIQUE REAL-TIME INFRARED IMAGE PROCESSING ARCHITECTURE.

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| APPLIED SYSTEMS TECHNOLOGY, INC.<br>P.O. BOX 529<br>FRANKLIN, MA 02038<br>PAUL C. GRANTZ<br>TITLE:<br>COMPUTER GRAPHICS CONTROL SYSTEM<br>TOPIC: 105 OFFICE: MERADCOM | ARMY | \$ 40,519 |
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ASTECH PROPOSES COMPUTER SOFTWARE FOR A TACHISTOSCOPE, CONSISTING OF A GENISCO GCT-3000 DISPLAY AND A PDP-11/34A PROCESSOR, FOR RESEARCH IN VISUAL PSYCHOPHYSICS AND PHYSIOLOGY. IN ADDITION TO CONTROLLING AND ADMINISTERING TESTS, THE SOFTWARE WILL FEATURE INNOVATIVE SUPPORT FOR DEVELOPING GRAPHIC DISPLAYS OF IMAGES OF A RIGOROUSLY DEFINED SPATIAL SCENE, WHERE:

- (1) IMAGES ARE FORMED ON A CRT DEFINED AS THE APERTURE AND FOCAL SURFACE OF AN INDEPENDENT MOBILE OBSERVER OPTICAL SYSTEM.
- (2) THE SCENE IS ILLUMINATED BY MULTIPLE MOBILE LIGHT SOURCES CAPABLE OF DIVERSE CHROMATIC ATTRIBUTES AND RADIANT GEOMETRIES.

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>---- | AWARDED<br>AMOUNT<br>----- |
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(3) OBJECTS REFLECT COLORS DEFINED BY CIE CHROMATICITY CO-ORDINATES AND MOVE ACCORDING TO RIGOROUS APPLICATION OF PHYSICAL LAWS. PHASE I WORK WILL CONSIST OF FUNCTIONAL REQUIREMENTS DEFINITION, GENERAL DESIGN AND FEASIBILITY DEMONSTRATION.

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| APPLIED TECHNOLOGIES INC<br>6395 GUNPARK UNIT E<br>BOULDER, CO 80301<br>W. R. DAGLE<br>TITLE:<br>SOLID-STATE OXYGEN SENSOR<br>TOPIC: 131            OFFICE: AMD/RDO | AF | \$ 40,940 |
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THE PERCENT OF O<sub>2</sub> IN BREATHING GASES CAN BE MEASURED TO AN ACCURACY OF +- 0.01 PERCENT BY USING SONIC MEASUREMENT TECHNOLOGY. A SOLID-STATE OXYGEN SENSOR CAN BE DEVELOPED WHICH IS SMALL IN SIZE, INSENSITIVE TO PRESSURE AND TEMPERATURE CHANGES, AND IS NOT AFFECTED BY ACCELERATION.

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| APTEK, INC.<br>2860 S. CIRCLE DR., SOUTH BLDG.SUITE 346<br>COLORADO SPRINGS, CO 80906<br>JAMES C. NICKELL<br>TITLE:<br>HYDROMETEOR INSTRUMENTATION DEVELOPMENT<br>TOPIC: 258            OFFICE: BMO/PMX | AF | \$ 59,644 |
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THE DEVELOPMENT OF PASSIVE ACOUSTIC INSTRUMENTATION SYSTEMS AND TECHNOLOGY FOR REENTRY VEHICLE FLIGHT TEST MEASUREMENT OF HYDROMETER MASS AND NUMBER DENSITY IS PROPOSED.

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| AQUA-MAGNETICS, INC.<br>2700 VAN DIVER DRIVE #6-D<br>WEST PALM BEACH, FL 33409<br>DR. DAVID D. WOODBRIDGE<br>TITLE:<br>WASTE WATER TREATMENT AND PURIFICATION BY ELECTRICAL AND RADIATIVE METHODS FOR A 'BUTTONED-UP' MANNED DEEP BASE<br>TOPIC: 247            OFFICE: BMO/PMX | AF | \$ 67,814 |
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IN A "BUTTON-UP" MANNED DEEP BASE ALL OPERATIONS MUST BE SELF-

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>----- | AWARDED<br>AMOUNT<br>----- |
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CONTAINED AND INTERNAL POWERED. THE ELECTRO-RADIATIVE DECONTAMINATION SYSTEM DEVELOPED BY PERSONNEL OF AQUA-MAGNETICS, INC. HAS PRODUCED POTABLE WATER FROM RAW HUMAN SEWAGE. NOT ONLY ARE BACTERIA, VIRUS, AND SPORES KILLED BUT TOXIC CHEMICALS ARE BROKEN INTO COMPONENT ELEMENTS. A COMPUTERIZED STATISTICAL COMPARISON WILL BE MADE OF DATA OBTAINED FROM SEVEN YEARS OF TESTING THE ELECTRO-RADIATIVE DECONTAMINATION SYSTEM AND DATA FROM FOUR OTHER ADVANCED WASTE WATER TREATMENT SYSTEMS. THESE COMPARATIVE SYSTEMS WILL BE REVERSE OSMOSIS, ION EXCHANGE, ELECTRON BOMBARDMENT, AND MEMBRANE FILTRATION WITH SUPERHYPO-CHLORINATION. AIMS OF THE COMPARATIVE ANALYSIS WILL BE TO DETERMINE THE MOST EFFECTIVE SYSTEM FOR PROCESSING WASTE WATER FOR RE-USE. COMBINATIONS OF THE ABOVE STATED SYSTEMS WILL ALSO BE EVALUATED. AN OPTIMUM SYSTEM DESIGN WILL BE DEVELOPED FOR THE PURIFICATION OF WASTE WATER IN A "BUTTONED-UP" MANNED DEEP BASE, BASED ON THE RESULTS OF THE COMPUTERIZED STATISTICAL ANALYSIS.

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| ARCHITECTURAL ENERGY CORP<br>8753 YATES DR SUITE 105<br>WESTMINSTRER, CO 80030<br>JOEL N SWISHER P.E.<br>TITLE:<br>A COMPREHENSIVE ENERGY DIAGNOSTIC PROCEDURE FOR LARGE BUILDINGS<br>TOPIC: 61 OFFICE: CERL | ARMY | \$ 59,710 |
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THE PROPOSED PROJECT WILL DEVELOP AN INTEGRATED BUILDING ENERGY EVALUATION PROGRAM, TO BE APPLIED TO LARGE BUILDINGS THAT DETERMINES THE OVERALL BUILDING ENERGY EFFICIENCY AND DIAGNOSES SPECIFIC SOURCES OF ENERGY INEFFICIENCY. THE APPROACH IS TO MEASURE AND CALCULATE AN OVERALL BUILDING ENERGY PERFORMANCE FACTOR AND COMPARE IT TO EXPECTED STANDARDS TO PROVIDE BUILDING ENERGY EFFICIENCY EVALUATION. MORE IMPORTANTLY, IT WILL INDICATE AREAS OF INEFFICIENCY TO BE IMPROVED. MANY DATA INPUTS TO THE ANALYSIS WILL COME FROM A QUANTITATIVE ENERGY AUDIT PROCEDURE THAT IS ALSO EXPECTED TO DIAGNOSE ADDITIONAL ENERGY INEFFICIENCIES. THE ANALYSIS PROCEDURE AND AUDIT PROCEDURE WILL BE TESTED USING DATA FROM REAL BUILDINGS AND INTEGRATED INTO A COMPLETE ENERGY EVALUATION PROGRAM.

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| ARTECH CORP.<br>2901 TELESTAR COURT<br>FALLS CHURCH, VA 22042<br>DR. FRED ORDWAY<br>TITLE:<br>DEVELOPMENT OF METALLIC SURFACES WITH VERY HIGH LIGHT ABSORPTION CAPABILITY<br>TOPIC: 107 OFFICE: NWS | NAVY | \$ 49,780 |
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SENSITIVITY OF STELLAR GUIDANCE OPTICS IS LIMITED BY REFLECTION OF

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>----- | AWARDED<br>AMOUNT<br>----- |
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STRAY LIGHT INSIDE THE OPTICAL SYSTEM. IMPROVEMENT BY 50-100% OR MORE CAN BE OBTAINED WITH A BLACK COATING, DISCOVERED BY CHARLES FELDMAN AT JOHNS HOPKINS APPLIED PHYSICS LABROATORY, CONSISTING OF SUBMICROSCOPIC COLUMNS OF AMORPHOUS SILICON PRODUCED BY ETCHING THE SURFACE OF A SOLID SILICON LAYER. THE PROGRAM, WITH DR. FELDMAN AS CONSULTANT, WILL EXPLORE THE COATING AND ETCHING PROCESSES INVOLVED AND OPTIMIZE THE OPTICAL AND MECHANICAL PROPERTIES OF THE FILM IN PREPARATION FOR PRACTICAL APPLICATIONS TO BE DEVELOPED IN PHASE II.

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| ASTRON RESEARCH AND ENGINEERING<br>2028 OLD MIDDLEFIELD WAY<br>MOUNTAIN VIEW, CA 94043<br>THOMAS J. DAHM<br>TITLE:<br>EVALUATION OF INTERNAL BALLISTIC CAPABILITIES OF WAVE GUN FOR STRATEGIC WEAPON APPLICATIONS<br>TOPIC: 13      OFFICE: DARPA | DARPA | \$ 50,000 |
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CONVENTIONAL LIGHT GAS GUNS (LGG) ARE DESCRIBED, AND VARIANTS TO OBTAIN HYPERVELOCITY PERFORMANCE OUTLINED. CONCLUSIONS FROM RECENT CONTRACTS TO EVALUATE THE FEASIBILITY OF LGG IN AIR-TO-GROUND WARFARE ARE PRESENTED SHOWING THE DIFFICULT TECHNICAL CHALLENGES ASSOCIATED WITH A CONVENTIONAL LGG. THE WAVE GUN CONCEPT IS ADVANCED THAT AVOIDS THE PROBLEMS OF A CONVENTIONAL LGG THROUGH AN ALTERED INTERNAL BALLISTIC CYCLE THAT ENABLES USE OF A LIGHT, EXPENDABLE PISTON. THE CYCLE ENABLES EXCELLENT LGG PERFORMANCE USING A SMALL L/D CARTRIDGE THAT CAN BE HANDLED IN A RAPID FIRE MODE USING CONVENTIONAL MECHANISMS. THE OBJECTIVES OF THE PROPOSED PROGRAM ARE TO DEFINE THE LIMITS OF PERFORMANCE AND THE DESIGN CRITERIA FOR WAVE GUN FOR STRATEGIC APPLICATIONS THROUGH EXERCISES OF THE AIBAL COMPUTER SIMULATION. AIBAL IS QUALIFIED BY COMPARING THE SIMULATION WITH EXISTING WAVE GUN EXPERIMENTAL DATA.

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| ASTRON RESEARCH AND ENGINEERING<br>2028 OLD MIDDLEFIELD WAY<br>MOUNTAIN VIEW, CA 94043<br>CHARLES POWARS<br>TITLE:<br>CARBON THERMOPHYSICAL PROPERTY MEASUREMENTS AT THE TRIPLE POINT<br>TOPIC: 260      OFFICE: BMO/PMX | AF | \$ 49,890 |
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THE MELT TEMPERATURE, HEAT OF FUSION, LIQUID VISCOSITY, AND ULTRA-

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>----- | AWARDED<br>AMOUNT<br>----- |
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HIGH TEMPERATURE STRENGTH OF GRAPHITE AND CARBON-CARBON MATERIALS ARE UNCERTAIN AND OF SUBSTANTIAL INTEREST RELATIVE TO NOSETIP PERFORMANCE IN ADVANCED EARTH ENTRY MISSIONS. THE OBJECTIVE OF THIS PROJECT IS TO USE COMPONENTS OF A UNIQUE AND AVAILABLE FACILITY-- THE NASA AMES ELECTRIC ARC SHOCK TUBE (EAST)--TO RAPIDLY RESISTANCE HEAT CARBON SPECIMENS TO THE TRIPLE POINT, AND MEASURE THESE THERMO-PHYSICAL PROPERTIES. THE HIGH ENERGY CAPACITY AT EAST (1.25 MJ) ENABLES MILLISECOND TIME SCALE HEATING WHICH HELPS TO CIRCUMVENT MANY OF THE PROBLEMS WHICH HAVE THWARTED PREVIOUS MEASUREMENTS ATTEMPTS. ON PHASE I, WE WILL EXPERIMENTALLY DEMONSTRATE THE BASIC FEASIBILITY OF THIS APPROACH AND DESIGN QUANTITATIVE MEASUREMENT EXPERIMENTS. ON PHASE II, WE WILL CARRY OUT THE DETAILED THERMO-PHYSICAL PROPERTY MEASUREMENT TESTS.

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| ASTROSYSTEMS, INC.<br>30 LOVETT AVE<br>NEWARD, DE 19711<br>JAMES B. McNEELY<br>TITLE:<br>GaAsP TOP SOLAR CELLS FOR INCREASED SOLAR CONVERSION EFFICIENCY<br>TOPIC: 199 OFFICE: AFSTC/XN | AF | \$ 49,999 |
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GaAsP SOLAR CELLS PLACED ON TOP OF CONVENTIONAL SILICON SOLAR CELL ARRAYS CAN INCREASE THE ENERGY CONVERSION EFFICIENCY OF THE SYSTEM AS MUCH AS 100%. ASTROPOWER DIVISION OF ASTROSYSTEMS, INC. PROPOSES TO DEVELOP A HIGH BAND GAP TOP SOLAR CELL FOR ATTACHMENT TO CONVENTIONAL SILICON SOLAR CELLS. TRANSPARENT GaP SUBSTRATES WILL BE USED WITH EPITAXIALLY GROWN LAYERS OF GaAsPH HAVING A BAND GAP OF 1.75 TO 2.1 eV APPROPRIATE FOR MAXIMUM ABSORPTION FOR A TOP CELL WITH A SILICON BASE. THE GaAsP SYSTEM HAS LESS MOISTURE AND OXIDATION SENSITIVITY AND IS MORE STABLE FOR ELECTRICAL CONTACTS THAN THE GaAlAs ALTERNATIVE SYSTEM. AN ADDITIONAL BENEFIT FOR THE PROGRAM IS THAT THE ASTROPOWER DIVISION SENIOR PERSONNEL HAVE SUBSTANTIAL COMMERCIAL EXPERIENCE WITH THE PREPARATION OF GaAsP AND GaP LIGHT EMITTING DIODES AND ARRAYS, AND ARE QUITE FAMILIAR WITH THE GaAsP MATERIAL SYSTEMS. THE KEY TECHNICAL TASKS ARE LIQUID PHASE EPITAXY OF THE GaAsP LAYERS, AND SYSTEMATIC SOLAR DESIGN AND FABRICATION. VARIOUS APPROACHES TO COMPOSITION GRADING TO MINIMIZE THE EFFECT OF LATTICE MISMATCH WILL BE EXPLORED EXPERIMENTALLY. LOSS MINIMIZATION WILL ALSO BE USED TO OPTIMIZE THE TANDEM DESIGN.

FISCAL YEAR 1984

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| ATMOSPHERIC AND ENVIRONMENTAL RESEARCH<br>840 MEMORIAL DRIVE<br>CAMBRIDGE, MA 02139<br>RONALD G. ISSAACS<br>TITLE:<br>DESIGN SPECIFICATION FOR A MICROWAVE MOISTURE SOUNDER<br>TOPIC: 215            OFFICE: AFGL/XOP | AF           | \$ 74,500                  |

A RESEARCH PROGRAM TO PROVIDE SIMULATION MODELS APPLICABLE TO THE DESIGN SPECIFICATION OF A MICROWAVE MOISTURE SOUNDER OPERATING AT 183 GHZ IS DESCRIBED. THE DESIGN SPECIFICATION PROCESS CONSISTS OF INSTRUMENT RESPONSE SIMULATION, SENSITIVITY ANALYSES, AND MOISTURE RETRIEVAL PERFORMANCE ASSESSMENT. THE OBJECTIVE OF THE INITIAL EFFORT IS TO DEVELOP COMPUTER ALGORITHMS CAPABLE OF TREATING THE RESPONSE OF A MULTI-FREQUENCY RADIOMETER TO REALISTIC VARIATIONS IN RELEVANT METEOROLOGICAL VARIABLES POTENTIALLY AFFECTING ITS OPERATIONAL PERFORMANCE. THESE INCLUDE TEMPERATURE AND MOISTURE PROFILES, SURFACE EMISSIVITY, CLOUDS, AND PRECIPITATION. A MULTICOMPONENT APPROACH BASED ON RADIATIVE TRANSFER THEORY AND SUPPORT BY METEOROLOGICAL AND SPECTRAL DATA IS PROPOSED. THE MODELS WILL BE TESTED AND VERIFIED AND PRELIMINARY RECOMMENDATIONS WILL BE TENDERED CONCERNING POTENTIAL CLOUD DEGRADATION OF ALL WEATHER PERFORMANCE BASED ON LIMITED SENSITIVITY TESTS.

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| AUTOFLEX, INC.<br>24655 SOUTHFIELD ROAD<br>SOUTHFIELD, MI 48075<br>JOHN HARNED<br>TITLE:<br>COMPUTER INTEGRATED ROBOTIC WORK CELL<br>TOPIC: 70            OFFICE: NSWC | NAVY | \$ 50,000 |
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THE OBJECTIVE OF THIS DEVELOPMENTAL EFFORT IS TO DETERMINE THE FEASIBILITY OF DEVELOPING A COMPUTER INTEGRATED ROBOT WORK CELL GAGING FINISHED PARTS OR OTHER ASSEMBLY/MACHINING OPERATIONS. THE FOCUS OF THE RESEARCH IS TO CONTROL THE ROBOT TOOL CONTROL POINT (TCP) THROUGH AN ADAPTIVE FEEDBACK CONTROL SYSTEM. THE

FISCAL YEAR 1984

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ROLE OF THE FEEDBACK CONTROL SYSTEM IS TO CONTROL AND MODIFY THE PATH OF THE TCP TO WITHIN 0.0005". THE INPUT TO THE ROBOT WORK CELL IS VIA A POST PROCESSOR FROM AN ON-LINE CAD/CAM SYSTEM. THE COMPUTER INTEGRATED ROBOT WORK CELL IS CONTROLLED BY A HIERARCHICAL COMPUTER WHICH CONTROLS THE VARIOUS SUB-SYSTEMS IN THE WORK CELL E.G. CAD/CAM, ROBOT, 3D VISION SENSOR AND A LIGHTING SYSTEM, TOOL CONTROL POINT, GRIPPERS, TOOL FEEDING CARROUSELS, MATERIAL CONTROL SYSTEMS E.G. A.G.V'S.

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| AUTOFLEX, INC.<br>24655 SOUTHFIELD ROAD<br>SOUTHFIELD, MI 48075<br>JOHN HARNED<br>TITLE:<br>THREE-DIMENSIONAL ON-LINE ROBOTIC INSPECTION SYSTEM<br>TOPIC: 139      OFFICE: NASC | NAVY | \$ 63,007 |
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THE OBJECTIVE OF THIS DEVELOPMENT IS TO DETERMINE THE TECHNICAL FEASIBILITY OF DEVELOPING A THREE DIMENSIONAL VISION BASED PASSIVE OBJECT RECOGNITION SYSTEM CAPABLE OF GENERATING THREE DIMENSIONAL COORDINATE LOCATION INFORMATION IN REAL TIME AT VIDEO FRAME RATES OF 30 FRAMES PER SECOND. THE SYSTEM CONFIGURATION UNDER INVESTIGATION WILL UTILIZE PARALLEL PROCESSING OF RAW VIDEO INPUT FROM MULTIPLE CAMERAS. HIGH SPEED PROCESSING HARDWARE SUCH AS VERY HIGH SPEED INTEGRATED CIRCUITS CURRENTLY BEING DEVELOPED THRU THE DOD WILL BE INVESTIGATED FOR THEIR POTENTIAL AS HIGH SPEED IMAGE PROCESSORS FOR REAL TIME OBJECT RECOGNITION. THIS RESEARCH WILL ESTABLISH THE FEASIBILITY OF PROVIDING A REAL TIME PROGRAMMABLE OBJECT RECOGNITION AND ORIENTATION SYSTEM CAPABLE OF PROVIDING ROBOT PATH ALTERATION DATA IN REAL TIME.

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| AVELEX<br>310 BONIFANT ROAD<br>SILVER SPRING, MD 20904<br>G. WILLIAM MEEKER<br>TITLE:<br>NEW TECHNOLOGY HIGH EFFICIENCY, HIGH STABILITY COLOR MOTION VIDEO COMPRESSION SYSTEM<br>TOPIC: 8      OFFICE: DARPA | DARPA | \$ 49,946 |
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A NEW MATHEMATICAL TRANSFORM METHOD FOR THE COMPRESSION OF MOTION

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>---- | AWARDED<br>AMOUNT<br>----- |
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VIDEO HAS BEEN FORMULATED BY AVELEX AND A BREADBOARD MODEL FABRICATED TO DEMONSTRATE LOW BIT-RATE MONOCHROME IMAGERY. A METHOD IS PROPOSED FOR OBTAINING COLOR MOTION VIDEO BY A NOVEL MEANS WITH A RATHER SMALL INCREASE IN THE AMOUNT OF DATA REQUIRED TO BE TRANSMITTED. THE BENEFIT OF THIS NEW TECHNOLOGY IS TO PROVIDE STABLE MOTION IMAGERY AT LOW TRANSMISSION BIT RATES IN THE PRESENCE OF CONSIDERABLE SUBJECT MOTION AND IN THE PRESENCE OF UNAVOIDABLE CAMERA/SUBJECT MOTION, A PERFORMANCE NOT ACHIEVED BY PRIOR TECHNOLOGIES. IMAGERY HAS BEEN DEMONSTRATED WITH TRANSMISSION CHANNEL CAPACITIES FROM 19.2 KBITS/SEC UP TO 500 KBITS/SEC. WHEREIN NO RECONSTRUCTED IMAGE BREAKUP OCCURS AT ANY RATE, AND THE DEGRADATION AT LOWER RATES IS ONLY ONE OF TEMPORARY AND GRACEFUL RESOLUTION LOSS IN AREAS OF MOTION FOR A BRIEF TIME WHILE THE MOTION IS OCCURRING. THIS PROPOSAL DEFINES THE WORK REQUIRED TO DEMONSTRATE THIS NEW TECHNOLOGY (PATENT PENDING) AND BRING IT TO A STATE TO BE CONSIDERED IN DEFENSE DEPARTMENT APPLICATIONS REQUIRING LOW BIT-RATE TRANSMISSION.

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| B-K DYNAMICS, INC.<br>247 SHAW STREET<br>NEW LONDON, CT 06320<br>JAMES W. FITZGERALD<br>TITLE:<br>IMPROVED TONPILZ TRANSDUCER HEAD-MASS<br>TOPIC: 97 OFFICE: NUSC | NAVY | \$ 4,593 |
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IMPROVED PERFORMANCE OF TONPILZ-TYPE TRANSDUCER ELEMENTS CAN RESULT FROM (1) INCREASING THE AREA OF THE RADIATING FACE AND (2) DECREASING THE MASS OF THE RADIATING HEAD. HOWEVER, SUCH IMPROVEMENT IS LIMITED BY THE INTRODUCTION OF A FLEXURE MODE, WITH THE OUTER RING MOVING AT A DIFFERENT VELOCITY AND PHASE FROM THE INNER AREA OF THE HEAD-MASS. THE UNDESIRABLE RESULT IS A BI-MODAL RESPONSE WITH, GENERALLY, A REDUCTION IN OUTPUT OF THE DESIGN FREQUENCY. IN ORDER TO MINIMIZE THIS EFFECT, THE HEAD-MASS SHOULD HAVE BOTH LOW DENSITY AND HIGH STIFFNESS. THE DESIGN "FIGURE-OF-MERIT" FOR HEAD-MASS MATERIAL IS THE SPECIFIC MODULUS. IT IS SHOWN THAT BERYLLIUM HAS THE HIGHEST SPECIFIC MODULUS OF METALS, BEING MORE THAN FIVE TIMES THE SPECIFIC MODULUS OF SUCH COMMON HEAD-MASS MATERIALS AS STAINLESS STEEL AND ALUMINUM. A SIMPLE PROGRAM IS PROPOSED TO COMPARE THE PERFORMANCE OF TONPILZ ELEMENTS WITH HEADMASSES OF BERYLLIUM,

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>---- | AWARDED<br>AMOUNT<br>----- |
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STAINLESS STEEL, AND ALUMINUM.

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| BABCOCK ELECTRO-MECHANICAL, INC.<br>3535 HARBOR BLVD.<br>COSTA MESA, CA 92626<br>RICHARD D. MCGUNIGLE<br>TITLE:<br>REENTRY VEHICLE ON-BOARD CONSIDERATIONS<br>TOPIC: 259                      OFFICE: BMO/PMX | AF | \$ 74,500 |
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IN THIS PROGRAM, THE EFFORT WILL CONCENTRATE ON ATTAINING A COMPLETE UNDERSTANDING OF THE PHYSICS INVOLVED IN INFERRING THE SHAPE OF THE FORWARD SURFACE OF A CARBON/CARBON NOSETIP FROM THE ECHO WAVESHAPE GENERATED BY A NULTRASONIC TRANSMITTER/RECEIVER MOUNTED ON THE BACK FACE. THE HIGHEST PRIORITY WILL BE FOCUSED ON THE ABILITY TO IMPROVE THE INTERPRETATION OF PREVIOUS AND FUTURE FLIGHT DATA USING CURRENT UADS, WHILE A SECONDARY GOAL WILL BE THE ABILITY TO OPTIMIZE THE TRASMITTED/RECEIVER DESIGN FOR INCREASED RESOLUTION OF NOSETIP SHAPE.

THE FIRST PHASE STUDIES THE PRINCIPLES BY WHICH (1) ACOUSTIC WAVES ARE GENERATED AT THE BACK SURFACE BY PRACTICAL ULTRASONIC TRANSMITTERS WHICH CAN GENERATE STRESS WAVES WHICH ARE SUFFICIENTLY INTENSE TO BE DETECTABLE OVER THE ACOUSTIC NOISE IN THE NOSETIP, (2) ACOUSTIC WAVES ARE PROPAGATED AND REFECTED WITHIN THE COLD NOSETIP, AND (3) THE WAVES ARE AFFECTED BY THE HIGH TEMPERATURE PRESENT NEAR THE SURFACE OF THE NOSETIP.

THIS PHASE I STUDY WILL BE PRIMARILY THEORETICAL, BASED ON EXISTING MATHEMATICAL MODELS, BUT WILL BE SUPPORTED BY SELECETED LABORATORY TESTS TO PROVIDE ROUGH CORROBORATION OF THE THEORY. BASED ON THE GENERAL UNDERSTANDING OF ECHO BEHAVIOR IN CARBON/CARBON NOSETIPS, THE EXISTING UADS NOISE SENSORS, AND A PROPOSED IMPROVED TRANSMITTERS/RECEIVER WILL BE CHARACTERIZED IN THEIR ABILITY TO DISTINGUISH BETWEEN NOSETIP SHAPES. THIS CHARACTERIZATION WILL THEN BE APPLIED TO THE EXISTING FLIGHT AND GROUND TEST DATA TO ASSESS THE PROBABILITY OF OBTAINING IMPROVED RESULTS FROM THE PHASE II EXPERIMENTS.

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| BEHAVIORAL RESEARCH ASSOCIATES<br>693 NORTH 400 WEST<br>WEST LAFAYETTE, IN 47906<br>BARRY K. KANTOWITZ, PH.D.<br>TITLE:<br>BIOCYBERNETIC ANALYSIS OF A HYBRID WORKLOAD MODEL<br>TOPIC: 174                      OFFICE: AFOSR/XOT | AF | \$ 47,034 |
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THE HUMAN AS A SYSTEM COMPONENT IS MOST LIKELY TO FAIL UNDER HIGH

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>----- | AWARDED<br>AMOUNT<br>----- |
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WORKLOAD WHICH OFTEN IS THE TIME THAT FAILURE IS MOST CATASTROPHIC FOR THE ENTIRE SYSTEM. THE PROPOSED RESEARCH ATTEMPTS TO EXPAND OUR THEORETICAL UNDERSTANDING OF HUMAN INFORMATION PROCESSING WITH PARTICULAR REFERENCE TO MODELS OF ATTENTION AND HIGH WORKLOAD. BIO-CYBERNETIC MEASURE (P300 AND HEART RATE) ARE USED TO PROVIDE CONVERGING OPERATIONS TO IMPROVE A HYBRID PROCESSING MODEL OF ATTENTION FORMULATED BY KANTOWITZ AND KNIGHT (1976). AN EXPERIMENT BASED UPON A MODIFIED PSYCHOLOGICAL REFRACTORY PERIOD PARADIGM WILL BE CONDUCTED WITH STIMULUS-RESPONSE UNCERTAINTY AND INTER-STIMULUS INTERVAL AS PRIMARY INDEPENDENT VARIABLES. THE DATA ANALYSES WILL EXAMINE RELATIONSHIPS BETWEEN BEHAVIORAL AND BIOCYBERNETIC DEPENDENT VARIABLES AS WELL AS BETWEEN HEART RATE AND P300. THE RESULTS WILL DETERMINE THE FEASIBILITY OF EXPANDING THIS APPROACH TO TIMESHARING PARADIGMS. ULTIMATELY, IT IS POSSIBLE THAT BIOCYBERNETIC MEASURES OF OPERATOR WORKLOAD CAN BE USED IN INDUSTRIAL SETTINGS, ESPECIALLY FOR ON-LINE ALLOCATION OF FUNCTION.

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| BELTRAN ASSOCIATES, INC.<br>200 OAK DRIVE<br>SYOSSET, NY 11791<br>THOMAS C. KOSVIC<br>TITLE:<br>FUEL NEUTRALIZATION TO PREVENT FLASHBACK ON AIRCRAFT FIRES<br>TOPIC: 265      OFFICE: AFESC/RDX | AF | \$ 49,786 |
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CURRENT EXTINGUISHMENT TECHNIQUES CAN UTILIZE DRY CHEMICAL AND AQUEOUS FOAMS TO KNOCKDOWN A POOL FIRE IN AN AIRCRAFT FIRE INCIDENT. AS NEW FUEL IS ADDED, DUE TO SPILLS, REIGNITION AND FLASHBACK IS POSSIBLE. MECHANISMS BASED ON COMBUSTION REACTION AND VAPORIZATION PROCESSES WILL BE SCREENED TO DETERMINE CANDIDATE MECHANISMS TO PREVENT OR NEUTRALIZE FUEL ENTERING THE FIRE ZONE. BASED ON MECHANISMS DEVELOPED BY KNOWLEDGE OF THE INVESTIGATORS AND REVIEWS ON THE ANALYTICAL AND EXPERIMENTAL LITERATURE, SEVERAL AGENTS, TECHNIQUES, OR PROCESSES WILL BE PROPOSED FOR FURTHER INVESTIGATION IN PHASE II EFFORTS. THE TEAM OF INVESTIGATORS DRAWS FROM NEARLY 80 MAN YEARS OF EXPERIENCE IN COMBUSTION PROCESSES. OVER 10 DIRECTLY USEFUL REFERENCES IN THE AIRCRAFT FIRE SAFETY, LITERATURE INVOLVE THE INVESTIGATORS (KOSVIC, GERSTEIN, AND BELTRAN).

FISCAL YEAR 1984

| SUBMITTED BY<br>-----  | DEPT<br>----- | AWARDED<br>AMOUNT<br>----- |
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| BEND RESEARCH, INC.<br>64550 RESEARCH ROAD<br>BEND, OR 97701<br>RODERICK J. RAY<br>TITLE:<br>ONBOARD WATER GENERATION FOR MILITARY VEHICLES<br>TOPIC: 37 OFFICE: DRSTA-RGI | ARMY          | \$ 48,852                  |

SUPPLYING ADEQUATE DRINKING WATER TO SOLDIERS ON ARID OR CONTAMINATED BATTLEFIELDS IS A FORMIDABLE PROBLEM. ONE POSSIBLE SOURCE OF WATER IS ENGINE EXHAUST; FOR EXAMPLE, DIESEL EXHAUST CONTAINS 1.1 POUNDS OF WATER VAPOR FOR EACH POUND OF FUEL BURNED. WE PROPOSE TO DEVELOP AN ONBOARD, COMPACT, EASILY MAINTAINED MEMBRANE-BASED SYSTEM THAT CAN RECOVER AND PURIFY WATER FROM COMBAT VEHICLE EXHAUSTS IN A SIMPLE AND SELF-CONTAINED PROCESS. WATER VAPOR IN THE EXHAUST WILL BE MADE TO PERMEATE SELECTIVELY ACROSS A HYDROPHILIC MEMBRANE BY THE APPLICATION OF A VACUUM ON THE DOWNSTREAM SIDE. THIS WILL RESULT IN SEPARATION OF THE EXHAUST INTO TWO STREAMS: ONE UNDER VACUUM, CONTAINING ESSENTIALLY PURE WATER VAPOR, AND THE SECOND CONTAINING THE OTHER GASES IN THE EXHAUST. THE WATER VAPOR STREAM WILL BE COMPRESSED AND CONDENSED TO PROVIDE A RELIABLE SUPPLY OF DRINKING-QUALITY WATER.

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| BETAC CORPORATION<br>1401 WILSON BLVD<br>ARLINGTON, VA 22209<br>RAYMOND MADONNA<br>TITLE:<br>ADVANCED AUTOMATED WARGAME STUDY<br>TOPIC: 49 OFFICE: MARINE CORPS | NAVY | \$ 75,776 |
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THE MARINE CORPS TRAINS ITS COMMANDERS AND THEIR STAFFS UNDER A NUMBER OF CONSTRAINTS (TIME, MONEY, TRAINING AREAS, ETC.) NEW C3I SYSTEMS AND WEAPON SYSTEMS REQUIRE MORE TRAINING THAN EVER BEFORE. ONE INNOVATIVE TOOL THE MARINE CORPS HAS DEVELOPED IS THE TACTICAL WARFARE SIMULATION EVALUATION AND ANALYSIS SYSTEM (TWSEAS) IT IS, HOWEVER, BECOMING OBSOLETE AND ITS REPLACEMENT WILL REQUIRE CAREFUL ANALYSIS OF OPERATIONAL, FUNCTIONAL, AND SYSTEM REQUIREMENTS AND STATE-OF-THE-ART TECHNOLOGY IN ORDER TO PROVIDE THE NECESSARY

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>---- | AWARDED<br>AMOUNT<br>----- |
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INTERFACES WITH EXISTING AND PLANNED C3I SYSTEMS AND TO GIVE THE LOWEST POSSIBLE LIFE-CYCLE COST. THIS PROPOSAL ADDRESSES THE CONDUCT OF A STRUCTURED SYSTEM ANALYSIS LENDING TO THE PROCURING OF THE REPLACEMENT SYSTEM.

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| BIO-DYNAMICS RESEARCH & DEVELOPMENT CORP<br>1000 WILLAGILLESPIE ROAD, SUITE 200<br>EUGENE, OR 97401<br>HAROLD HAWKINS<br>TITLE:<br>FEASIBILITY STUDY FOR ERGONOMICS ANALYSIS AND DESIGN OF FUTURE HELICOPTER COCKPIT SYSTEMS<br>TOPIC:           6           OFFICE: DRDAV-PD | ARMY | \$ 42,146 |
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PROPOSED IS PHASE I OF A CONCENTRATED PHASE RESEARCH PROJECT AIMED AT THE DESIGN AND IMPLEMENTATION OF A PREDICTIVE METHODOLOGY WHICH RELATES THE HUMAN PILOT TO PROPOSED MILITARY HELICOPTER SYSTEMS IN ADVANCE OF COMMITMENT TO HARDWARE DEVELOPMENT. RECENT ADVANCES IN AVIONICS AND TECHNOLOGY CAN PROVIDE MORE CAPABILITIES, SYSTEMS, AND DISPLAYS THAN THE PILOT AND OTHER CREW MEMBERS CAN POSSIBLY EXPLOIT. THUS, A NEED EXISTS FOR METHODOLOGIES TO ENABLE THE DESIGN AND INSTRUMENTATION OF HARDWARE SYSTEMS THAT MEETS SYSTEM MISSION REQUIREMENTS AND EXHIBIT A SENSITIVITY TO THE INFORMATION PROCESSING LIMITATIONS AND CAPABILITIES OF THE HUMAN OPERATOR. THE OBJECTIVE OF THE PROJECT'S FIRST PHASE IS TO ASSESS THE FEASIBILITY OF AN EMPIRICALLY-BASED, COMPUTER-DRIVEN SYSTEM EVALUATION PROCESS THAT WILL YIELD JOINT OPTIMIZATION OF THE HARDWARE AND HUMAN SUBSYSTEM CONSTITUTING THE HELICOPTER AS A TOTAL OPERATING SYSTEM. THE ANTICIPATED RESULT OF THE PROJECT IS AN ERGONOMICALLY VALIDATED COCKPIT DESIGN EVALUATION PROCEDURE THAT CAN BE APPLIED FLEXIBLY ACROSS A BROAD RANGE OF POTENTIAL HELICOPTER HARDWARE SYSTEMS.

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| BIO-DYNAMICS RESEARCH & DEVELOPMENT CORP<br>1000 WILLAGILLESPIE ROAD, SUITE 200<br>EUGENE, OR 97401<br>BARRY T. BATES, PH.D.<br>TITLE:<br>DISCRIMINATE ANALYSIS COMPARING MALE AND FEMALE HEAD AND FACE PROPORTIONS<br>TOPIC:           125           OFFICE: AMD/RDO | AF | \$ 28,770 |
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PROPOSED IS PHASE 1 OF A PHASED RESEARCH PROJECT AIMED AT PROVIDING

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>----- | AWARDED<br>AMOUNT<br>----- |
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NECESSARY DATA TO ASSIST IN THE MORE EFFECTIVE AND EFFICIENT DESIGN OF HEAD AND FACE PROTECTIVE EQUIPMENT FOR MEN AND WOMEN. THIS IS TO BE ACCOMPLISHED THROUGH STATISTICAL (MULTI-VARIATE DISCRIMINATE ANALYSIS) EVALUATION OF AN EXISTING U.S. ARMY DATA SET OF 30 HEAD AND FACE DIMENSIONS FOR 100 MALE AND 200 FEMALE SUBJECTS. THE PRIMARY OBJECTIVE OF THE RESEARCH IS TO QUANTIFY DIFFERENCES BETWEEN THE SEXES ON RELEVANT HEAD AND FACIAL CHARACTERISTICS AND PRODUCE PARAMETER PROFILES TO AID IN THE DEVELOPMENT OF SIZING SYSTEMS. A FURTHER OBJECTIVE IS TO DETERMINE WHETHER THE EXISTING DATA SET IS STATISTICALLY AND PRACTICALLY ADEQUATE AND IF NOT, TO MAKE RECOMMENDATIONS FOR THE FOLLOW-ON PHASE.

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| BIO-IMAGING RESEARCH, INC.<br>3000 DUNDEE ROAD, SUITE 320<br>NORTHBROOK, IL 60062<br>NAND K. GUPTA, PH.D.<br>TITLE:<br>FEASIBILITY OF INSPECTING HIGH-Z MATERIAL COATINGS USING X-RAY OR GAMMA-RAY TECHNIQUES<br>TOPIC: 71            OFFICE: NSWC | NAVY | \$ 49,632 |
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WE PROPOSE TO EVALUATE TRANSMISSION, FLUORESCENCE, AND BACK-SCATTERING TECHNIQUES OF X-RAYS OR GAMMA-RAYS TO DETERMINE DEFECTS IN HIGH-Z COATINGS ON LOW-Z SUBSTRATES. THE PROPOSAL INCLUDES X-RAY SPECTRAL ANALYSIS, FOLLOWED BY EXPERIMENTAL MEASUREMENTS ON ACTUAL SAMPLES, TO DETERMINE OPTIMUM DESIGN PARAMETERS AND THE MINIMUM SIZE OF DEFECT THAT CAN BE DETECTED.

UNDER FAVORABLE EXPERIMENTAL RESULTS, BOTH THE PARAMETERS AND THE OPERATING CONCEPT FOR AN OPTIMUM INSTRUMENT CAN BE DEFINED AT THE END OF PHASE I, FOR THE EVENTUAL FABRICATION OF A PROTOTYPE IN PHASE II.

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| BIO-METRIC SYSTEMS, INC.<br>9932 WEST 74TH STREET<br>EDEN PRAIRIE, MN 55344<br>PETER NASH, PH.D.<br>TITLE:<br>DEVELOPMENT OF A SENSITIVE, RAPID CHEMICAL/BIOLOGICAL AGENT DETECTOR<br>TOPIC: 245            OFFICE: BMO/PMX | AF | \$ 61,899 |
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THE RAPID DEVELOPMENT OF BIOTECHNOLOGY HAS MADE IT IMPERATIVE TO

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>----- | AWARDED<br>AMOUNT<br>----- |
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DETECT BIOHAZARDS WHICH MAY BE ENCOUNTERED IN STRATEGIC AREAS OF AIR FORCE OPERATIONS. THE RELEASE OF BIOLOGICAL/CHEMICAL WARFARE AGENTS IN A DEEP BASE WOULD PRESENT A SIGNIFICANT THREAT. IN PHASE I OF THIS PROPOSAL, WE WILL DEVELOP A QUALITATIVE METHOD OF DETECTING LOW CONCENTRATIONS OF AIRBORNE CHEMICAL AND BIOLOGICAL AGENTS. THIS SENSITIVE, RAPID CHEMICAL/BIOLOGICAL AGENT DETECTOR USES AN ENZYME IMMUNOASSAY (EIA) SYSTEM WHICH WILL PRODUCE A COLORED SPOT ON A FILTER PAPER IN THE PRESENCE OF THE AGENT. ANTIBODIES TO THE VARIOUS AGENTS WILL BE BOUND TO SMALL PARTICLES AND TO A READOUT ENZYME. THESE ANTIBODIES WILL BE MIXED WITH THE SAMPLE CONTAINING THE AGENT THEN FILTERED ONTO A PAPER DISK. A SUBSTRATE SOLUTION WILL BE APPLIED AND THE ENZYME WILL PRODUCE A COLOR ON THE PAPER IF THE AGENT IS PRESENT. THIS METHOD IS QUICK, SENSITIVE, LIGHT WEIGHT, PORTABLE AND MAY BE USED BY NONPROFESSIONAL PERSONNEL. THIS DETECTOR SYSTEM MAY BE PACKAGED FOR USE IN A VARIETY OF ENVIRONMENTS TO DETECT A NUMBER OF BIOLOGICAL/CHEMICAL AGENTS SIMULTANEOUSLY. THE FEASIBILITY OF THIS DETECTOR SYSTEM WILL BE STUDIED IN PHASE II.

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| BIOELECTRONICS<br>25091 ARMAGOSA DRIVE<br>LAGUNA NIGUEL, CA 92677<br>HENRY BARCIKOWSKI<br>TITLE:<br>MINITURIZED POCKET PORTABLE DEFIBRILLATOR<br>TOPIC: 95 OFFICE: SGRD-RMA | ARMY | \$ 47,704 |
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CURRENTLY AVAILABLE PORTABLE DC DEFIBRILLATORS ARE CUMBERSOME IN EMERGENCY VEHICLES, ROOMS AND MEDICAL AIRCRAFT. POWER SOURCE AND CAPACITIVE DISCHARGE SYSTEMS PRESENTLY SEVERELY LIMIT REDUCTION IN DEFIBRILLATION SIZE. PROPOSED PHASE I EFFORT WILL DESIGN AND DEVELOP A HIGH CAPACITY, HIGH ENERGY DENSITY RATE PRIMARY BATTERY SYSTEM PER UNIT VOLUME. THIS BATTERY WILL BE COUPLED TO A DC-DC CONVERTER PROVIDING 400 WATT-SEC OF ENERGY AVAILABLE FOR DEFIBRILLATION.

TOTAL MINIATURE PORTABLE DEFIBRILLATOR VOLUME IS ANTICIPATED TO BE 115 CUBIC INCHES, EXCLUDING ELECTRODE PADDLES. THE PRIMARY BATTERY HAS AN EXPECTED 6 MINUTE LIFE, A 5 YEAR SHELF LIFE, AND IS DISPOSIBLE.

SMALL BUSINESS INNOVATION RESEARCH (SBIR) PROGRAM - PHASE I PAGE 37  
FISCAL YEAR 1984

| SUBMITTED BY<br>-----  | DEPT<br>---- | AWARDED<br>AMOUNT<br>----- |
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| BIOMETALLICS INC.<br>6216 TRINITY CIRCLE<br>RALEIGH, NC 27607<br>CHRISTA G. KUEHN<br>TITLE:<br>BIOELECTRONIC SENSORS USING ELECTROCHEMICAL ENZYME LINKED<br>IMMUNOASSAYS<br>TOPIC: 9 OFFICE: ONR | NAVY         | \$ 55,000                  |

THE GOAL OF THIS PROJECT IS TO DEVELOP ELECTROCHEMICALLY SENSITIVE DETECTORS WHOSE SIGNAL DEPENDS ON THE POTENTIAL DEVELOPED BY ELECTROCHEMICAL OR ENZYMATIC REACTIONS. BIOLOGICALLY SELECTIVE MATERIALS SUCH AS POLYCLONAL OR MONOCLONAL ANTIBODIES ARE IMMOBILIZED AT THE ELECTRODE SURFACE. IN THESE PROPOSED BISENSORS THE HIGH SPECIFICITY AND SELECTIVITY OF BIOLOGICAL MOLECULES ARE COMBINED WITH THE HIGH SENSITIVITY AND RAPIDITY OF ELECTRONIC DETECTION FOR ANALYSIS OF A WIDE VARIETY OF HORMONES, TOXINS, AND DRUGS AT VERY LOW CONCENTRATIONS (ie. = OR < THAN  $10^{-9}$ m).

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| BRIMROSE CORP OF AMERICA<br>7527 BELAIR RD<br>BALTIMORE, MD 21236<br>DR RONALD G. ROSEMEIER<br>TITLE:<br>DEVELOPMENT OF REAL-TIME X-RAY DIFFRACTION INSTRUMENTATION TO ASSESS<br>AUTOMATED MANUFACTURE OF RDX AND HMX<br>TOPIC: 7 OFFICE: ONR | NAVY | \$ 56,628 |
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RECENT WORK PERFORMED AT NSWC, WHITE OAK, MD HAS SHOWN THAT CONVENTIONAL LAUE X-RAY TRANSMISSION PATTERNS OBTAINED BY FILM METHODS GIVE AN INDICATION OF GROWN-IN MICROSTRUCTURAL DEFORMATION OF HOLSTEN CLASS D RDX ENERGETIC MATERIALS. THE OBJECT OF THIS STUDY IS TO DETERMINE IF X-RAY LAUE PATTERNS FROM RDX AND/OR HMX ILLUSTRATING SEVERE MICROSTRUCTURAL DEFORMATION ALSO CORRESPOND TO POOR PERFORMANCE IN THESE MATERIALS. ALSO, EXISTING REAL-TIME X-RAY LAUE SYSTEMS WILL BE FURTHER DEVELOPED AND MODIFIED FOR USE AS A QUALITY CONTROL METHOD FOR RDX AND/OR HMX. THE PRINCIPAL INVESTIGATOR HAS BEEN INVOLVED WITH THE CHARACTERIZATION OF LABORATORY GROWN RDX AND HOLSTEN CLASS D MATERIALS FOR TWO YEARS. ALSO, SINCE 1978 BRIMROSE HAS BEEN A PIONEER IN THE DESIGN AND DEVELOPMENT OF REAL-TIME X-RAY DIFFRACTION IMAGING

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>----- | AWARDED<br>AMOUNT<br>----- |
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EQUIPMENT FOR VARIOUS APPLICATIONS IN QUALITY CONTROL OF DEVELOPMENTAL SEMICONDUCTORS FOR DOD AND NASA LABORATORIES.

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| BRIMROSE CORP OF AMERICA<br>7527 BELAIR ROAD<br>BALTIMORE, MD 21236<br>DR. RONALD G. ROSEMEIER<br>TITLE:<br>CRYSTAL GROWTH AND CHARACTERIZATION OF A VARIABLE BANDGAP SEMIMAGNETIC SEMICONDUCTOR: Hg <sub>1-x</sub> Mn <sub>x</sub> Te<br>TOPIC: 15 OFFICE: NESC | NAVY | \$ 49,998 |
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THE PROPOSED RESEARCH WORK IS A RESPONSE TO THE NATIONAL DEFENSE EFFORT OF THE UNITED STATES OF AMERICA TO ULTIMATELY MANUFACTURE A LOW COST, RELIABLE AND EFFECTIVE TURNABLE FREQUENCY FAR INFRARED (IR) DETECTOR THAT CAN BE PLACED UPON BOTH OUR OFFENSIVE AND DEFENSIVE WEAPONS SYSTEMS. THE MATERIAL THAT WILL BE INVESTIGATED IS THE "SEMIMAGNETIC" SEMICONDUCTOR HG 1-X MN X TE, A SISTER COMPOUND TO HG 1-X CD X TE. EVEN THOUGH THE SEMIMAGNETIC SEMI-CONDUCTOR HAS SIMILAR PROPERTIES TO HG 1-X CD X TE, HG 1-X MN X TE HAS A UNIQUE FEATURE WHICH ALLOWS ITS BAND GAP TO BE CHANGED SIGNIFICANTLY AS A FUNCTION OF APPLIED MAGNETIC FIELD. WE ARE PROPOSING A TWO-FOLD RESEARCH PROGRAM. FIRST, HG 1-X MN X TE WILL BE GROWN BY A SPECIALLY DESIGNED, PROVEN EFFECTIVE UNIDIRECTIONAL CRYSTAL BOULE (UXB) SOLIDIFICATION TECHNIQUE. SECOND, A NOVEL, NON-DESTRUCTIVE X-RAY TOPOGRAPHY TECHNIQUE WHICH ALLOWS THE DEFECT STRUCTURE IN THE MATERIAL TO BE DIAGNOSED WILL BE FURTHER DEVELOPED USING REAL-TIME X-RAY IMAGE INTENSIFICATION IN WHICH BRIMROSE IS PIONEER.

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| BRIMROSE CORP. OF AMERICA<br>7527 BELAIR ROAD<br>BALTIMORE, MD 21236<br>DR. RONALD G. ROSEMEIER<br>TITLE:<br>REAL-TIME X-RAY TOPOGRAPHY OF GaAs AND HgCdTe EPITAXIAL FILMS AND/OR VARIOUS SUBSTRATES<br>TOPIC: 1 OFFICE: DARPA | DARPA | \$ 56,298 |
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WITH THE DOD HgCdTe AND GaAs PROGRAMS MOVING TOWARD EPITAXIAL GROWTH TECHNOLOGY THERE IS A NEED TO DEVELOP REAL-TIME MATERIALS CHARACTERI-

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>---- | AWARDED<br>AMOUNT<br>----- |
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ZATION TECHNIQUES OF BOTH SUBSTRATES AND/OR EPITAXIAL FILMS QUICKLY FOR PRODUCTION ENVIRONMENTS. REAL-TIME X-RAY TOPOGRAPHY OF WHICH BRIMROSE IS A PIONEER IS ONE METHOD OF CHARACTERIZING THESE MATERIALS INSTANTLY BEFORE COSTLY PROCESSING IS PERFORMED ON POOR MATERIALS. INITIAL RESEARCH AND DEVELOPMENT EFFORTS WHICH HAVE BEEN INTERNALLY FUNDED AND NAVY FUNDED HAVE SHOWN THAT X-RAY TOPOGRAPHY IS FEASIBLE FOR INVESTIGATING BOTH BaF2 SUBSTRATES AND Pb SALT EPITAXIAL FILMS ON 1 X 1 CM2 AREA DEVICES. HOWEVER, THIS TECHNIQUE IS NOT LIMITED TO SUCH SMALL AREA DEVICES. RECENTLY 6 X 6 IN2 CAST SILICON WAFERS HAVE BEEN INVESTIGATED BY REAL-TIME X-RAY TOPOGRAPHY. ALSO, X-RAY TOPOGRAPHY IS A GOOD METHOD OF LOCATING DEFECT AREAS IN BULK EPITAXIAL FILMS AND/OR SUBSTRATES WHICH CAN BE LATER INVESTIGATED BY HIGH RESOLUTION TEM AND EBIC TECHNIQUES.

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| CAD/CAM ENGINEERING, INC.<br>4000 EAST SOUTHPORT ROAD<br>INDIANAPOLIS, IN 46227<br>JOSEPH B. SHEETS<br>TITLE:<br>IMPLICATIONS OF AND OPPORTUNITIES FOR 32-BIT MICROPROCESSORS<br>TOPIC: 19                      OFFICE: ASD/ENO | AF | \$ 44,520 |
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THE EVOLUTION OF PERSONAL MICRO COMPUTERS INTO FULL FUNCTION PROFESSIONAL WORKSTATIONS OPENS NEW OPPORTUNITIES FOR IMPROVING THE DESIGN, ENGINEERING AND MANUFACTURING PRODUCTIVITY OF POTENTIAL USERS WHO CANNOT AFFORD THE HIGH COST OF PRESENT DAY COMPUTER AIDED ENGINEERING (CAE) AND RELATED SYSTEMS. THE CONTINUED DEVELOPMENT OF LOW COST MICROPROCESSORS PROMISES TO REMOVE THE CURRENT PRICE BARRIER OF CAE AND RELATED SYSTEMS AND TO ACCELERATE THE USAGE OF THESE TOOLS WITHIN INDUSTRY AND GOVERNMENT.

THE PROPOSED RESEARCH WILL FOCUS ON THE IMPLICATIONS OF 32-BIT PROCESSOR TECHNOLOGY VIS-A-VIS 16-BIT AND 8-BIT PROCESSOR TECHNOLOGY. IT WILL DEFINE THOSE APPLICATIONS IN WHICH 32-BIT TECHNOLOGY IS REQUIRED OR USEFUL, IDENTIFY SOFTWARE THAT NEEDS TO BE DEVELOPED IN ORDER TO ALLOW FULL USE OF 32-BIT TECHNOLOGY, AND PROVIDE A BASIS UPON WHICH TO DEVELOP COMMERCIALY FEASIBLE SOFTWARE PRODUCTS AND SERVICES FOR THE 32-BIT MARKETPLACE.

FISCAL YEAR 1984

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| CAPE COD RESEARCH, INC.<br>P.O. BOX 600<br>BUZZARDS BAY, MA 02532<br>DR. MYLES WALSH<br>TITLE:<br>IMPROVED VELOCITY AND SEA ENVIRONMENT SENSOR<br>TOPIC: 80 OFFICE: NSWC | NAVY         | \$ 49,994                  |

THE PURPOSE OF THE PROPOSED RESEARCH IS TO INVESTIGATE THE FEASIBILITY OF MONITORING BOTH SUBMARINE VELOCITY AND SEA ENVIRONMENT WITH A NOVEL ELECTROCHEMICAL SENSOR. THE PROPOSED SENSOR CONSISTS OF CATALYZED METAL FILMS WHICH COAT A QUARTZ DISK MOUNTED FLUSH WITH THE DECK. THE RESEARCH FOCUSES ON DEVELOPING SENSORS WITH ELECTRODE GRIDS FINE ENOUGH SO THAT DETECTION OF CHANGES IN CONCENTRATION BOUNDARY LAYERS CAN BE MONITORED. THE NOVEL APPROACH IS TO GENERATE SMALL AMOUNTS OF CHLORINE AND HYDROGEN ON THE SENSOR SURFACE AND ACCURATELY TRACK THEIR MOTION WITH TIME. THE PROPOSED PROGRAM INVOLVES DEVELOPING TECHNIQUES FOR FABRICATING THE SENSOR, TESTING THE SENSOR, AND DEVELOPING ELECTRONIC TECHNIQUES FOR THE DIGITAL OUTPUT OF THE SEA STATE AND THE RELATIVE WATER SPEED ACROSS THE SUBMARINE'S DECK.

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| CERAMPHYSICS, INC.<br>P.O. BOX 346<br>WESTERVILLE, OH 43081<br>DR. W. N. LAWLESS<br>TITLE:<br>CAPACITY ENERGY STORAGE AT CRYOGENIC TEMPERATURES<br>TOPIC: 184 OFFICE: AFOSR/XOT | AF | \$ 49,616 |
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A BASIC RESEARCH PROGRAM IS PROPOSED TO STUDY CAPACITIVE ENERGY STORAGE AT 77 K BASED ON CADMIUM-LEAD NIOBATE CERAMICS FOR TWO REASONS: (1) THE DIELECTRIC CONSTANT IS UNUSUALLY LARGE AT THESE TEMPERATURES (~8000); AND (2) THE FERROELECTRIC TRANSITION CAN BE COMPOSITIONALLY ADJUSTED BELOW 77 K. TWO ADVANTAGES ACCRUE: (1) THE STORED ENERGY DENSITY AT 77 K IS MAXIMIZED; AND (2) ON DISCHARGE (I.E., E O) THE DIELECTRIC COOLS BY ADIABATIC DEPOLARIZATION, THUS PARTIALLY COMPENSATING HEATING EFFECTS.

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>---- | AWARDED<br>AMOUNT<br>----- |
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ADDITIONALLY, AT CRYOGENIC TEMPERATURES DIELECTRIC BREAKDOWN STRENGTHS INCREASE AND METAL RESISTIVITIES DECREASE. A ROUGH ESTIMATE SUGGESTS THAT ENERGY DENSITIES ~20-25 J/CM<sup>3</sup> (~3-4 J/G) MIGHT BE ACHIEVED. THE RESEARCH PLAN CALLS FOR DIELECTRIC, ELECTROCALORIC, AND DIELECTRIC-BREAKDOWN STUDIES AT LIQUID NITROGEN TEMPERATURES ON PROTOTYPE, MULTILAYER, CERAMIC CAPACITORS. EXPERIMENTAL DATA WILL BE ANALYZED USING GIBBS AND HELMHOLTZ THERMODYNAMIC FUNCTIONS.

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| CHARLES RIVER ANALYTICS, INC.<br>55 WHEELER STREET<br>CAMBRIDGE, MA 02138<br>DR. GREG ZACHARIAS<br>TITLE:<br>FLOW-FIELD PASSIVE RANGING FOR TACTICAL MISSILE GUIDANCE<br>TOPIC: 28            OFFICE: DRSMI-ICDA | ARMY | \$ 48,768 |
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THE PRIMARY OBJECTIVE OF THE PHASE I EFFORT IS TO EVALUATE THE FEASIBILITY OF DEVELOPING AN ON-BOARD FLOW-FIELD PASSIVE RANGING SYSTEM FOR USE IN TACTICAL MISSILE GUIDANCE. THE BASIC TECHNIQUE PROPOSED FOR STUDY USES THE FLOW-FIELD INFORMATION IMPLICIT IN ALL PASSIVELY-IMAGED DYNAMIC SCENES, TO DEVELOP EVOLVING AND AUTONOMOUS ESTIMATES OF MISSILE IMPACT TIMES TO ALL TERRAIN POINTS IN THE SEEKER FIELD-OF-VIEW. COMBINED WITH A MISSILE SPEED ESTIMATE, THESE IMPACT THESE IMPACT TIMES DETERMINE A MISSILE-RELATIVE RANGE "DEPTH MAP" TO ALL VIEWED TERRAIN POINTS. WE PROPOSED TO EVALUATE THE TECHNIQUE'S FEASIBILITY OVER THREE TASKS. WE WILL: 1) DEFINE A PRE-LIMINARY ON-BOARD SYSTEM INCORPORATING THE TECHNIQUE AND IDENTIFY BASIC FEASIBILITY ISSUES; 2) DEVELOP AND EXERCISE A PERFORMANCE MODEL TO ASSESS EXPECTED RANGING ACCURACY; AND 3) DEFINE COMPONENT FUNCTIONAL SPECIFICATIONS FOR FOLLOW-ON DEVELOPMENT. A FINAL REPORT WILL INCLUDE A SUMMARY OF THE PROGRAM'S OBJECTIVES AND ACHIEVEMENTS, AND A SET OF OVERALL SYSTEM FUNCTIONAL SPECIFICATIONS TO SUPPORT FURTHER DEVELOPMENT.

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| COAL GAS INCORPORATED<br>115 M. UMSTEAD INDUSTRIAL PARK<br>RALEIGH, NC 27612<br>DR. A. ATTAR<br>TITLE:<br>PERSONAL PROPELLANT-VAPOR DETECTOR USING GAS SENSITIVE WAFER AND ELECTROOPTICAL MEASURING DEVICE<br>TOPIC: 193            OFFICE: OL-AB | AF | \$ 50,000 |
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MOST POISONOUS GASES CAN REACT WITH PROPERLY SELECTED REAGENTS TO

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>---- | AWARDED<br>AMOUNT<br>----- |
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FORM COLORFUL COMPOUNDS. THE CHANGE IN COLOR CAN BE USED FOR QUALITATIVE AND QUANTITATIVE DETERMINATION OF THE POISONOUS GAS IN AIR IF THE OPTICAL DENSITY OF THE COLORED COMPOUND IS MEASURED. IN THE PROPOSED WORK, A SOLID WAFER WILL BE IMPREGNATED WITH COMPOUNDS THAT CHANGE THEIR COLOR FROM COLORLESS TO RED WHEN THEY REACT WITH NOX. A PHOTOCCELL WHICH IS SENSITIVE TO THE INTENSITY OF THE REFLECTED LIGHT IS CURRENTLY USED IN OUR LAB TO DETERMINE THE CHANGE IN COLOR AND THUS TO QUANTIFY THE CONCENTRATION OF THE POISONOUS GAS AND THE TOTAL EXPOSURE OF THE WAFER TO THE GAS.

IN PHASE I, SEVERAL WAFERS FOR DETECTING NOX WILL BE TESTED, THEIR PERFORMANCE CURVES FOR DIFFERENT NOX CONCENTRATIONS WILL BE DETERMINED AND AN "OPTIMAL" WAFER WILL BE IDENTIFIED. IN PHASE II THE PRESENTLY USED ELECTRONICS WILL BE MINIATURIZED AND A COMPACT PERSONAL EQUIPMENT WILL BE BUILT.

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| COMPUTER TECHNOLOGY ASSOCIATES                             | AF | \$ 59,954 |
| 5680 S. SYRACUSE CIRCLE SUITE 506                          |    |           |
| ENGLEWOOD, CO 80111  |    |           |
| DAVID H. WALTERS   |    |           |
| TITLE:   |    |           |
| MIGRATION OF MICROCOMPUTERS INTO PROFESSIONAL WORKSTATIONS |    |           |
| TOPIC: 19 OFFICE: ASD/ENO                                  |    |           |

COMPUTER TECHNOLOGY ASSOCIATES (CTA) PROPOSES TO INVESTIGATE THE REQUIREMENTS FOR A PROFESSIONAL WORKSTATION TO BE USED BY ENGINEERS AT WRIGHT-PATTERSON, TO DEFINE ALTERNATIVES FOR MIGRATION OF MICRO COMPUTERS INTO PROFESSIONAL WORKSTATIONS, AND TO RECOMMEND A PLAN FOR IMPLEMENTING THIS MIGRATION. ALTERNATIVES CONSIDERED WILL INCLUDE THE INTEGRATION OF OFF-THE-SHELF HARDWARE AND SOFTWARE AS WELL AS THE CUSTOM DEVELOPMENT OF HARDWARE AND SOFTWARE. ENHANCEMENT OF BOTH THE MICROCOMPUTER AND ASSOCIATED HOSTS AS WELL AS THE ADDITION OF LOCAL AREA NETWORKS MAY ALSO BE PROPOSED. THE ENHANCEMENTS DEVELOPED WILL INCLUDE THE STANDALONE OPERATION AND THE OPERATION IN A COMMUNICATIONS MODE AMONG AN ENGINEERING TEAM. THE TECHNICAL APPROACH EMPLOYS A UNIQUE CTA SYSTEMS ENGINEERING METHODOLOGY. THE ENHANCEMENTS PROPOSED WILL BE APPLICABLE NOT ONLY TO THE MICROCOMPUTERS AT WRIGHT-PATTERSON, BUT OFFER THE PROMISE OF COMMERCIAL DEVELOPMENT.

FISCAL YEAR 1984

| SUBMITTED BY<br>-----   | DEPT<br>---- | AWARDED<br>AMOUNT<br>----- |
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| CONDAR COMPANY<br>12000 WINROCK ROAD<br>HIRAM, OH 44234<br>DR. STOCKTON BARNETT<br>TITLE:<br>LOWER EMISSION POLLUTANTS FROM BURNERS USING DIESEL FUEL<br>TOPIC: 52            OFFICE: DRDNA-EPT | ARMY         | \$ 48,900                  |

THE OBJECTIVE OF THE PROPOSED PROGRAM IS REDUCTION OF NOX, FORMALDEHYDE AND CARBON MONOXIDE FROM DIESEL BURNERS. A METAL SUBSTRATE CATALYST, NOW UNDER DEVELOPMENT AT CONDAR AND EMPLOYING A UNIQUE INTERNAL STRUCTURE AND NEW PRINCIPLES OF PHYSICAL CHEMISTRY, WILL BE LOCATED IN THE EXHAUST STREAM TO BURN AWAY POLLUTANT RESIDUALS. THE UNIQUE PHYSICAL AND CHEMICAL CHARACTERISTICS OF THE NEW CATALYST SUGGEST ITS USE IN A WIDE VARIETY OF NEW APPLICATIONS SUCH AS THE DIESEL BURNER. UNLIKE CERAMIC CATALYSTS, IT WILL NOT SHATTER WHEN SUBJECTED TO THERMAL SHOCK, JARRING OR PULSATIONS. THE PRESSURE DROP ACROSS THE NEW CATALYST IS MINIMAL BECAUSE OF ITS THIN WALLS AND HIGH FRONTAL OPER AREA. ALSO, ITS VERY LOW THERMAL INERTIA ALLOWS IT TO ACTIVATE MUCH EARLIER DURING START-UP OF THE DIESEL BURNER. THE PROGRAM EFFORT WILL BE DIRECTED TOWARD (1) LIFE TESTING WITH THE NEW CATALYST, (2) REDUCING AND/OR ELIMINATING POLLUTANTS, (3) EVALUATING THE PERFORMANCE CHARACTERISTICS OF THE CATALYST OVER TIME USING GAS SAMPLING AND PARTICULATE COLLECTION TECHNIQUES, (4) DETERMINING SUITABLE, SIMPLE MECHANICAL MEANS OF ATTACHING OR INSERTING THE CATALYST MODULE IN EXISTING DIESEL BURNERS AND (5) EXPLORING THE POTENTIAL FOR SECONDARY HEAT RECOVERY.

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| CONSULTANT'S CHOICE, INC.<br>8601 DUNWOODY PLACE SUITE 122<br>ATLANTA, GA 30338<br>KIRK F. PENNYWITZ<br>TITLE:<br>TARTILE SENSOR STUDY<br>TOPIC: 2            OFFICE: DARPA | DARPA | \$ 51,169 |
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THE GOAL OF THIS PROJECT IS TO DETERMINE THE FEASIBILITY OF DEVELOP-

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>----- | AWARDED<br>AMOUNT<br>----- |
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ING A GENERAL PURPOSE TACTILE SENSOR CAPABLE OF IDENTIFYING THE TEXTURE, COMPLIANCE, AND SURFACE FEATURES OF AN OBJECT. THE TACTILE SENSOR WILL CONSIST OF A PIEZOELECTRIC POLYMER MATERIAL WHICH GENERATES AN ELECTRICAL SIGNAL IN RESPONSE TO AN APPLIED FORCE. THE SENSOR WILL BE DESIGNED TO MOVE ACROSS THE OBJECT BEING EXAMINED, AND THE SIGNALS THUS GENERATED WILL BE ANALYZED AND ASSOCIATED WITH THE CORRESPONDING SURFACE FEATURES OF THE OBJECT. THEN, THROUGH THE USE OF APPROPRIATE PHYSICAL SEARCH ALGORITHMS AND PROCESSING TECHNIQUES, THE SENSOR'S CAPABILITIES WILL BE EXTENDED TO ALLOW IDENTIFICATION OF AN OBJECT'S EDGES, IT'S OVERALL SIZE AND SHAPE, AND THE TYPE OF MATERIAL IT IS COMPOSED OF.

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| CREARE R&D INC.<br>P. O. BOX 71<br>HANOVER, NH 03755<br>DR. JAMES A. BLOCK<br>TITLE:<br>LIQUID HYDROGEN COOLED CONDUCTORS FOR PULSED HIGH POWER APPLICATIONS<br>TOPIC: 102                      OFFICE: AFWAL | AF | \$ 49,137 |
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THERE ARE NUMEROUS APPLICATIONS WHERE THE THERMAL AND ELECTROMAGNETIC PERFORMANCE OF PURE METAL CONDUCTORS CAN BE APPRECIABLY ENHANCED BY COOLING WITH LIQUID HYDROGEN. ONE SUCH APPLICATION INVOLVES COPPER AND TUNGSTEN CONDUCTORS OF ELECTROMAGNETIC LAUNCH SYSTEMS COMMONLY KNOWN AS RAIL GUNS. THIS PROPOSAL ADDRESSES A NOVEL CONCEPT TO ENHANCE THE PERFORMANCE OF RAIL GUNS BY INCREASING THEIR EFFICIENCY AND FIRING RATE.

THE NOVEL CONCEPT INVOLVES MODIFYING THE DESIGN OF RAIL GUNS BY ADDITION OF MULTIPLE WIRES ATTCHED TO THE RAIL AND COOLED BY IMMERSION IN A CIRCULATING BATH OF LIQUID HYDROGEN. CRYOGENIC COOLING IS ESPECIALLY POWERFUL WITH THIS CONCEPT SINCE THE RESISTIVE HEATING OF THE RAILS IS REDUCED AND THIS LEADS TO THE IMPROVED EFFICIENCY EXPECTED. IN ADDITION, THE CAPABILITY TO EFFECTIVELY TRANSFER THE ENERGY FROM ELECTRICAL HEATING OF THE RAILS TO THE COOLING SYSTEM LEADS TO THE RAPID MULTIPLE LAUNCH CAPABILITY.

THE OBJECTIVES OF THIS WORK ARE TO SHOW THAT THE ENERGY INPUT TO THE RAILS FROM THE ELECTRICAL CURRENT CAN BE TRANSFERRED TO THE CRYOGENIC COOLANT IN SHORT TIME PERIODS, AND BURNOUT OF COPPER WIRES ATTACHED TO THE RAILS WILL NOT OCCUR. THIS

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>----- | AWARDED<br>AMOUNT<br>----- |
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ANALYTICAL WORK WILL LEAD TO AN EARLY INDICATON OF THE FEASIBILITY OF THE NOVEL CONCEPT.

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| CRYSTAL SPECIALTIES INCORPORATED<br>10160 S.W. NIMBUS F-7<br>PORTLAND, OR 97223<br>WORTH ALLRED<br>TITLE:<br>FEASIBILITY OF LARGE SCALE GROWTH OF HIGH QUALITY AlGaAs/GaAs<br>SUPERLATTICES<br>TOPIC: 42                      OFFICE: AVPO | AF | \$ 49,165 |
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AN INVESTIGATION IS PROPOSED THAT WILL EXAMINE THE PROBLEMS ASSOCIATED WITH THE GROWTH OF HIGH QUALITY ALGAAS/GAAS SUPERLATTICES IN METALORGANIC EPITAXIAL REACTORS. THE TECHNICAL APPROACH WILL BE TO SELECT THE MOST PROMISING ADVANCES MADE IN THIS FIELD AND INTEGRATE THEM INTO A SINGLE ADVANCED DESIGN METALORGANIC REACTOR FOR LARGE SCALE PRODUCTION OF GAAS, ALGAAS AND THE ASSOCIATED MULTILAYER STRUCTURES. APPLICATIONS WILL BE DIRECTED TOWARD DEVELOPMENT OF GAAS METAL-SEMICONDUCTOR FIELD EFFECT TRANSISTORS (MESFETS), HETEROSTRUCTURE LASERS, MODULATION DOPED HIGH ELECTRON MOBILITY TRANSISTORS AND OTHER OPTOELECTRONIC DEVICES.

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| CRYSTAL SYSTEMS, INC.<br>SHETLAND INDUSTRIAL PARK, 35 CONGRESS ST<br>SALEM, MA 01970<br>FREDERICK SCHMID<br>TITLE:<br>A STUDY OF TI:AL2O3 AND CR:GSGG CRYSTAL GROWTH BY HEM FOR FLUORESCENT CONVERTER APPLICATIONS<br>TOPIC: 39                      OFFICE: AVPO | AF | \$ 49,881 |
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TI:AL2O3 AND CR:GSGG ARE NEW CRYSTALS USED FOR SOLID STATE LASERS. THEY ALSO OFFER POTENTIAL AS FLUORESCENT CONVERTER MATERIALS. TO DATE EVALUATION OF FLUORESCENT CONVERTER MATERIALS HAS INVOLVED MATERIALS WHICH WERE NOT WELL SUITED FOR THE TASK. THE PROPOSED APPROACH IS AN EFFORT TO SYSTEMATICALLY EVALUATE THESE MATERIALS BY CORRELATING THE CRYSTAL GROWTH PARAMETERS WITH THE PROPERTIES AFFECTING THE FLUORESCENCE CONVERSION. THE SIX-MONTH PROGRAM

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>---- | AWARDED<br>AMOUNT<br>----- |
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WILL ALLOW ESTABLISHING FEASIBILITY OF USE OF FLUORESCENCE CONVERTERS BY STUDYING THESE TWO QUITE DIFFERENT MATERIALS AND PRODUCING THEM IN LARGE SIZES SO THAT WIDELY DIFFERENT CAVITY CONFIGURATIONS CAN ALSO BE EVALUATED. IT IS INTENDED TO TAILOR MATERIAL PARAMETERS SUCH THAT THE SPECTRALLY USEFUL RADIATION FOR ND:YAG LASER ROD IS NOT ATTENUATED; HOWEVER, THE SPECTRALLY USELESS RADIATION IS DOWNCONVERTED INTO USEFUL RADIATION.

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| CRYSTAL SYSTEMS, INC.<br>35 CONGRESS STREET<br>SALEM, MA 01970<br>CHANDRA KHATTAK<br>TITLE:<br>CRYSTAL GROWTH OF CADMIUM TELLURIDE (CdTe) BY THE HEAT EXCHANGER METHOD (HEM)<br>TOPIC: 40            OFFICE: AVPO | AF | \$ 57,189 |
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CADMIUM TELLURIDE (CDTE) CRYSTALS ARE REQUIRED FOR A NUMBER OF APPLICATIONS. ONE OF THE MAIN REQUIREMENTS IS AS MODULATORS OF 10.6 UM CO2 LASER RADIATION, ESPECIALLY IN LASER RADAR. A NUMBER OF CRYSTAL GROWTH PROCESSES HAVE BEEN USED; HOWEVER, ONLY SMALL CRYSTALS WITH LOW YIELDS HAVE BEEN GROWN. IT IS INTENDED TO USE A NEW CRYSTAL GROWTH PROCESS, THE HEAT EXCHANGER METHOD (HEM), AND SHOW FEASIBILITY OF GROWTH FOR CDTE CRYSTALS. SOME OF THE ADVANTAGES OF HEM ARE SUBMERGED SOLID-LIQUID INTERFACE, INDEPENDENT CONTROL OF SOLID AND LIQUID GRADIENTS WITHOUT MOVEMENT, UNIFORM GRADIENTS AT THE CONVEX SOLID-LIQUID INTERFACE, FLEXIBILITY AND PRECISE CONTROL OF HEAT EXCHANGER TEMPERATURE AND IN-SITU ANNEALING OF THE CRYSTAL AFTER GROWTH. THE COMBINATION OF THESE FEATURES AND THE ABILITY TO SCALE UP IN SIZE ALLOW IMPORTANT ADVANTAGES TO HEM. DURING THE PROPOSED PHASE I IT IS INTENDED TO SHOW FEASIBILITY OF GROWTH OF CDTE CRYSTALS IN SEALED QUARTZ AMPULES. ALTERNATE CRUCIBLE MATERIALS AND ENCAPSULATED GROWTH CAN BE EASILY ADAPTED IN THE HEM SYSTEM.

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| CRYSTAL SYSTEMS, INC.<br>35 CONGRESS STREET<br>SALEM, MA 01970<br>MAYNARD B. SMITH<br>TITLE:<br>SLICING GALLIUM ARSENIDE (GaSS) WITH REDUCED SURFACE DAMAGE FOR MORE COST EFFECTIVE SOLAR CELLS<br>TOPIC: 199            OFFICE: AFSTC/XN | AF | \$ 74,701 |
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GaSS IS KEY STRATEGIC MATERIAL FOR SPACE ELECTRONICS. IT IS COSTLY

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>----- | AWARDED<br>AMOUNT<br>----- |
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BECAUSE OF HIGH RAW MATERIAL COSTS, HIGH CRYSTAL GROWTH COSTS, AND LOW MATERIAL UTILIZATION DUE TO INEFFICIENT SLICING. THE COST CAN BE REDUCED SIGNIFICANTLY BY INCREASING THE MATERIAL UTILIZATION USING A NEW WIRE SLICING TECHNIQUE--FIXED ABRASIVE SLICING TECHNIQUE (FAST). THE FEASIBILITY OF THE MULTI-WIRE FAST APPROACH HAS BEEN DEMONSTRATED FOR PHOTOVOLTAIC SILICON BY REDUCING KERF LOSS, SURFACE DAMAGE AND WAFER THICKNESS. SUBSTANTIAL ADDITIONAL SAVINGS CAN BE GENERATED, PARTICULAR FOR THE MORE COSTLY GaAs, BY IMPROVING SLICING ACCURACY. BY SLICING ACCURATELY WITH MINIMUM SURFACE DAMAGE, IT WOULD BE POSSIBLE TO ELIMINATE A COSTLY MATERIAL-INTENSIVE GRINDING OPERATION AND GO DIRECTLY TO POLISHING. THE PROPOSED PROGRAM FOR GaAs WILL ADDRESS THREE RELATED AREAS AFFECTING SLICE ACCURACY: WIRE GUIDE ROLLERS, BLADE COMPOSITION AND CRITICAL CONTACT LENGTH TESTING. IT IS EXPECTED THAT THE GUIDE ROLLER SYSTEM WILL BE OPTIMIZED BY USING ABRASION RESISTANT POLYURETHANE AS A ROLLER MATERIAL. EMPHASIS IN BLADE DEVELOPMENT WILL BE ON PLATING DIAMONDS BELOW 30UM IN SIZE ON 100UM DIAMETER WIRE TO ACHIEVE MINIMUM KERF, HIGH SLICING ACCURACY AND LONG LIFE. SLICING EXPERIMENTS WILL BE PERFORMED ON AN EXISTING BREADBOARD SLICER WITH 175-WIRE BLADEPACKS AT 48 WAFERS PER INCH. THE WAFERS WILL BE CHARACTERIZED FOR ACCURACY--I.E., BOW, TAPR, FLATNESS, WAFER-TO-WAFER THICKNESS AND DEPTH OF SURFACE DAMAGE.

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| DCS CORPORATION<br>1055 NORTH FAIRFAX STREET<br>ALEXANDRIA, VA 22314<br>RICHARD FLAHERTY<br>TITLE:<br>SURVEY OF VISION TEST<br>TOPIC: 103            OFFICE: SGRD-RMA | ARMY | \$ 49,867 |
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DESCRIPTIONS OF TESTS USED TO MEASURE VARIOUS ASPECTS OF VISION ARE SCATTERED THROUGHOUT THE LITERATURE OF FIELDS SUCH AS MEDICINE, PHYSIOLOGY, PSYCHOLOGY, HUMAN FACTORS ENGINEERING, OPTICS AND OTHERS. WITH STEADY ADVANCES IN THE COMPLEXITY OF MILITARY SYSTEMS (NOTABLY AIRCRAFT), THE NEED FOR A READILY ACCESSIBLE AND THOROUGH SOURCE OF MATERIAL ON VISION TESTS BECOMES IMPERATIVE. DCS PROPOSES TO CONDUCT A SURVEY OF ALL CURRENT VISION TESTS, BEGINNING WITH AN EXHAUSTIVE LITERATURE SEARCH ON THE SUBJECT. RESULTING DATA WILL BE ORGANIZED BASED ON ARMY FLIGHT REQUIREMENTS AND COMPILED INTO A

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>---- | AWARDED<br>AMOUNT<br>----- |
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COMPUTERIZED DATA BASE. WITH THIS ACCOMPLISHED, FLIGHT DOCTORS SCREENING PROSPECTIVE PILOTS AND DESIGN ENGINEERS DEVELOPING COCKPITS WILL HAVE AT THEIR FINGERTIPS THE MOST AUTHORITATIVE AND UP-TO-DATE INFORMATION ON THE TESTING OF HUMAN VISION AVAILABLE.

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| DCS CORPORATION<br>1055 N. FAIRFAX STREET<br>ALEXANDRIA, VA 22314<br>FRED W. REDDING, JR.<br>TITLE:<br>NAVAL AIRCRAFT REFUELING ALTERNATIVES<br>TOPIC: 118            OFFICE: NAVAIR | NAVY | \$ 48,907 |
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THE OBJECTIVE OF THE PROPOSED PHASE I EFFORT IS TO PRESENT TO THE NAVY DETAILED CONCEPTUAL DEVELOPMENT AND ANALYSES OF ALTERNATIVE IN-FLIGHT REFUELING CONCEPTS. THESE RESULTS WILL FACILITATE THE DETERMINATION BY THE NAVY OF WHICH CONCEPTS WARRANT FURTHER INVESTIGATION OR DEVELOPMENT QUESTIONS THAT WILL BE ANSWERED IN THE ANALYSES INCLUDE: (1) IS THE COMPLETE SYSTEM TECHNICALLY FEASIBLE? (2) IS THE SYSTEM OPERATIONALLY FEASIBLE? (3) IS THE SYSTEM FEASIBLE FROM A COST EFFECTIVENESS POINT OF VIEW? RECOMMENDATIONS WILL BE MADE ON WHETHER ONE OR MORE CONCEPTS SHOULD BE PURSUED. FOR THE CONCEPT SHOWING THE MOST PROMISE, AN OUTLINE WILL BE PROVIDED GIVING A CONCEPT DEMONSTRATION TEST PROTOCOL. THE STUDY AND ANALYSIS EFFORT WILL CONSIST OF FIVE TASKS. THESE TASKS ARE DATA RESEARCH, CONFIGURATION CONCEPTS ANALYSIS, OPERATIONAL APPLICATION ANALYSIS, CONCEPTS DEMONSTRATION PLANNING AND THE FINAL REPORT.

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| DECISION SCIENCE CONSORTIUM, INC.<br>7700 LEESBURG PIKE, SUITE 421<br>FALLS CHURCH, VA 22043<br>MARVIN S. COHEN<br>TITLE:<br>CONSENSUS THEORY AND EXPERT SYSTEMS<br>TOPIC: 67            OFFICE: ETL-PRO | ARMY | \$ 83,953 |
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A VARIETY OF ALTERNATIVE APPROACHES HAVE BEEN PROPOSED FOR INFERENCE IN EXPERT SYSTEMS: BAYESIAN PROBABILITIES, BELIEF

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>----- | AWARDED<br>AMOUNT<br>----- |
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FUNCTIONS, FUZZY SETS, AND OTHERS. THEY DIFFER IN THE CONCEPTS THEY SEEK TO ADDRESS IN THEIR NORMATIVE JUSTIFICATION, IN EASE OF USE, AND PSYCHOLOGICAL APTNESS FOR THE PURPOSES OF EXPERTS AND EXPERT SYSTEM USERS. COMBINING RESEARCH EFFORTS IN STATISTICAL INFERENCE THEORY, COMPUTER SCIENCE, AND COGNITIVE PSYCHOLOGY, DSC PROPOSES TO ADDRESS THE PROBLEM OF DESIGNING AND SELECTING INFERENCE FRAMEWORKS FOR EXPERT SYSTEMS. THE PRIMARY OBJECTIVE OF THE INITIAL RESEARCH (PHASE I) IS TO EXPLORE THE FEASIBILITY OF DEVELOPING NEW METHODS FOR INFERENCE IN EXPERT SYSTEMS, WHICH ADDRESS SPECIFIC SHORTCOMINGS IN EXISTING APPROACHES AND COMBINE SOME OF THEIR DISTINCT VIRTUES. THE SECOND OBJECTIVE OF PHASE I RESEARCH IS TO IMPROVE UNDERSTANDING OF THE CHARACTERISTICS OF EXPERTS, USERS, AND PROBLEM DOMAINS THAT MAKE CHOICE OF ONE INFERENCE SCHEME MORE APPROPRIATE THAN ANOTHER. FIVE SUBSTANTIVE TASKS HAVE BEEN PROPOSED: (1) A SYSTEMATIC EXAMINATION OF ALTERNATIVE THEORIES OF INFERENCE IN TERMS OF FACTORS RELEVANT TO EXPERT SYSTEM APPLICATIONS; (2) THEORETICAL DEVELOPMENT OF IMPROVED INFERENCE METHODS; (3) SELECTION OF AN ARMY OPERATIONAL TESTBED; (4) COMPUTER IMPLEMENTATION OF A SMALL-SCALE EXPERT SYSTEM FOR EXPERIMENTAL TESTING; AND (5) EXPERIMENTAL COMPARISON OF ALTERNATIVE INFERENCE SCHEMES.

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| DECISION SCIENCE CONSORTIUM, INC.<br>7700 LEESBURG PIKE, SUITE 421<br>FALLS CHURCH, VA 22043<br>JAMES O. CHINNIS, JR<br>TITLE:<br>EXPERIMENTAL DEVELOPMENT OF INFORMATION PORTRAYAL PRINCIPLES FOR<br>DECISION AIDS<br>TOPIC: 239 | AF           | \$ 74,968 |
|   | OFFICE: DORM |           |

AMONG THE MAJOR CAUSES OF RESISTANCE TO THE USE OF DECISION AIDS OF THE NEAR-UNIVERSAL MISMATCH BETWEEN A USER'S THOUGHT PROCESSING AND THE ANALYTIC MODEL AND CONSTRUCTS IMPOSED ON HIM BY THE COMPUTER. TO CORRECT THIS SITUATION, DESIGN PRINCIPLES MUST BE DEVELOPED BASED ON EXPERIMENTAL EVIDENCE--THAT CAUSE AND AID TO PRESENT INFORMATION TO A USER IN A MANNER COMPATIBLE WITH HIS THOUGHT PROCESS. WE PROPOSE TO DEVELOP AND TEST, WITHIN AN AIR FORCE CONTEXT, INFORMATION PORTRAYAL PRINCIPLES FOR DECISION AIDS. THREE AREAS OF WORK ARE PROPOSED: (1) THE DEVELOPMENT OF A FRAMEWORK FOR RELATING COGNITIVE AND PORTRAYAL FACTORS AND GENERATING CANDIDATE PORTRAYAL,

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>----- | AWARDED<br>AMOUNT<br>----- |
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PRINCIPLES, (2) THE DEVELOPMENT OF A PROTOTYPE COMPUTER-IMPLEMENTED AID CAPABLE OF SUPPORTING EXPERIMENTAL TESTING OF HYPOTHESIZED PRINCIPLES, AND (3) THE TESTING OF KEY PORTRAYAL HYPOTHESES.

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| DEFENSE SYSTEMS, INC<br>7903 WESTPARK DRIVE<br>MCLEAN, VA 22102<br>GERALD W. HOPPLE PH.D.<br>TITLE:<br>THE DESIGN AND DEVELOPMENT OF A PROTOTYPE CAUSAL SCHEMA KNOWLEDGE-BASED SYSTEM FOR TACTICAL PLANNING AND OPTION-GENERATION<br>TOPIC: 109      OFFICE: PERI-PO | ARMY | \$ 53,768 |
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DEFENSE SYSTEMS, INC. PROPOSES TO DESIGN, DEVELOP, AND TEST A PROTOTYPE CAUSAL SCHEMA EXPERT SYSTEM DECISION AID FOR TACTICAL PLANNING AND OPTION-GENERATION. THIS PROJECT WILL FOCUS ON WEAPON TARGET PLANNING OPTIONS, A PROBLEM DOMAIN WHERE A NUMBER OF SMART DECISION AIDS ARE AVAILABLE. NONE OF THE AIDS FOCUSES DIRECTLY ON THE EXPERT'S CAUSAL SCHEMA. THIS PROPOSAL ENVISIONS AN EXPERT SYSTEM COMPRISED OF A SUBSTANTIVE COMPONENT CONCERNED WITH CAUSAL FORCES AND CONSTRAINTS WHICH SHAPE AND LIMIT TARGET PLANNING AND A MASTER CAUSAL RULE SYSTEM DESIGNED AS AN INTELLIGENT AID TO ADVISE AND MAKE RECOMMENDATIONS TO THE USER BEFORE THE SCHEMA IS REVISED AND STORED. RESEARCH WILL EMPHASIZE THE DESIGN OF THE GENERIC SCHEMA AND CAUSAL RULE SYSTEM KNOWLEDGE BASE AND THE DETAILED DEVELOPMENT OF A SCENARIO-DRIVEN SCHEMA FOR TACTICAL PLANNING. THE PERFORMANCE OF THE AID WILL BE EVALUATED FOR A RESTRICTED SET OF WEAPON-TO-TARGET PLANNING PROBLEMS IN TERMS OF BOTH THE EFFICIENCY AND EFFECTIVENESS OF OPTION-GENERATION. PROSPECTS FOR EXTENDING THE APPROACH TO OTHER PROBLEM DOMAINS IN TACTICAL PLANNING WILL BE ASSESSED.

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| DEFENSE SYSTEMS, INC.<br>7903 WESTPARK DRIVE<br>MCLEAN, VA 22102<br>GERALD W. HOPPLE, PH.D.<br>TITLE:<br>DESIGN AND DEVELOPMENT OF A PROTOTYPE USER-FRIENDLY, EXPERT SYSTEM LOGISTIC PLANNING AND DECISION AID FOR THE BATTLEFIELD COMMANDER<br>TOPIC: 8      OFFICE: DARPA | DARPA | \$ 60,379 |
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COMMAND IN GROUND COMBAT INVOLVES MANY DIFFICULT DECISION-MAKING

FISCAL YEAR 1984

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TASKS. A HIGHLY PROMISING ROUTE FOR ASSISTANCE TO THE COMMANDER IS USE OF COMPUTERS. BY 1985-87 GREAT COMPUTATIONAL POWER WILL BE AVAILABLE IN LAP-SIZED MACHINES; HOWEVER, SUBSTANTIAL ADVANCES IN SOFTWARE ARE NECESSARY IF THIS PROMISE IS TO BE REALIZED. IN THIS PROPOSAL, DEFENSE SYSTEMS, INC. (DSI) DESCRIBES RESEARCH WHICH WILL LEAD TO DEVELOPMENT OF AN OPERATIONALLY USEFUL AID WHILE ADVANCING THE STATE OF THE ART IN AID DESIGN. THIS EFFORT WILL EXPLOIT THE POTENTIAL OF KNOWLEDGE-BASED ARTIFICIAL INTELLIGENCE (AI) SYSTEMS TO BUILD A FLEXIBLE, SELF-ADAPTIVE PLANNING DEVICE. BECAUSE AI RESEARCH IS MOST SUCCESSFUL IN TIGHTLY BOUND, FORMALLY WELL-UNDERSTOOD AREAS, DSI WILL FIRST DEVELOP A LOGISTICS PLANNING AID. TECHNIQUES ESTABLISHED IN THIS EFFORT CAN THEN BE APPLIED TO LESS WELL-STRUCTURED DOMAINS, SUCH AS OPERATIONS. THE AID WILL CONSIST OF A "SMART" FRONT END AND A LIBRARY OF LOGISTICS SUBROUTINES. THE TECHNICALLY INTERESTING PORTION OF THE WORK WILL INVOLVE THE DEVELOPMENT OF THE FRONT-END, WHICH WILL: (1) HELP A NAIVE USER SET UP LOGISTICS PROBLEMS; (2) AUTONOMOUSLY SELECT AND EMPLOY ALGORITHMS BEST SUITED TO SOLVE THEM; AND (3) LEARN ABOUT ITS ENVIRONMENT DURING USE. THE CHIEF METHOD BY WHICH THE AID WILL LEARN IS THROUGH USE OF AN ADAPTIVE LEARNING NETWORK APPROACH TO HELP THE USER DECIDE WHEN TO REFORECAST DEMAND FOR SUPPLIES.

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| DEFENSE SYSTEMS, INC.<br>7903 WESTPARK DRIVE<br>MCLEAN, VA 22102<br>DR. HENRY MULLANEY | NAVY | \$ 49,920 |
| TITLE:<br>LOW POWER HF SURFACE WAVE COMMUNICATIONS                                     |      |           |
| TOPIC: 16 OFFICE: NESC   |      |           |

DATA RECOVERY FROM OPERATIONAL ASW BUOYS NOW REQUIRES THE PRESENCE OF A P-3 OR S-3 AIRCRAFT. SATELLITE RELAY CAPABILITY EXISTS, BUT THE AVERAGE BIT RATE IS TOO LOW, AND IT IS NOT REAL TIME. WE PROPOSE THE DEVELOPMENT OF A REAL TIME ONE WATT KILOBIT PER SECOND HF SURFACE WAVE SYSTEM FOR BUOYS WITH A UNIQUE MODULATION FORMAT THAT WILL GIVE EFFECTIVE COMMUNICATION RANGES OF OVER 500 NAUTICAL MILES. THROUGH PROPER BUOY FIELD MANAGEMENT AND FREQUENCY CONTROL, A LARGE FIELD OF BUOYS CAN BE SERVICED BY A SINGLE SHIP OR SHORE BASED RECEIVER/CONTROLLER. THE BUOY COMMAND LINK IS A COVERT LINK WITH A UNIQUE NARROWBAND FREQUENCY HOPPED M-ARY FSK MODULATION THAT EMPLOYS

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>---- | AWARDED<br>AMOUNT<br>----- |
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HARDWARE ALREADY DEVELOPED BY DSI FOR AN IN BUOY ASW SIGNAL PROCESSOR. THROUGH QUIET CHANNEL SELECTION AND POWER CONTROL, REQUIRED TRANSMIT POWER CAN BE REDUCED BY TWO ORDERS OF MAGNITUDE. IN PHASE I, WE WILL DESIGN THIS NOVEL BUOY-SPECIFIC COMMUNICATION SYSTEM, CONSTRUCT A BREADBOARD VERSION OF THE BUOY TRANSCEIVER/MODEM AND CONDUCT LABORATORY TESTING. IN PHASE II, WE WILL REPACKAGE THE DESIGN INTO AN A-SIZE BUOY AND FIELD TEST IT AT SEA.

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| DEFENSE SYSTEMS, INC.<br>7903 WESTPARK DRIVE<br>MCLEAN, VA 22102<br>DR. GEORGE SEBESTYEN<br>TITLE:<br>ADVANCED ASW WEAPONS TECHNOLOGY EVALUATION STRATEGY<br>TOPIC: 102            OFFICE: NOSC | NAVY | \$ 51,075 |
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TO OVERCOME SHORTCOMINGS OF ASW WEAPONRY, NOSC PLANS A TECH BASE PROGRAM IN SUPPORT OF HIGH POTENTIAL ADVANCED ASW WEAPONS CONCEPTS. NUMEROUS CANDIDATES ARE AVAILABLE IN EACH OF THE SIGNIFICANT AREAS OF PROPULSION, WARHEADS, GUIDANCE, QUIETING AND NON-TORPEDO CONCEPTS. THERE IS A NEED FOR A TECHNOLOGY EVALUATION STRATEGY. THE OBJECTIVE OF PHASE I IS TO DEVELOP A STRATEGY THAT ENABLES THE INDIVIDUAL TECHNOLOGIST, TECHNOLOGY ADMINISTRATOR AND NAVAL OFFICER PROGRAM OR BUDGET MANAGER ALIKE TO COME TO SIMILAR CONCLUSIONS REGARDING THE MERITS OF ASW WEAPON TECHNOLOGY OPTIONS. THE STRATEGY WILL BE EASY TO EXPLAIN TO PERMIT THE DEFENDER OF THE TECHNOLOGY PROGRAM TO CONVINCE HIGHER OFFICIALS. THE STRATEGY CONTAINS TECHNICAL, PROGRAMMATIC AND MILITARY WORTH SUBSECTIONS IN EACH OF WHICH FACT FINDING, EVALUATION AND REPORTING MODULES ARE USED TO EXTRACT THE RELEVANT FEATURES OF THE PROPOSED TECHNOLOGY AND TO MAKE CLEAR THE IMPACT IT WOULD HAVE ON OTHER SUBSYSTEMS, THE WEAPON, THE WEAPONS PLATFORM AND ON OTHER PROGRAMS. IN PHASE I THE EVALUATION STRATEGY FLOW CHART AND AN INTERACTIVE DECISION AID COMPUTER PROGRAM WOULD BE DELIVERED AND APPLIED TO SELECTED CURRENT ASW WEAPON TECHNOLOGY CANDIDATES. IN PHASE II AND LATER, THE METHODOLOGY COULD BE EXPANDED, APPLIED TO ALL CURRENT CANDIDATES, AND BROADENED TO APPLY TO OTHER TECHNOLOGY EVALUATION PROBLEMS AT NOSC AND ELSEWHERE.

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| DIGITAL VIDEO PROCESSING, INC.<br>3000 SPOUT RUN PKWY, SUITE A-106<br>ARLINGTON, VA 22201<br>MATTHEW W. PRICE<br>TITLE:<br>ENCODING OF COLOR GRAPHICS IMAGE<br>TOPIC: 36            OFFICE: NAVSUPSYS | NAVY | \$ 47,848 |
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A DIGITAL ENCODING SCHEME FOR THE ARCHIVAL, STORAGE, AND SUBSEQUENT

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>----- | AWARDED<br>AMOUNT<br>----- |
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TRANSMISSION OF COLOR GRAPHIC IMAGES WILL BE DEVELOPED. THIS SCHEME WILL ACCOMMODATE RAPID RESPONSE TIMES AND ALLOW FOR FUTURE IMPROVEMENTS AND MODIFICATIONS IN A WELL-DEFINED AND ECONOMIC MANNER. THE TECHNIQUE PROPOSED TO ACCOMPLISH THIS TASK IS BASED ON A PICTURE MATRIX TRANSFORMATION, WHICH IS BASED ON THE S-TRANSFORM CODING SCHEME (A DERIVATION OF THE HADAMARD TRANSFORM). THIS TRANSFORM WILL CONVERT AN INPUT PICTURE (2 DIMENSIONAL PIXEL MATRIX) TO A PRIMARY MATRIX AND VARIABLE NUMBER OF SECONDARY MATRICES. THE PRIMARY MATRIX IS DERIVED BY SUCCESSIVE TRANSFORMATIONS OF THE INPUT PICTURE, EACH OF WHICH REDUCES THE PICTURE RESOLUTION BY ONE HALF. THE INPUT MATRIX IS PARTITIONED INTO SUB-MATRICES WITH DIMENSIONS OF TWO PIXELS SQUARE. NEXT A SUMMING IS PERFORMED--THEN REPEATED UNTIL THE DESIRED RESOLUTION IS ACHIEVED. DEPENDING ON THE APPLICATION, THE DEFINITION OF THE PRIMARY MATRIX CAN BE ALTERED TO GIVE A DIFFERENT ASPECT RATIO, THUS MAKING THE CODE VIRTUALLY DEVICE INDEPENDENT.

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| DL LABORATORIES<br>116 EAST 16TH STREET<br>NEW YORK, NY 1000<br>SAUL SPINDEL<br>TITLE:<br>PAINT AND COATINGS INDUSTRY SURVEY FOR BARRIER TECHNOLOGY<br>TOPIC: 201            OFFICE: AFRPL/TSTR | AF | \$ 56,660 |
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A LITERATURE SEARCH AND AN INDUSTRY SURVEY WILL BE CARRIED OUT IN ORDER TO OBTAIN POTENTIAL MATERIALS, FORMULATIONS AND COMMERCIAL PRODUCTS TO PREVENT THE MIGRATION OF ORGANIC LIQUIDS AND MOISTURE. THE INFORMATION RECEIVED WILL BE COLLECTED, ANALYZED AND SUMMARIZED TO PROVIDE THE AIR FORCE WITH A DETAILED, COMPREHENSIVE ASSESSMENT OF THE POTENTIAL OF THE MATERIALS AVAILABLE TO ACCOMPLISH THE MISSION. SAMPLES OF CANDIDATE PRODUCTS WILL BE COLLECTED AND MADE AVAILABLE TO THE AIR FORCE.

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| DME CORPORATION<br>1631 SOUTH DIXIE HWY, BLDG E<br>POMPANO BEACH, FL 33060<br>GARY C. LEEGATE<br>TITLE:<br>INVESTIGATION INTO THE TECHNICAL FEASIBILITY OF A MINIATURIZED POCKET PORTABLE DEFIBRILLATOR FOR MILITARY USE<br>TOPIC: 95            OFFICE: SGRD-RMA | ARMY | \$ 49,795 |
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DME CORPORATION PROPOSES PHASE I OF A RESEARCH AND DEVELOPMENT

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>---- | AWARDED<br>AMOUNT<br>----- |
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PROJECT TO ESTABLISH THE TECHNICAL FEASIBILITY OF A MINIATURIZED POCKET DEFIBRILLATOR FOR USE IN THE MILITARY EMERGENCY MEDICAL ENVIRONMENT. EFFORTS TOWARD ADVANCING STATE-OF-THE ART IN PORTABLE DEFIBRILLATORS IN FAVOR OF MINIATURIZATION IS TO BE CONCENTRATED IN FOUR AREAS: (1) USER REQUIREMENTS DEFINITION TO FULLY DEFINE AND INTERFACE PARAMETERS FOR SUCH EQUIPMENT, (2) SEARCH OF THE MEDICAL LITERATURE, ON-SITE RESEARCH, AND FOLLOW-ON CONTACT WITH MEDICAL RESEARCHERS TOWARD ESTABLISHING A BASIS OF FEASIBILITY FOR THE MODIFICATION AND/OR REDUCTION OF POWER REQUIREMENTS TO ACCOMPLISH DEFIBRILLATION, (3) INVESTIGATION INTO ADVANCES IN COMPONENT DESIGN WHICH COULD RESULT IN SIGNIFICANT SIZE REDUCTIONS, AND (4) INNOVATIVE PACKAGE DESIGN TO MINIMIZE UNIT BULK AND MAXIMIZE UTILITY AND PORTABILITY. SPECIFIC AREAS OF RESEARCH WILL INCLUDE: (1) VIABLE ALTERNATE OUTPUT PULSE WAVE FORMS, (2) REDUCED DELIVERED POWER REQUIREMENTS, (3) CAPACITOR MINIATURIZATION THROUGH THE USE OF FLOUROPLASTIC FILMS, (4) HIGH CAPACITY, HIGH DRAIN RECHARGEABLE AND PRIMARY BATTERY OPTIONS, AND (5) EFFICIENT TRANSFORMER AND INDUCTOR DESIGNS USING NICKLE-IRON INSULATED RIBBON CORES.

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| DOMINION ENGINEERING, INC.<br>6862 ELM STREET<br>MCLEAN, VA 22101<br>DR. ARTHUR P. L. TURNER<br>TITLE:<br>DETERMINATION OF BOLT AXIAL LOAD BY MAGNETOELASTIC STRESS MEASUREMENT<br>TOPIC: 41 | ARMY | \$ 49,538 |
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OFFICE: DRSTA-RGI

AT PRESENT IT IS DIFFICULT TO DETERMINE THE AXIAL LOAD IN A BOLTED CONNECTION. TORQUE MEASUREMENTS ARE UNRELIABLE DUE TO VARIABLE FRICTION COEFFICIENTS AND OTHER MORE ACCURATE METHODS SUCH AS HYDRAULIC TENSIONERS, ULTRASONIC MEASUREMENTS, STRAIN GAUGES, AND X-RAY DIFFRACTION ARE OFTEN IMPRACTICAL IN THE FIELD. THE PURPOSE OF THIS PROPOSAL IS TO DEMONSTRATE THAT BOLT AXIAL STRESSES, AND THEREFORE LOADS, CAN BE DETERMINED RELIABLY IN THE FIELD USING THE MAGNETOELASTIC PROPERTIES OF FERROMAGNETIC MATERIAL. WHEN A FERROMAGNETIC MATERIAL, SUCH AS A STEEL BOLT, IS SUBJECTED TO A MAGNETIZING FIELD A SERIES OF ABRUPT CHANGES IN MATERIAL MAGNETIZATION OCCURS. THIS PHENOMENON IS KNOWN AS "BARKHAUSEN NOISE." PREVIOUS TESTS HAVE CONFIRMED THAT THE BARKHAUSEN NOISE LEVEL IS PROPORTIONAL

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>---- | AWARDED<br>AMOUNT<br>----- |
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TO THE STRESS LEVEL IN THE MATERIAL WHICH IS BEING SUBJECTED TO THE MAGNETIZING FIELD. SMALL, PORTABLE EQUIPMENT IS COMMERCIALY AVAILABLE WHICH USES THE BARKHAUSEN PRINCIPLE TO DETERMINE THE RESIDUAL STRESSES IN WELD SEAMS, FORGINGS, CASTINGS, SHAFTS AND CAMS, ETC. THIS PROPOSAL IS TO MODIFY THIS COMMERCIALY AVAILABLE EQUIPMENT TO MEET THE NEED TO BOLT STRESS MEASUREMENT AND THEN TO DEMONSTRATE THAT BOLT AXIAL STRESSES AND HENCE BOLT AXIAL LOADS, CAN BE CORRELATED TO THE BARKHAUSEN NOISE LEVEL MEASURED ON THE BOLT HEAD OR IN A SMALL DIAMETER HOLE IN THE BOLT SHANK.

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| DOTY ASSOCIATES, INC.<br>406 OAKMEARS CRESCENT<br>VIRGINIA BEACH, VA 23462<br>HAROLD H. CASEY<br>TITLE:<br>AIRCRAFT ACCIDENT DATA ANALYSIS SOFTWARE<br>TOPIC: 16            OFFICE: ASD/ENO | AF | \$ 34,880 |
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AN AUTOMATIC DECISION AID, USEABLE ON A MINI/MICRO-COMPUTER WILL BE DEVELOPED TO ANALYZE CAUSES OF ACCIDENTS/MALFUNCTIONS IN U. S. AIR FORCE AIRCRAFT. THE PROTOTYPE MODEL WILL PROVIDE THE NUMBER OF OCCURRENCES OF EACH PROBLEM FOR BOTH INDIVIDUAL AIRCRAFT TYPES AND FOR THE AIR FORCE AS A WHOLE. DATA WILL BE EXTRACTED AS A FUNCTION OF DESIRED INPUT AIRCRAFT PARAMETERS, SUCH AS LOADING, MISSION, ETC. THE MAJOR OBJECTIVES OF PHASE I ARE TO DEMONSTRATE THE TECHNICAL FEASIBILITY OF DEVELOPING THE SOFTWARE, AND TO DEMONSTRATE ITS ACCEPTABILITY WITHIN THE POTENTIAL USER COMMUNITY.

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| DR. HERBERT E. HALLIDAY/CC&CS<br>301 SOUTH HANOVER STREET<br>CARLISLE, PA 17013<br>DR. HERBERT E. HALLIDAY<br>TITLE:<br>A FEASIBILITY STUDY OF THE PROPOSED METHODOLOGY IN ASSESSING THE POTENTIAL USE OF EXTENDED-WEAR CONTACT LENSES IN A COMBAT AVIATION<br>TOPIC: 102            OFFICE: MERADCOM | ARMY | \$ 0 |
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THIS PHASE I STUDY WILL DETERMINE THE FEASIBILITY OF THE PROPOSED

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>---- | AWARDED<br>AMOUNT<br>----- |
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METHODOLOGY IN ASSESSING THE POTENTIAL USE OF EW CONTACT LENSES IN AN ARMY AVIATION COMBAT ENVIRONMENT. IT WILL ACCOMPLISH THIS BY: (A) EVALUATING FDA MANUFACTURERS' DATA ON CHEMICAL AND PHYSICAL PROPERTIES OF APPROVED EW CONTACT LENSES; (B) PRETESTING, SELECTING, AND FITTING EW CONTACT LENSES TO TEST SUBJECTS WHO ARE CURRENTLY ENGAGED IN OPERATIONAL FLYING ON A FULL TIME BASIS; (C) MONITORING AND RECORDING THE PROGRESS OF THE TEST SUBJECTS ON A PERIODIC BASIS UTILIZING BOTH OBJECTIVE AND SUBJECTIVE MEASUREMENTS; (D) CORRELATING, ANALYZING, AND EVALUATING ALL STUDY DATA; (E) DEVELOPING PARAMETERS FOR COMPARATIVE EVALUATIONS OF EW LENSES BASED UPON TEST STUDY; AND (F) SUBMITTING FINDINGS AND RECOMMENDATIONS TO APPROPRIATE DOD COMPONENTS.

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| DUFFY ENGINEERING CO.<br>R.F.D. #1 BOX 387A, NASHAWENA ROAD<br>MASHPEE, MA 02649<br>WILLIAM F. DUFFY<br>TITLE:<br>RAPID AND ACCURATE PERSONNEL IDENTIFICATION<br>TOPIC: 248      OFFICE: BMO/PMX | AF | \$ 43,700 |
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THIS PROPOSAL IS SUBMITTED, NOT AS A COMPLETE PHYSICAL SECURITY CONCEPT, BUT AS AN INNOVATIVE APPROACH FOR RAPID AND ACCURATE PERSONNEL IDENTIFICATION. IT HAS LONG BEEN ACCEPTED THAT VOICEPRINTS, A DERIVATION OF THE WAVEFORM OF A PERSON'S VOICE, ARE NEARLY AS ACCURATE AS FINGERPRINTS. OUR RESEARCH INDICATED THAT A STATISTICAL ANALYSIS OF ZERO-CROSSINGS COULD LIKEWISE BE NEARLY AS ACCURATE AS FINGERPRINTS. THIS APPROACH WOULD ALLOW THE INFORMATION TO BE PROCESSED ON A MICROCOMPUTER. IN ADDITION, IF A SPEECH OUTPUT DEVICE WERE USED IN CONJUNCTION WITH THE SPEECH INPUT DEVICE THE SYSTEM COULD BECOME INTERACTIVE. THE USER WOULD CONTINUE TALKING UNTIL THE SYSTEM DETERMINES IF THIS IS OR IS NOT THE CORRECT PERSON.

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| DWA COMPOSITE SPECIALTIES, INC.<br>21119 SUPERIOR STREET<br>CHATSWORTH, CA 91311<br>EDWARD C. SUPAN<br>TITLE:<br>HIGH-TEMPERATURE METAL-MATRIX STRUCTURE<br>TOPIC: 52      OFFICE: AFWAL/XRPF | AF | \$ 49,779 |
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THIS PHASE I PROGRAM PROPOSES FIRST TO DEMONSTRATE THE FEASIBILITY

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>----- | AWARDED<br>AMOUNT<br>----- |
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OF PRODUCING A CERAMIC PARTICULATE-REINFORCED SUPERALLOY MMC, AND SECONDLY TO SHOW THAT THE NEW MATERIAL CAN FUNCTION USEFULLY FOR STRUCTURE OPERATING UP TO 2000 DEGREE (F). THE PROGRAM WILL FOCUS ON USE OF INCO 718 AS A MATRIX METAL WITH REINFORCEMENT OF TIC AND/OR Al2O3. HOT PRESS SINTERING WILL BE USED AS THE CONSOLIDATION TECHNIQUE WITH A GOOD PORTION OF THE PROGRAM DEVOTED TO DEVELOPING FUNCTIONAL TOOLING FOR USE AT THE VERY HIGH CONSOLIDATING TEMPERATURE. ROOM-TEMPERATURE TENSILE PROPERTIES, DENSITY, TIME-TEMPERATURE TESTING, AND ULTIMATE TENSILE TESTING AT 2000 DEGREE (F) WILL BE RELIED ON TO SHOW MERIT OF THE NEW SUPERALLOY MMC. A FINAL REPORT BE PREPARED, INCLUDING RECOMMENDED TASKS FOR THE PHASE II PROGRAM.

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| DYNAMET TECHNOLOGY INC.<br>EIGHT A STREET<br>BURLINGTON, MA 01803<br>STANLEY ABKOWITZ | NAVY | \$ 47,847 |
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TITLE:  
FABRICATION AND EVALUATION OF TITANIUM MATRIX CERMET COMPOSITES FOR HIGH MODULUS AND HIGH TEMPERATURE APPLICATIONS  
TOPIC: 69 OFFICE: NS/IC

PRELIMINARY DEVELOPMENT AT DYNAMET HAS INDICATED THE FABRICATING POTENTIAL FOR PRODUCING TITANIUM MATRIX COMPOSITES BY ADVANCED POWDER METAL TECHNOLOGY. PROTOTYPE COMPOSITE BARS OF TWO CERMET COMPOSITIONS WILL BE FABRICATED BY COLD ISOSTATIC PRESSING, VACUUM SINTERING AND HOT ISOSTATIC PRESSING. IN ADDITION, EXTRUDED BARS OF THE TWO CERMET COMPOSITIONS WILL BE FABRICATED. THE TEST BARS WILL BE INITIALLY EVALUATED FOR DENSITY, MICROSTRUCTURE AND MECHANICAL PROPERTIES.

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| DYNAMIC ANALYSIS & TESTING ASSOCIATES<br>677 SECOND STREET<br>ENCINITAS, CA 92024<br>JOHN JAKOVICH | AF | \$ 75,000 |
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TITLE:  
PROPOSAL TO CONVERT FASTGEN MODELS TO NASTRAN MODELS  
TOPIC: 18 OFFICE: ASD/ENO

THIS PROPOSAL IS TO WRITE A PROGRAM TO TRANSLATE FASTGEN II INPUT

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>---- | AWARDED<br>AMOUNT<br>----- |
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DATA DECKS TO EQUIVALENT NASTRAN BULK DATA DECKS. THE RESULTING FINITE ELEMENT MESH CAN BE INCORPORATED INTO A NASTRAN DATA INPUT DATA DECK TO BE USED FOR NUCLEAR ANALYSIS AND STRESS ANALYSIS. THIS EFFORT WILL INCLUDE THE DEVELOPMENT OF A COMPLETE STATIC 3-52 NASTRAN MODEL AND A COMPLETE STATIC F-16 NASTRAN MODEL.

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| DYNAMICS TECHNOLOGY, INC.<br>22939 HAWTHORNE BLVD, SUITE 200<br>TORRANCE, CA 90505<br>C. MICHAEL DUBE | ARMY | \$ 50,241 |
| TITLES:<br>FIBER OPTIC BLAST PRESSURE SENSOR  |      |           |
| TOPIC: 70 OFFICE: WESVB   |      |           |

A NOVEL FIBER OPTIC SENSOR IS PROPOSED FOR THE MEASUREMENT OF BLAST WAVE PRESSURE HISTORY IN AN EXPLOSIVE ENVIRONMENT. THE CAPABILITY TO CONSISTENTLY MEASURE BLAST-RELATED SURFACE PRESSURES ON THE ORDER OF 20-100 KBAR WITH 400KHZ RESPONSE UNDER HIGH G LOADING DOES NOT EXIST IN PRESENT SENSORS. FIBER OPTIC SENSOR TECHNOLOGY WHICH HAS EVOLVED IN THE LAST 5 YEARS, OFFERS AN APPROACH BASED ON MICROBEND-INDUCED MODAL COUPLING TO SENSITIVELY MEASURE HIGH FREQUENCY STRAINS. AN OPTICAL FIBER IMBEDDED IN A COMPACT HARDENED CASING CAN BE CONFIGURED TO PERFORM DIRECT MEASUREMENTS OF BLAST WAVE PRESSURE HISTORY. FIBER OPTIC SENSORS ARE ALSO HIGHLY RESISTANT TO EMI/RFI AND RADIATION. THE SENSOR TO BE DEVELOPED IS ANTICIPATED TO BE LOW-COST AND SURVIVABLE. IN PHASE I, DYNAMICS TECHNOLOGY WILL DEVELOP ONE OR MORE CONCEPTUAL SENSOR DESIGNS THROUGH ANALYSIS AND LABORATORY TESTING. UPON VALIDATION OF THE SENSOR CONCEPT, A PRELIMINARY PROTOTYPE DESIGN WILL ALSO BE PREPARED. PROTOTYPE LABORATORY TESTING. UPON VALIDATION OF THE SENSOR CONCEPT, A PRELIMINARY PROTOTYPE DESIGN WILL ALSO BE PREPARED. PROTOTYPE LABORATORY AND FIELD TESTING WILL BE PERFORMED IN PHASE II.

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| DYNAMICS TECHNOLOGY, INC.<br>22939 HAWTHORNE BLVD, SUITE 200<br>TORRANCE, CA 90505<br>DONALD JACOBSON | ARMY | \$ 49,689 |
| TITLE:<br>PASSIVE RANGING ALGORITHMS  |      |           |
| TOPIC: 28 OFFICE: DRSMI-ICDA  |      |           |

THIS PROPOSAL ADDRESSES THE DEVELOPMENT OF REAL TIME ALGORITHMS

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>----- | AWARDED<br>AMOUNT<br>----- |
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FOR PASSIVE RANGING, THAT IS, RANGE ESTIMATION BASED ON TV OR IR IMAGES OBTAINED FROM MOVING SENSOR PLATFORMS AS ON SELF-GUIDED AND TARGETED MISSILES. SUCH PASSIVE RANGING ALGORITHMS SERVE AS A BASIS FOR PASSIVE GUIDANCE DURING TARGET ACQUISITION AND INITIAL TARGETING. DURING PHASE I, A BASELINE ALGORITHM WILL BE SELECTED AND ANALYZED BASED ON CORRELATED RECTIFICATION OF TIME-DEPENDENT IMAGES. THE ANALYSIS WILL INCLUDE A SIMULATION OF PERFORMANCE ACCURACY INCORPORATING THE MOST IMPORTANT SOURCES OF DEGRADATION. THE OVERALL RESULT WILL BE PROOF OF THE CORRELATED RECTIFICATION APPROACH, AND AN INITIAL ASSESSMENT OF POTENTIAL REAL TIME CAPABILITY.

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| ECO<br>225 NEEDHAM STREET<br>NEWTON, MA 02164<br>DR. FRASER WALSH<br>TITLE:<br>A SAFE, HIGH-POWER-DENSITY LITHIUM BATTERY<br>TOPIC:       3       OFFICE: DARPA | DARPA | \$ 49,493 |
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THE PROPOSED PROGRAM RELATES TO THE EVALUATION OF A NEW CATHODE CATALYST IN DISK-TYPE Li/SOCl<sub>2</sub> CELLS. THIS NEW CATALYST HAS BEEN SHOWN TO CHANGE THE CATHODE REACTION MECHANISM AND TO INCREASE BOTH CATHODE RATE (FACTOR OF TEN) AND CAPACITY (FACTOR OF AT LEAST TWO) IN BOBBIN-TYPE Li/SOCl<sub>2</sub> CELLS. THE NEW MECHANISM RESULTS IN A DECREASE IN CATHODE OVERPOTENTIAL (LESS LiCl) AND A SAFER Li/SOCl<sub>2</sub> CELL. SUCCESSFUL COMPLETION OF THE PROPOSED PROGRAM WILL RESULT IN PROVIDING THE MILITARY WITH A SAFE, HIGH ENERGY/POWER DENSITY BATTERY SYSTEM CAPABLE OF MEETING THE DARPA PERFORMANCE REQUIREMENTS (400 W/kg), INCLUDING LOW TEMPERATURE OPERATION, OF A MULTIPURPOSE HIGH-RATE POWER SOURCE. THE MAJOR OBJECTIVE OF THE PROGRAM IS TO DEMONSTRATE THAT MULTI-ELECTRODE CATALYZED-CATHODE Li/SOCl<sub>2</sub> CELLS HAVE IMPROVED PERFORMANCE; CELL COMPONENT OPTIMIZATION WILL ALSO BE CARRIED OUT. THE PROGRAM APPROACH IS TO MAKE CATALYZED-CATHODE MULTIELECTRODE Li/SOCl<sub>2</sub> CELLS, AND TO TEST THEIR PERFORMANCE AT HIGH AND MODERATE RATE AT ROOM TEMPERATURE AS A FUNCTION OF ELECTRODE GAP, ELECTROLYTE SALT CONCENTRATION, AND CATHODE THICKNESS.

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| ECO<br>225 NEEDHAM STREET<br>NEWTON, MA 02164<br>DR. FRASER WALSH<br>TITLE:<br>AN IMPROVED LITHIUM-INTERCALATION CATHODE MATERIAL<br>TOPIC:       3       OFFICE: ONR | NAVY | \$ 49,029 |
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THE PROPOSED PROGRAM RELATES TO THE EVALUATION OF THE POTENTIAL OF

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>---- | AWARDED<br>AMOUNT<br>----- |
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A NEW CLASS OF CATHODE MATERIALS FOR IMPROVED PERFORMANCE/ENERGY-DENSITY LITHIUM SECONDARY BATTERIES. AN IMPROVED SECONDARY BATTERY WILL PROVIDE THE NAVY WITH A SAFE AND RELIABLE POWER SOURCE FOR PORTABLE COMMUNICATION SYSTEMS, REMOTE SENSORS, AND OTHER ELECTRONIC EQUIPMENT. THE MAJOR OBJECTIVE OF THE PROGRAM IS TO DETERMINE THE LITHIATION CAPACITY AND REVERSIBILITY OF FOUR FUNCTIONALIZED TETRAAZAANNULENES (TAAS). A SECOND OBJECTIVE IS TO BETTER CHARACTERIZE THE INTERCALATION REACTIONS OF LITHIUM WITH ORGANOMETALLIC COMPOUNDS. THE MAJOR ADVANTAGE OF USING SUCH ORGANOMETALLIC MATERIALS IS THEIR ABILITY TO INTERCALATE UP TO 17 EQUIVALENTS OF LITHIUM. THE PROGRAM APPROACH IS TO PREPARE FOUR FUNCTIONALIZED TAAS, DETERMINE THEIR CAPACITY FOR REVERSIBLE LITHIATION, AND TO CHARACTERIZE THE LITHIATED AND UNLITHIATED COMPOUNDS BY IR, NMR AND X-RAY SPECTROSCOPY. THE USE OF TAAS IN SECONDARY LITHIUM BATTERIES IS A NEW APPROACH TO DEVELOPING HIGHER-ENERGY-DENSITY PORTABLE POWER SOURCES.

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| ELECTROMAGNETIC LAUNCH RESEARCH, INC.<br>625 PUTNAM AVE.<br>CAMBRIDGE, MA 02139<br>HENRY H. KOLM, PH.D.<br>TITLE:<br>CONTACT-LESS PORTABLE DEFIBRILLATOR<br>TOPIC: 95                      OFFICE: SGRD-RMA | ARMY | \$ 34,988 |
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CONTACT-LESS, PORTABLE DEFIBRILLATOR COMPRISING AN ENERGY STORAGE CAPACITOR, A PULSED FIELD COIL, AND PULSE CONTROL CIRCUITRY, TO STIMULATE CARDIAC MUSCLE BY INDUCED VOLTAGE PULSE, INSTEAD OF APPLICATION OF ELECTRODES TO SKIN. INDUCTION COIL WORKS THROUGH CLOTHING, CAN BE APPLIED BY INEXPERIENCED PERSONNEL, AND REDUCES TIME DELAY, PAIN, RISK OF BURNS, TISSUE DAMAGE, OR CARDIAC ARREST. IT MAY ALSO REDUCE THE ENERGY REQUIRED BY ELIMINATING SKIN CONDUCTION LOSSES. PHASE I INCLUDES THE CONSTRUCTION OF AN EXPERIMENTAL PROTOTYPE WITH VARIABLE ENERGY LEVEL, PULSE DURATION, AND PULSE WAVEFORM, FOR THE CONDUCTION OF TESTS TO DETERMINE THE OPTIMUM SPECIFICATIONS FOR A PORTABLE DEVICE. PHASE II INVOLVES THE CONSTRUCTION OF SEVERAL PORTABLE DEVICES FOR CLINICAL AND FIELD TESTING, AND REFINEMENT OF THE DESIGN ON THE BASIS OF RESULTS. PHASE III DEVELOPS A PRODUCTION MODEL.

FISCAL YEAR 1984

| SUBMITTED BY<br>-----  | DEPT<br>---- | AWARDED<br>AMOUNT<br>----- |
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| ELECTROMAGNETIC SCIENCES, INC.<br>125 TECHNOLOGY PARK/ATLANTA<br>NORCROSS, GA 30092<br>GORDON R. HARRISON<br>TITLE:<br>STUDY OF HIGHLY ANISOTROPIC HEXAGONAL FERRITE COMPOUNDS AS BROADBAND<br>MICROWAVE ABSORBERS<br>TOPIC: 24 OFFICE: DRDME-PM | ARMY         | \$ 55,044                  |

FERRIMAGNETIC OXIDES WITH HEXAGONAL CRYSTAL STRUCTURE ARE CHARACTERIZED PRIMARILY BY THEIR FOLIATE (LEAF-LIKE OR PLATELET) STRUCTURE AND HIGH ANISOTROPY FIELDS. THESE HIGHLY ANISOTROPIC COMPOUNDS CAN BE PREPARED AS A COMPOSITE COMPOSED OF SINGLE DOMAIN GRAINS POSSESSING A SPECTRUM OF CONTROLLED VALUES OF ANISOTROPY FIELDS AND ATTENDANT PREFERRED DIRECTION OF MAGNETIZATION. THESE HEXAGONAL SINGLE DOMAIN GRAINS WITH PREDICTABLE AND CONTROLLED PROPERTIES INCLUDING THE "BUILT IN" EFFECTIVE MAGNETIC FIELD (UP TO 50 KILO-OERSTEDS) IN BOTH UNIAXIAL AND PLANAR STRUCTURES, WILL THUS PROVIDE A COMPOSITE STRUCTURE IN WHICH THE COMPLEX PERMEABILITY AND DIELECTRIC PROPERTIES OF THE COMPOSITE CAN BE OPTIMIZED FOR BROADBAND MICROWAVE ABSORPTIVE CHARACTERISTICS THROUGH RESONANCE INTERACTIONS. ABSORPTIVE CHARACTERISTICS WILL BE CONTROLLED THROUGH FERROMAGNETIC RESONANCE (DOMAIN ROTATION) INTERACTIONS WITH THE RANDOMLY ORIENTED MAGNETIC MOMENTS, BIASED GRAIN BY "BUILT-IN" INTERNAL ANISOTROPY FIELDS AND THROUGH CONDUCTIVE PROCESSES ASSOCIATED WITH OPTIMIZATION AND CONTROL OF THE COMPLEX DIELECTRIC PROPERTIES.

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| ELECTRONIC DESIGN & RESEARCH, INC.<br>770 MEDICAL TOWERS SOUTH<br>LOUISVILLE, KY 40202<br>VLADIMIR SHVARTSMAN<br>TITLE:<br>COMPUTER GRAPHICS CONTROL SYSTEM<br>TOPIC: 105 OFFICE: SGRD-RMA | ARMY | \$ 19,323 |
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PHASE I WOULD INVOLVE STUDY TO DETERMINE THE PARAMETERS OF THE REQUIRED SYSTEM AND TO ASCERTAIN THE FEASIBILITY AND BEST APPROACHES. VISUAL STIMULI REQUIREMENTS OF PRESENT AND FUTURE VISUAL RESEARCH CONDUCTED BY THIS ARMY LABORATORY WOULD BE ASCERTAINED. THE CAPABILITIES OF THE EXISTING HARDWARE WILL THEN BE EVALUATED.

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>----- | AWARDED<br>AMOUNT<br>----- |
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FINALLY, THE DESIRED TYPES OF USER INTERACTIONS WITH THE SYSTEM WILL BE EXPLORED. THE FINDINGS IN THESE THREE CATEGORIES WILL BE COMBINED, AND A WORKABLE SYSTEM WILL BE DESIGNED IN DETAIL AND WILL INCLUDE:

- (1) A COMPLETE DESIGN FOR USER INPUT AND INTERACTION WITH THE SYSTEM,
- (2) AN OVERVIEW DESIGN OF THE COMPUTER PROGRAM SYSTEM,
- (3) A COMPLETE SPECIFICATION OF NEEDED COMPUTER ROUTINES AND SUBROUTINES INCLUDING WHAT IT WILL DO AND THE ALGORITHM AND FLOW CHARTS,
- (4) A DESCRIPTION AND ASSESSMENT OF THE CAPABILITIES OF THE SYSTEM.

IF PHASE I IS SATISFACTORY, THEN PHASE II WOULD INVOLVE PROGRAMMING, DEBUGGING AND USER DOCUMENTATION AND TRAINING.

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| ELECTRONIC SYSTEMS DEVELOPMENT/TRAINING | NAVY | \$ 44,989 |
| ROUTE 10 BOX 247H                       |      |           |
| WACO, TX 76708                          |      |           |
| LAWRENCE M. THOMPSON                    |      |           |
| TITLE:                                  |      |           |
| PRE-FAULTED TRAINING MODULE ADAPTER     |      |           |
| TOPIC: 109            OFFICE: NWS       |      |           |

INVESTIGATE THE REQUIREMENTS FOR A SEMICONDUCTOR BASED TIMED FAULT MODULE: PHYSICAL DIMENSIONS, ELECTRICAL SPECIFICATIONS, ERGONOMIC REQUIREMENTS, POSSIBLE CONFIGURATIONS, AND LEVEL OF USER EXPERTISE NECESSARY TO SUCCESSFULLY UTILIZE THE ADAPTER. DESIGN, PROTOTYPE, AND EVALUATE A DISCRETE COMPONENT VERSION WITH DATA TO DETERMINE CUSTOM LARGE SCALE INTEGRATION/PROGRAMMABLE LOGIC ARRAY MANUFACTURE POSSIBILITIES. THE ADAPTER MODEL WOULD FIT IN EXISTING EQUIPMENT MODULES AND CONNECT TO VARIOUS CIRCUIT COMPONENTS. POWER WOULD BE SUPPLIED BY UNIT TO BE FAULTED. ADAPTER WOULD BE CURRENT LIMITED TO PREVENT EXCESSIVE HEATING AND OPERATE WITH VARIOUS STANDARD CIRCUIT VOLTAGES. ONE ADAPTER WOULD BE "UNIVERSAL" ALLOWING FLEXIBILITY IN FAULT LOCATION. FAULT WOULD OCCUR AFTER A SPECIFIED VOLTAGE CONDITION OR SIGNAL CONDITION. THIS MODULE, BY MORE REALISTIC FAULT INSERTION, WOULD GREATLY ENHANCE PERFORMANCE BASED TRAINING ON MODERN ELECTRONIC EQUIPMENTS AND RESULT IN COST SAVINGS, TIME SAVINGS, AND GREATER INSTRUCTIONAL EFFECTIVENESS OVER PRESENT METHODS.

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| ELTRON RESEARCH INC.                              | NAVY | \$ 48,244 |
| 710 E OGDEN AVE 108                               |      |           |
| NAPERVILLE, IL 60540                              |      |           |
| ANTHONY F SAMMELLS                                |      |           |
| TITLE:  |      |           |
| PHOTOINTERCALATION SOLID ELECTROLYTE STORAGE CELL |      |           |
| TOPIC: 4            OFFICE: ONR                   |      |           |

THE PROPOSED PROGRAM IS DIRECTED TOWARDS EVALUATING THE TECHNICAL

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>---- | AWARDED<br>AMOUNT<br>----- |
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FEASIBILITY OF APPLYING SOLID POLYMER ELECTROLYTES (SPE) IN NOVEL ALL SOLID-STATE PHOTOELECTROCHEMICAL STORAGE CELLS. THE UNIQUENESS OF THIS APPROACH LIES IN THE USE OF PHOTOCATHODES WHICH WILL HAVE THE POTENTIAL TO NOT ONLY GENERATE REDUCED REDOX SPECIES, AT THEIR INTERFACE WITH THE SOLID ELECTROLYTE, BUT ALSO WILL STORE SUCH SPECIES VIA INTERCALATION WITHIN THEIR BULK. THE PROGRAM WOULD INVESTIGATE SOLID-STATE JUNCTIONS BETWEEN P-DOPED GROUP IV TRANSITION METAL DICHALCOGENIDES (EG. ZRSE<sub>2</sub>, HFSZ) AND SOLID POLYMER ELECTROLYTES SUCH A POLY (ETHYLENE OXIDE) (PEO) OR NAFION BASED MATERIALS. PARTICULAR INTEREST WILL BE ON DETERMINING THE REVERSIBILITY OF SUCH SOLID-STATE INTERFACE TO THE INTERCALATION AND DE-INTERCALATION OF THE COUPLES CU<sup>+</sup>/CU<sup>0</sup> AND FE<sup>2+</sup>/FE<sup>0</sup>. VARIOUS SOLID-STATE CELLS WILL BE FABRICATED AND BOTH PHOTOELECTROCHEMICALLY AND ELECTROCHEMICALLY INVESTIGATED. THESE WILL CONSIST OF THE GENERAL CONFIGURATIONS: p-MY<sub>0</sub>.2X<sub>2</sub>/PEO, KCl/PEO, KClI<sub>2</sub>/SnO<sub>2</sub>-In<sub>2</sub>O<sub>3</sub> GLASS, p-MY<sub>0</sub>.2X<sub>2</sub>/PEO, NaSCN/PEO, NaSCN, Na<sub>2</sub>S, S/SnO<sub>2</sub>-In<sub>2</sub>O<sub>3</sub> GLASS AND p-MY<sub>0</sub>.2X<sub>2</sub>/Nafion/Nafion, RU<sup>+3</sup>/<sup>+2</sup>/Au, p-MY<sub>0</sub>.2X<sub>2</sub>/Nafion/Nafion, FeT<sub>3</sub>/T<sub>2</sub>/Au WHERE M= Zr OR Hf; Y= Fe OR Cu; X = Se OR S.

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| ENERGY OPTICS INC<br>224 NORTH CAMPO ST<br>LA CRUCES, NM 88001<br>STEVEN M WARD<br>TITLE:<br>PILOT LOSS OF CONCIIOUSNESS (PLOC) ALARM DEVELOPMENT<br>TOPIC: 121                      OFFICE: AMD/RDO | AF | \$ 50,000 |
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THIS PROJECT IS DESIGNED TO INVESTIGATE A NEW TECHNOLOGY FOR MONITORING PILOT LOSS OF CONSCIOUSNESS (PLOC). A PLOC ALARM SYSTEM WILL BE DEVELOPED TO THE STAGE OF ENGINEERING MODELS WHICH CAN BE MOUNTED IN A PILOT'S HELMET SUITABLE FOR SYSTEM DEMONSTRATION. THE APPROACH COMBINES OFF-THE-SHELF COMPONENTS INCLUDING AN IR REFLECTIVE TRANSDUCER, A SINGLE CHIP MICRO-COMPUTER AND AN AUDIBLE ALARM TO PRODUCE A LOW COST, MINIATURIZED SYSTEM FOR MONITORING THE EYELID MOVEMENTS OF A PILOT. THE PROPOSED SYSTEM INCLUDES SUFFICIENT INTELLIGENCE TO DETERMINE LOSS OF CONSCIOUSNESS AND TO GENERATE AUDIBL ALARMS. A SELF TEST MODE INFORMS THE PILOT THAT THE PLOC ALARM IS WORKING PROPERLY WHEN IT IS INITIALLY ACTIVATED, AND DIAFOSTIC FIRMWARE RESULTS IN SPECIAL ALARMS IF A TRANSDUCER FAILURE IS DETECTED. A LACK OF EYELID MOVEMENT OVER A TWENTY SECOND PERIOD

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>---- | AWARDED<br>AMOUNT<br>----- |
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WILL RESULT IN AN AUDIBLE PLOC ALARM WHICH WILL EITHER TERMINATE ON A SUBSEQUENT BLINK EVENT OR INCREASE IN INTENSITY IF NO SUBSEQUENT MOVEMENTS ARE DETECTED.

THE PRIMARY OBJECTIVES OF THE PROJECT ARE TO DEVELOP EXPERIMENTAL HARDWARE FOR SELECTING THE OPTIMAL TRANSDUCER, SENSOR GEOMETRY AND HELMET CONFIGURATION. BASED ON EXPERIMENTATION AND LABORATORY TESTING, OPTIMIZED ENGINEER MODELS WILL BE PRODUCED FOR USER TESTING.

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| ENGINEERING AND ECONOMICS RESEARCH, INC.<br>1951 KIDWELL DRIVE<br>VIENNA, VA 22180<br>WILLIAM J. ROGERS<br>TITLE:<br>MODEL OF ASSESSMENT OF CONTRACTOR PERFORMANCE<br>TOPIC: 41 OFFICE: NAVSUPSYS | NAVY | \$ 45,480 |
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THE PROJECT OBJECTIVES FOR DEVELOPING A MODEL TO EVALUATE CONTRACTOR PERFORMANCE INCLUDE: REDUCING THE TIME AND VOLUME OF INFORMATION REQUIRED TO MAKE DECISIONS; REDUCING TIME AND EFFORT REQUIRED BY CONTRACTORS AND GOVERNMENT PERSONNEL TO PREPARE ADMINISTRATIVE AND OTHER REPORTS; DATA EASILY UNDERSTOOD BY THOSE WHO USE IT; GRAPHICS DEPICTING STATUS EASY TO READ AND COMPREHENSIVE IN COMMUNICATION; AND A MODEL ECONOMICAL TO USE AND MAINTAIN, PLUS PROVIDING FLEXIBILITY AND ADAPTIBILITY TO CHANGE.

EER'S EFFORT AND APPROACH WILL CONSIST OF A LITERATURE SURVEY AND PERSONAL INTERVIEWS WITH PROGRAM, PROCUREMENT AND PRODUCTION, CONTRACT ADMINISTRATION, CONTRACTOR MANAGERS AND THEIR STAFFS. THIS RESEARCH EFFORT WILL BE DIRECTED TOWARD THE DEVELOPMENT OF A DYNAMIC METHOD FOR SOLVING CONTRACTOR PROGRESS REPORTING ON LESSER DOLLAR VALUE CONTRACTS. EMPHASIS WILL BE PLACED ON DEVELOPING A LOGICAL, UNDERSTANDABLE AND STRAIGHTFORWARD WORKING MODEL.

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| ENVIRONMENTAL DEVICES, INC.<br>4147 NORTHGATE BLVD., SUITE 6<br>SACRAMENTO, CA 95834<br>A. R. MATHEWS<br>TITLE:<br>COINCIDENCE CHEMICAL SIGNATURE IDENTIFIER<br>TOPIC: 248 OFFICE: BMO/PMX | AF | \$ 49,953 |
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AS AN UNREACHABLE PERSONNEL IDENTIFICATION SYSTEM, WE PROPOSE TO

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>----- | AWARDED<br>AMOUNT<br>----- |
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COUPLE A VAPOR COLLECTOR TO A MASS SPECTROMETER IN ORDER TO PROFILE HUMAN VAPOR "SIGNATURES." THESE PROFILES OF CHEMICALLY COMPLEX "SIGNATURES" WILL THEN BE COMPARED TO A REFERENCES FILE USING A HIGHLY EFFECTIVE PATTERN MATCHING ALGORITHM. PHASE I EFFORT WILL DEMONSTRATE THE EXISTENCE OF THESE "SIGNATURES" AND SHOW THAT EXISTING INSTRUMENTATION HAS ALMOST SUFFICIENT SENSITIVITY AND SPECIFICALLY TO DETECT AND DISTINGUISHED BETWEEN THEM. IN PHASE II A PRACTICAL SYSTEM HAVING THE REQUIRED CAPABILITIES WILL BE CONSTRUCTED BY REFINING AND UPDATING CURRENTLY AVAILABLE TECHNOLOGY. THIS SYSTEM WILL THEN BE USED TO DETERMINE THE PARAMETERS AND CONSTANCY OF THE IDENTIFYING CHEMICAL "SIGNATURES" AND TO DISCOVER WHAT DIFFERENTIATES EACH FROM ALL OTHERS. THESE DATA WILL BE USED TO DEVISE AN ALGORITHM THAT WILL AUTOMATICALLY DETERMINE AND STORE THE UNIQUE ASPECTS OF THE MASS SPECTRUM OF EACH SIGNATURE. IN ORDER TO ACHIEVE RAPID AND ACCURATE PERSONNEL IDENTIFICATION, THE SYSTEM WILL COMPARE FEATURES IN A MASS SPECTRUM OF THE CHEMICAL VAPORS EMANATING FROM AN INDIVIDUAL WITH CORRESPONDING ASPECTS IN A LIBRARY FILE OF UNIQUE CHEMICAL "SIGNATURES." THE DEGREE OF MATCH WHICH IS NECESSARY FOR A POSITIVE IDENTIFICATION WILL BE ESTABLISHED.

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| ENVIRONMETRICS, INC.<br>1567 NORTH WARSON ROAD<br>ST. LOUIS, MO 63132<br>EUGENE P. SCHEIDE<br>TITLE:<br>A MULTISENSOR CHEMICAL DETECTOR AND MEASUREMENT SYSTEM<br>TOPIC: 93            OFFICE: SGRD-RMA | ARMY | \$ 50,000 |
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IN THIS PROJECT WE WILL DEVELOP A PROTOTYPE MULTI-SENSOR CHEMICAL DETECTOR AND MEASUREMENT SYSTEM FOR MONITORING AMMONIA, CARBON MONOXIDE, TOTAL HYDROCARBONS, HYDROGEN CHLORIDE, AND NITROGEN OXIDES. THIS PROJECT WILL INCORPORATE COMMERCIALY AVAILABLE SOLID-STATE SENSORS FOR THE ABOVE MENTIONED GASES INTO A MICROPROCESSOR-BASED INSTRUMENT THAT WILL BE PORTABLE, HAVE INTERNAL DATA LOGGING CAPABILITIES AND BE ABLE TO GIVE A REAL-TIME READOUT OF THE CONCENTRATIONS OF THE FIVE POLLUTANTS. THE SENSORS OBTAINED AND/OR DEVELOPED DURING THIS PROJECT WILL BE EVALUATED AS TO SENSITIVITY, SELECTIVITY, RESPONSE TIME, RECOVERY TIME, LINEAR RANGE, REPRODUCIBILITY AND LIFETIME. THE INSTRUMENT WILL HAVE A KEYBOARD BY WHICH

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>----- | AWARDED<br>AMOUNT<br>----- |
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THE OPERATOR CAN INPUT IDENTIFICATION INFORMATION, CALIBRATION CONSTANTS, ETC. AND CAN REQUEST DATA OUT EITHER THROUGH THE SYSTEM DISPLAY OR THE DATA PORT INTERFACE. IN ADDITION TO PROVIDING A REAL-TIME READOUT OF THE CONCENTRATION OF THE VARIOUS GASES, WE WILL ALSO OBTAIN "TOTAL DOSE", "AVERAGE CONCENTRATION", AND "HIGHEST CONCENTRATION".

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| EPSILON LAMBDA ELECTRONICS CORP<br>427 STEVENS ST.<br>GENEVA, IL 60134<br>PETER P. TOULIOS<br>TITLE:<br>INSULAR WAVEGUIDE INTEGRATED MILLIMETER FRONT END FOR FM-CW TYPE<br>RADAR SYSTEMS<br>TOPIC: 1 | ARMY | \$ 49,555 |
| OFFICE: DRSMC-RAM   |      |           |

VARIOUS RADAR AND TARGET SEEKER SYSTEMS ARE BEING DEVELOPED TO OPERATE AT MILLIMETER SYSTEMS. LOW COST, HIGHLY RELIABLE FRONT END HARDWARE IS REQUIRED FOR THESE MUNITIONS. DIELECTRIC INSULAR WAVEGUIDE PLANAR INTEGRATED CIRCUITS FOR THIS PURPOSE WERE DESCRIBED INITIALLY BY EPSILON LAMBDA PERSONNEL IN 1970. SOME OF THESE RADARS ARE OF THE FM-CW TYPE, AND THIS PROPOSAL ADDRESSES THE NEED FOR DEMONSTRATING AN INTEGRATED, LOW NOISE TRANSMITTER FOR SUCH A RADAR. STATE-OF-THE-ART PERFORMANCE FROM A VARACTOR TUNED V-BAND GUNN OSCILLATOR IS EXPECTED DURING THIS PHASE I DEMONSTRATION. THE USE OF INSULAR WAVEGUIDE COMPATIBLE TECHNIQUES IS NOT EXPECTED TO LOWER PERFORMANCE CHARACTERISTICS. A SUBSEQUENT PHASE II PROGRAM EFFORT WOULD ALLOW DEMONSTRATION OF A PRE-PRODUCTION DESIGN OF A FULLY INTEGRATED INSULAR FRONT END INCLUDING TRANSMITTER, CIRCULATOR AND MIXER. THE FRONT END COULD BE FORM FACTORED FOR APPLICATION IN A TYPICAL (OR PARTICULAR) RADAR APPLICATION.

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| EPSILON LAMBDA ELECTRONICS CORPORATION<br>427 STEVENS STREET<br>GENEVA, IL 60134<br>PETER P. TOULIOS<br>TITLE:<br>INSULAR WAVEGUIDE-BASED INTEGRABLE WIDEBAND MIXER FOR MILLIMETER<br>WAVE RADAR APPLICATIONS<br>TOPIC: 1 | ARMY | \$ 47,601 |
| OFFICE: DRSMC-RAM   |      |           |

MILLIMETER-WAVE SYSTEMS ARE RAPIDLY EMERGING WITH NUMEROUS APPLICA-

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>---- | AWARDED<br>AMOUNT<br>----- |
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TIONS, INCLUDING VARIOUS RADAR SYSTEMS AND GUIDANCE FOR SELF-CONTAINED MUNITIONS. VIABILITY OF MANY MILLIMETER-WAVE SYSTEMS RELIES HEAVILY UPON ACHIEVING THE LOWER COST AND SMALL SIZE AFFORDED BY CIRCUIT INTEGRATION TECHNIQUES. DIELECTRIC-BASED WAVEGUIDES, SUCH AS INSULAR LINE, ARE HIGHLY APPROPRIATE MEDIA FOR SYSTEM INTEGRATION BY FABRICATING ALL CIRCUIT COMPONENTS BY SUITABLE MODIFYING THE BASIC WAVEGUIDE. WIDEBAND MIXERS ARE A VITAL COMPONENT IN MOST MILLIMETER-WAVE SYSTEMS. HOWEVER, INTEGRABLE VERSIONS OF DIELECTRIC BASED WIDEBAND MIXERS HAVE NOT BEEN DEVELOPED AS YET. THE PROPOSED RESEARCH WILL STUDY AND DEVELOP A WIDEBAND LOW-NOISE INSULAR GUIDE BALANCED MIXER. AN INTEGRATED VERSION OF STANDARD CROSS-BAR MIXER IS ENVISIONED. THEORETICAL WORK WILL FOCUS ON THE DESIGN AND CHARACTERIZATION OF THE TRANSITIONS AND MIXER DIODE MOUNT FOR CROSS-BAR. ANALYTIC FORMULATION WILL BE USED TO PREDICT AND OPTIMIZE PERFORMANCE. PROTOTYPES WILL BE FABRICATED, AND TESTED, TO VERIFY THEORETICAL RESULTS AND TO ESTABLISH AND OPTIMIZATION PROCEDURE.

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| ERGO-TECH SYSTEMS INC.<br>4529 ANGELES CREST HWY, SUITE 312<br>LA CANADA, CA 91011<br>JOSE E CHIRIVELLA<br>TITLE:<br>END-TO-END IMAGING SONAR SYSTEM (ETE/ISS)<br>TOPIC: 65 OFFICE: NAVSEA | NAVY | \$ 49,781 |
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THE ULTIMATE OBJECTIVE OF THIS PROPOSED WORK IS TO DEVELOP AN END-TO-END IMAGING SONAR SYSTEM FOR THE STUDY AND SURVEILLANCE OF THE SEA-BOTTOM. SPECIFICALLY, THE SYSTEM IS TO EXHIBIT ADVANCED TECHNIQUES FOR SONAR SIGNAL PROCESSING TO DETECT, SIZE AND CLASSIFY MINE TARGETS. AN IMAGE SONAR PROCESSOR SOFTWARE PACKAGE WILL BE DEVELOPED. ALTHOUGH SIDE-LOOKING SONARS WILL BE INCLUDED, THE PROCESSOR WILL EMPHASIZE SYNTHETIC APERTURE SONAR APPLICATIONS. THE PROCESSOR WILL BE DESIGNED TO OPERATE IN A REAL-TIME INTERACTIVE IMAGING ENVIRONMENT AS THE PRIMARY DATA DISPLAY IN ANTICIPATION OF ITS ULTIMATE USE BY NAVY AT SEA IN ACTUAL OPERATIONS. THE APPROACH PROPOSED HERE TAKES ADVANTAGE OF EXISTING LONG/SHORT RANGE, ADVANCED STATE-OF-THE-ART SONAR SENSORS. THE SPECIALIZED PROCESSING ALGORITHMS TO BE DEVELOPED WILL INCORPORATE THE LATEST RESULTS FROM THE NAVY SEA-BOTTOM ACCOUSTIC EXPERIMENTAL PROGRAMS. BY TRACING THE SIGNAL/ NOISE DEGRADATION FROM THE TRANSDUCER-TARGET-TRANSDUCER TO THE

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>---- | AWARDED<br>AMOUNT<br>----- |
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DATA ACQUISITION SYSTEMS, INCLUDING PHASE DISORTION (END-TO-END APPROACH), THE PROCESSOR WILL OPTIMIZE THE INFORMATION FOR DISPLAY TO THE FIELD OPERATOR AT THE HIGHEST POSSIBLE RESOLUTION. ULTIMATELY, THIS PROCESSOR CAN BE IMPLEMENTED ON ON-BOARD VLSI MINI-COMPUTERS PROVIDED WITH HIGH DENSITY MEMORY BUFFERS AND HIGH SPEED MICROPROCESSORS.

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| ESSEX CORP<br>333 NORTH FAIRFAX ST<br>ALEXANDRIA, VA 22314<br>RUSSELO A BENEL<br>TITLE:<br>PREDICTING SUBSEQUENT MYOPIA IN INITIALLY PILOT-QUALIFIED USAFA CADETS<br>TOPIC: 173 | AF | \$ 48,000 |
| OFFICE: AFOSR/XOT   |    |           |

EACH YEAR A NUMBER OF PREVIOUSLY VISUALLY-QUALIFIED USAFA CADETS BECOME UNQUALIFIED ON THE VISUAL PORTION OF THE PHYSICAL EXAMINATION AND BECOME INELIGIBLE FOR PILOT TRAINING. THE INCREASED MYOPIA IS A SIGNIFICANT PROBLEM FOR THE AF ACADEMY WHICH IS MANDATED TO GRADUATE A MINIMUM NUMBER OF PILOT-QUALIFIED CADETS. ALTHOUGH THE UNDERLYING, MECHANISM FOR THIS INCREASE IN MYOPIA IS UNKNOWN, A MEASURE THAT CORRELATES WITH THE INCREASE WOULD ALLOW FOR SELECTION OF CADETS ON THE BASIS OF RESISTANCE TO INCIPIENT MYOPIA. THIS PROPOSAL ADDRESSES THE DEVELOPMENT OF VISUAL TESTING BASED ON A THEORETICAL CORRELATE OF THE INCREASE IN MYOPIA. NAMELY, IT IS HYPOTHESIZED THAT THE DISPARITY BETWEEN THE VISUAL FAR POINT AND THE DARK FOCUS OF ACCOMMODATION MAY BE USED AS AN INDEX OF MYOPIA TENDENCY. THE APPROCH PROPOSED IS TO MEASURE THE DARK FOCUS OF ACCOMMODATION IN A SAMPLES OF CADETS WHO WERE PILOT-QUALIFIED ON ENTRY INTO USAFA. THE SAMPLES WILL BE DRAWN FORM EACH CLASS AT THE ACADEMY. PHYSICAL EXAMINATION DATA WILL PROVIDE THE FAR POINT MEASUREFOR COMPARISON. CONCOMITANT WITH THIS APPROACH IS DEVELOPMENT OF A RAPID SCREENING PROCEDURE FOR THE MEASUREMENT OF THE DARK FOCUS. DATA WILL BE ANALYZED TO DETERMINE THE VALIDITY OF THE HYPOTHESIS.

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| ESSEX CORPORATION<br>1040 WOODCOCK ROAD, SUITE 227<br>ORLANDO, FL 32803<br>ROBERT S. KENNEDY<br>TITLE:<br>LITERATURE REVIEW AND CRITIQUE OF METHODS TO ASSESS HUMAN PERFORMANCE IN DYNAMIC VEHICLE/OPERATOR SETTING<br>TOPIC: 97 | ARMY | \$ 45,736 |
| OFFICE: MERADCOM   |      |           |

HUMAN PERFORMANCE DEGRADATION OCCURS IN MILITARY SYSTEMS FOR MANY

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>----- | AWARDED<br>AMOUNT<br>----- |
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CAUSES. THE TEMPO OF OPERATION, PSYCHOLOGICAL STRESS AND THE COMPLEXITY OF WEAPONS SYSTEMS ALL TAKE THEIR TOLL. AS OPERATORS BECOME MORE INTERACTIVE WITH THEIR SYSTEMS, THEY ARE ASKED TO PERFORM MORE COMPLICATED WORK EVEN AS THEY ARE REQUIRED TO MAINTAIN CONTROL OF THEIR VEHICLES. FUTURE SYSTEMS ARE EXPECTED TO EMPHASIZE LIGHT DIVISION, SWIFTLY DEPLOYED FOR SMALL SCALE CONCOMITANTS. THE PRESENT EFFORT PROPOSES A LITERATURE REVIEW OF THE APPLIED AND THEORETICAL LITERATURE. THESE FIELDS AND THEIR METHODS WILL BE INTEGRATED AND CRITICALLY EVALUATED IN CONNECTION WITH THE ASSESSMENT OF HUMAN PERFORMANCE IN DYNAMIC VEHICLE OPERATOR SETTINGS. WE OFFER A TAXONOMY WHICH PROPOSES THE USE OF FOUR CATEGORIES OF MANAGEMENT CONCERN REGARDING HUMAN RESOURCES: HEALTH & SAFETY BIODYNAMIC EFFECTS; CREATURE COMFORTS & CENTRAL NERVOUS SYSTEM EFFECTS. THE ULTIMATE PRODUCTS WILL BE A REFERENCE LIST, AN INTEGRATED REVIEW OF THE LITERATURE AND A SOURCEBOOK WILL BE PREPARED.

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| ESSEX CORPORATION<br>1040 WOODCOCK ROAD, SUITE 227<br>ORLANDO, FL 32803<br>ROBERT S. KENNEDY<br>TITLE:<br>SURVEY OF VISION TESTS<br>TOPIC: 103            OFFICE: SGRD-RMA | ARMY | \$ 58,203 |
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VISION TESTING IS PRESENTLY IN A STAGE OF FLUX BASED ON AUTOMATION AND COMPUTER IMPLEMENTATION OF CLINICAL AND EXPERIMENTAL TASKS, AND A NUMBER OF AGENCIES HAVE ACKNOWLEDGED THE NEED FOR AN ORGANIZED, CENTRALIZED, AND AUTOMATED BATTERY OF VISION TESTS THAT ADEQUATELY INDEX THE VARIOUS DIMENSIONS OF VISUAL FUNCTION. AS A NECESSARY PRELIMINARY STEP TO THIS GENERAL GOAL, A SURVEY OF EXTANT VISUAL PERFORMANCE TESTS IS REQUIRED. TO BE OF OPTIMAL USE A SOURCEBOOK WILL BE GENERATED IN A COMPUTERIZED FORMAT WHICH WILL PERMIT SEARCHING AND SUBLISTINGS OF THESE TESTS RELATIVE TO A NUMBER OF IMPORTANT ATTRIBUTES. AMONG THESE ATTRIBUTES THE MOST IMPORTANT WILL BE DIMENSION OF VISUAL PERFORMANCE ASSESSED, DELINEATION OF THE SKILLS OR TASKS MOST CLOSELY RELATED AND AN ASSESSMENT OF THE EXTENT OF HIGHER COGNITIVE PROCESSES REQUIRED.

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| ESSEX CORPORATION<br>333 NORTH FAIRFAX ST.<br>ALEXANDRIA, VA 22314<br>DENISE C. R. BENEL<br>TITLE:<br>HUMAN FACTORS INFLUENCING WIND TUNNEL PRODUCTIVITY<br>TOPIC: 138            OFFICE: AEDC/DOT | AF | \$ 50,033 |
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THIS EFFORT WILL ADDRESS THE HUMAN FACTORS INFLUENCING WIND TUNNEL

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>---- | AWARDED<br>AMOUNT<br>----- |
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PRODUCTIVITY. THE EXTENSIVE APPLICATION OF AUTOMATIC DATA PROCESSING (ADP) TECHNOLOGIES TO SUPPORT OPERATOR DECISION-MAKING AND CONTROL FUNCTION HAS BECOME COMMON PLACE. WITH THE ADVENT OF COMPUTER-GENERATED DISPLAYS AND PROCESS CONTROL, THE HUMAN OPERATOR HAS BECOME THE FOCAL POINT OF A POTENTIALLY INUNDATING VOLUME OF INFORMATION. FACED WITH THE PROBLEM OF EXTRACTING SPECIFIC INFORMATION FROM THE VAST DATA STORE OF THE COMPUTER, THE OPERATOR MUST RELY ON THE SYSTEM'S DESIGNERS TO ANTICIPATE HIS NEEDS AND PROVIDE HIM WITH THE INFORMATION HE NEEDS WHEN HE NEED IT.

FOR MOST ADVANCED CONTROL SYSTEMS EMPLOYING ADP TECHNOLOGY, THE OPERATOR-COMPUTER INTERFACE HAS BECOME THE PRINCIPAL FOCUS OF THE MAN-MACHINE INTERACTION. AS SUCH, IT REPRESENTS THE MOST CRITICAL ELEMENT TO BE ASSESSED DURING A HUMAN FACTORS EVALUATION. INADEQUACIES IN DISPLAY FORMATTING, COMMAND LANGUAGE, DATA ENTRY TECHNIQUES OR OTHER CHARACTERISTICS OF THE INTERFACE CAN DEGRADE SYSTEM PERFORMANCE BELOW LEVELS NECESSARY FOR FUNCTIONAL EFFECTIVENESS.

NEVERTHELESS, OTHER ASPECTS OF CONTROL ROOM OPERATIONS RELATED TO PRODUCTIVITY MUST BE CONSIDERED INCLUDING CONTROL ROOM LAYOUT AND COMMUNICATIONS.

PHASE I ACTIVITIES WILL INCLUDE A REVIEW OF WIND TUNNEL CONTROL ROOMS, IDENTIFIED AND ANALYSIS OF PROBLEM AREAS, PROPOSAL OF AND EVALUATION OF PROPOSED IMPROVEMENTS AND DEVELOPMENT OF A PLAN FOR A COMPLETE CONTROL ROOM ENHANCEMENT PROGRAM.

EUREKA LABORATORIES, INC.  
215 - 26TH STREET  
SACRAMENTO, CA 95816  
WINSTON KO, PH.D.

NAVY \$ 58,650

TITLE:  
ROBOTIC DECK SCRUBBER  
TOPIC: 122 OFFICE: NASC

THE OVERALL OBJECTIVE OF THIS PHASE I PROPOSAL IS TO IDENTIFY SYSTEM PARAMETERS AND UTILIZE THIS INFORMATION TO PERFORM PRELIMINARY DESIGN FOR A ROBOTIC DECK SCRUBBER WITH DISTRIBUTED (MULTIPROCESSOR) INTELLIGENCE. SELECTION OF VARIOUS OPTIONS FOR SENSORY, POWER, LOCOMOTION, AND CLEANING SYSTEMS WILL BE MADE TO ALLOW RELIABLE OPERATION WITHIN THE CARRIER HANGER DECK

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>---- | AWARDED<br>AMOUNT<br>----- |
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ENVIRONMENT. THE OBSTACLE AVOIDANCE CAPABILITY REQUIRED IN SUCH A ROBOT WILL BE DEMONSTRATED. BASED UPON THE THOROUGH DESIGN STUDIES OF PHASE I, FINAL DEVELOPMENT OF A WORKABLE ROBOTIC DECK SCRUBBER WILL BE ACCOMPLISHED IN PHASE II.

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| EVAPORATED COATINGS, INC.<br>798 WELSH ROAD, P.O. BOX 160<br>HUNTINGDON VALLEY, PA 19006<br>JOHN J. WALLS, JR.<br>TITLE:<br>ANTI-REFLECTIVE WINDOW COATINGS<br>TOPIC: 104            OFFICE: NWSC | NAVY | \$ 44,000 |
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THE OBJECTIVES FOR THIS EFFORT WILL INCLUDE THEORETICAL STUDIES RELATED TO THE DEVELOPMENT OF MULTILAYER COATINGS FOR WINDOWS OF VARIOUS REFRACTIVE INDICES. ALSO, COATED SAMPLES DEMONSTRATING ANTI-REFLECTIVE PROPERTIES AS WELL AS STABILITY TO ENVIRONMENTAL CONDITIONS WILL BE PROVIDED. THIS EFFORT WILL CONSIST OF UTILIZING THIN FILM COMPUTER DESIGN OPTIMIZATION TECHNIQUES TO YIELD OPTIMAL OPTICAL ANTI-REFLECTIVE PROPERTIES. STUDIES WILL BE PERFORMED FOR THE DESIRED SPECTRAL REGION OF INTEREST. ELECTRON BEAM GUN TECHNOLOGY AND SPECIALIZED ANCILLARY CONTROL INSTRUMENTATION WILL BE UTILIZED FOR PROCESSING DURABLE AND OPTICALLY EFFICIENT SAMPLES.

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| FAME ASSOCIATES, INC.<br>P.O. BOX 572<br>FORT COLLINS, CO 80522<br>JAMES B. WEDDING, PH.D.<br>TITLE:<br>DETERMINATION OF OPTICAL/INFRARED PROPERTIES OF ATMOSPHERIC AEROSOLS WITH AN IN-SITU, MULTI-WAVELENGTH MULTICHANNEL NEPHELOMETER<br>TOPIC: 157            OFFICE: AFOSR/XOT | AF | \$ 58,831 |
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CHARACTERIZING THE OPTICAL PROPERTIES OF INDIVIDUAL AEROSOL PARTICLES IN THE AEROSPACE ENVIRONMENT REQUIRED TO ALLOW PERFORMANCE ANALYSIS OF OPTICAL AND INFRARED SYSTEMS AND OPTICAL OBSCURATION COUNTER-MEASURES. THERE EXISTS A NEED TO DEVELOP NEW INSTRUMENTATION WHICH CAN AUTOMATICALLY AND REMOTELY (IN-SITU) MEASURE AND RECORD THE TOTAL

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>----- | AWARDED<br>AMOUNT<br>----- |
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SCATTERING PATTERN FROM INDIVIDUAL AIRBORNE PARTICLES OF DIFFERENT MATERIAL AND SHAPES UNDER VARIOUS NATURAL AND MAN-MADE ATMOSPHERIC CONDITIONS. KNOWLEDGE OF PHYSICAL/OPTICAL PROPERTIES OF ATMOSPHERIC ATMOSPHERIC AEROSOLS WILL GREATLY ENHANCE THE CAPABILITY OF MODELING ATMOSPHERIC TRANSMISSION AND PREDICTING PERFORMANCE OF OPTICAL AND INFRARED SYSTEMS. THE OBJECTIVE OF THE PHASE I EFFORTS ARE TO IDENTIFY THE SYSTEM REQUIREMENTS, INVESTIGATE THE TECHNICAL FEASIBILITY OF THE DEVELOPED CONCEPT AND DESIGN A PROTOTYPE SYSTEM INCLUDING A PARTICLE (INLET) SAMPLING SYSTEM FOR POTENTIAL AIRCRAFT USAGE, IDENTIFY LIGHT SOURCE, OPTICS AND DETECTORS FOR THE SYSTEM, AND A DATA ACQUISITION SYSTEM. THE PROPOSED APPROACH IS TO MEASURE THE SPECTRAL AND ANGULAR VARIATION OF SCATTERED LIGHT PATTERNS OF INDIVIDUAL PARTICLES OVER 4 STERADIANS BY EMPLOYING MULTIPLE SOURCES AND DETECTORS AND A FAST RESPONSE DATA ACQUISITION SYSTEM. PHASE I RESULTS ARE INTENDED TO PROVIDE DETAILS OF SYSTEM DESIGN, HARDWARE IDENTIFICATION AND THEORETICAL ANALYSIS THAT WILL DIRECT THE IMPLEMENTATION OF PHASE II - THE ACTUAL CONSTRUCTION OF THE SYSTEM.

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| FIBER MATERIALS INC<br>BIDDEFORD INDUSTRIAL PARK<br>BIDDEFORD, ME 04005<br>JOHN W. HERRICK<br>TITLE:<br>IMPROVED CHEMICAL AGENT FILTER<br>TOPIC: 133 | AF | \$ 46,184 |
| OFFICE: AMD/RDO  |    |           |

A MAJOR PROBLEM WITH CURRENTLY AVAILABLE CHEMICAL AGENT FILTERS IS THE RESISTENCE TO AIR PERMEABILITY, OR BREATHABILITY. THIS RESISTANCE IS DUE TO THE RELATIVELY DENSE PACKING OF ACTIVATED CARBON MATERIAL TO ABSORB THE TOXIC CHEMICAL VAPORS. A PROGRAM IS PROPOSED TO DEVELOP ACTIVATED CARBON FIBER FELTX THAT POSSES LOW FIBER DENSITY TO ACHIEVE GOOD AIR PERMEABILITY, BUT ADEQUATE VAPOR ABSORPTION. THE REQUIRED ABSORPTIVE PROPERTIES WILL BE ACHIEVED BY MAXIMIZING THE "TORTUOSITY FACTOR" OF THE FILTER. VARIOUS TYPES OF ACTIVATED CARBON FIBER FELTS WILL BE PREPARED AND EVALUATED FOR VAPOR ABSORPTION AND AIR PERMEABILITY. THE FELTS WILL BE PRODUCED WITH RANDOM AND SEMIRANDOM FIBER ORIENTATIONS DESIGNED TO PROVIDE THE MAXIMUM POSSIBLE PATH LENGTH THAT A VAPOR MOLECULE MUST TRAVEL TO PASS THROUGH THE FELT. THIS

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>----- | AWARDED<br>AMOUNT<br>----- |
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LENGTH, AS DEFINED BY THE TORTUOSITY FACTOR, WILL PROVIDE MAXIMUM ABSORPTION POTENTIAL OF THE CHEMICAL AGENT. THOSE MATERIALS AND PROCESSING FACTORS THAT YIELD THE BEST FILTERS WILL BE DEFINED. IMPROVED FILTERS WILL BE PRODUCED FOR FURTHER EVALUATION.

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| FIBER MATERIALS, INC.<br>BIDDEFORD INDUSTRIAL PARK<br>BIDDEFORD, ME 04005<br>LAWRENCE E. MCALLISTER<br>TITLE:<br>HYBRID FIBER CARBON-CARBON COMPOSITES FOR IMPROVED COMPATIBILITY WITH OXIDATION RESISTANT COATINGS<br>TOPIC: 77 OFFICE: AFWAL/XRPM | AF | \$ 49,860 |
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CARBON-CARBON COMPOSITES ARE USEFUL HIGH TEMPERATURE STRUCTURAL MATERIALS OPPORTUNITIES EXIST FOR THEIR USE IN HOT, OXIDIZING ENVIRONMENTS, BUT PROTECTION SYSTEMS HAVE TO BE DEVELOPED TO PREVENT OXIDATION WHICH POSES A SERIOUS PROBLEM ABOVE 400 DEGREE C. CONVENTIONAL OXIDATION RESISTANT COATING SYSTEMS EMPLOYING THIN LAYERS OF EITHER SiC OR SiN CRACK WHILE UNDERGOING LARGE TEMPERATURE CHANGES DUE TO THE DIFFERENCE BETWEEN THEIR COEFFICIENTS OF THERMAL EXPANSION (CTE) AND THAT OF CARBON-CARBON. THE PURPOSE OF THE PROPOSED PROGRAM IS TO DETERMINE THE FEASIBILITY OF USING HYBRID FIBER CARBON-CARBON COMPOSITES TO REDUCE THE CTE MISMATCH BETWEEN THE SUBSTRATE SURFACE AND OXIDATION RESISTANT COATING.

3D TAPES WILL BE CONSTRUCTED IN WHICH HIGH CTE FIBERS WILL BE PLACED IN WEAVE LOCATIONS THAT CONTROL THE CTE OF SURFACE PORTIONS OF THE SUBSTRATE. HIGH STRENGTH T-300 FIBERS WILL BE USED IN THE REMAINING PERFORM LOCATIONS. BOTH CVD SiC AND Si3N4 WILL BE APPLIED TO THE DESIFIED COMPOSITES IN ORDER TO DETERMINE HOW THEIR DIFFERENT CTEs AND ELASTIC MODULI WILL AFFECT THEIR PERFORMANCE AS PROTECTIVE COATINGS. COATED SPECIMENS WILL BE EVALUATED IN STATIC AIR OXIDATION TESTS, AND SUCCESSFUL SUBSTRATE-COATING COMBINATIONS WILL UNDERGO MECHANICAL TEST AS WELL.

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| FOSTER-MILLER, INC.<br>350 SECOND AVENUE<br>WALTHAM, MA 02254<br>ROGER DEMLER<br>TITLE:<br>ENGINE POWERED MAN PORTABLE PERSONAL COOLING SYSTEM<br>TOPIC: 49 OFFICE: DRDNA-EPT | ARMY | \$ 49,309 |
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A MAN PORTABLE PCS (PERSONAL COOLING SYSTEM) WILL BE DEVELOPED FOR

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>---- | AWARDED<br>AMOUNT<br>----- |
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TROOPS REQUIRING COOLING WHILE WEARING CHEMICAL WARFARE PROTECTIVE CLOTHING. THE CONCEPT DEVELOPED ON THIS PROJECT WILL USE A VAPOR COMPRESSION FREON CYCLE. THE POWER SOURCE FOR THE ROTARY COMPRESSOR WILL BE AN IC (INTERNAL COMBUSTION) GLOW PLUG IGNITION ENGINE. THE HEAT TRANSFER MEDIUM TO THE BODY WILL BE A WATER/GLYCOL SOLUTION. THE HEAT REJECTION WILL BE A FREON TO AIR FAN POWERED HEAT EXCHANGER. THE USE OF AN IC ENGINE PERMITS THE LIGHTEST POSSIBLE PCS PACKAGE FOR A 6 HOUR MISSION. INTEGRATION OF THE ENGINE WITH TIME PROVEN AND TESTED REFRIGERATION COMPONENTS INTO A 7-LB PACKAGE MINIMIZES RESEARCH AND DEVELOPMENT DOLLARS AND COULD ALLOW PROTOTYPES TO BE AVAILABLE FOR TROOP TESTING AT THE END OF PHASE II. THE PCS IS ADAPTABLE TO ELECTRIC DRIVE WHEN POWER IS AVAILABLE SUCH AS IN VEHICLES. THE OBJECTIVE UB PHASE I IS TWOFOLD: 1) DEMONSTRATE THE FEASIBILITY OF AN ENGINE-DRIVEN ROTARY COMPRESSOR ON A BREADBOARD SYSTEM, 2) DETERMINE THE LEVEL OF ENGINE DEVELOPMENT REQUIRED TO ACHIEVE PERFORMANCE AND RELIABILITY. DELIVERED AT THE END OF PHASE I WILL BE: 1) REPORT ON ALL WORK, 2) PROTOTYPE DESIGN LAYOUT, 3) PHASE II COST, 4) BREADBOARD PCS SYSTEM HARDWARE.

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| FOSTER-MILLER, INC.<br>350 SECOND AVENUE<br>WALTHAM, MA 02254<br>LESLIE S. RUBIN<br>TITLE:<br>CENTRIFUGAL CLARIFIER FOR PRETREATMENT OF ROWPU FEED<br>TOPIC: 25 | ARMY | \$ 44,207 |
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OFFICE: DRDME-PM

TO PRODUCE POTABLE WATER FROM NATURAL WATER SOURCES FOR MILITARY PERSONNEL IN THE FIELD, THE U.S. ARMY IS DEVELOPING A NEW CLASS OF WATER PURIFICATION SYSTEMS UTILIZING REVERSE OSMOSIS TECHNOLOGY. THE FIRST OF THESE REVERSE OSMOSIS WATER PURIFICATION UNITS (ROWPU) HAS BEEN DESIGNED FOR THE PRODUCTION OF 600 GPH OF POTABLE WATER AND IS DIVIDED INTO TWO BASIC SUBSYSTEMS, A REVERSE OSMOSIS SYSTEM AND AN INITIAL PRETREATMENT SYSTEM. THE FILTRATION COMPONENTS OF THE PRE-TREATMENT SYSTEM (MIXED MEDIA FILTER, CARTRIDGE FILTER, BACKFLUSH PUMP AND BOOSTER PUMP) ARE ESTIMATED TO WEIGH IN EXCESS OF 1800 LB, OCCUPY APPROXIMATELY 30 FT3 AND UTILIZE A MAXIMUM OF 13.5 HP. SINCE THIS UNIT MUST BE AIR TRANSPORTABLE AND CAPABLE OF AIRDROP DELIVERY, THE TOTAL UNIT WEIGHT AND SIZE HAS BEEN APPROPRIATELY REDUCED. REDUCING THE SIZE AND WEIGHT WILL IMPROVE THE ROWPU'S

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>---- | AWARDED<br>AMOUNT<br>----- |
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TRANSPORTABILITY.

THE ALTERNATE PRETREATMENT SYSTEM BEING PROPOSED USES A CENTRIFUGAL CLARIFIER TO REPLACE THE MIXED MEDIA FILTER AND CARTRIDGE FILTER, WHILE ELIMINATING THE BACKFLUSH AND BOOSTER PUMPS. THIS PROPOSED CHANGE ACCORDING TO INITIAL ESTIMATES WILL REDUCE THE WEIGHT, SIZE AND TOTAL POWER REQUIREMENTS OF THE PRESENT ROWPU BY AT LEAST 1475 LB, 20 FT3 AND 9 HP, RESPECTIVELY.

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| FOSTER-MILLER, INC.<br>350 SECOND AVENUE<br>WALTHAM, MA 02254<br>R. EDWIN HICKS<br>TITLE:<br>TREATMENT OF PHENOLIC STRIPPER WASTEWATER IN A SEWER SYSTEM<br>TOPIC: 268                      OFFICE: AFESC/RDX | AF | \$ 49,706 |
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THE AIR FORCE HAS SEVERAL LARGE AIRCRAFT MAINTENANCE FACILITIES STRIPPING PAINT FROM AIRCRAFT AND GENERATING LARGE QUANTITIES OF PHENOLIC STRIPPING WASTEWATER. DISCHARGE OF THESE WASTES INTO PUBLICLY OWNED TREATMENT WORKS (POTW) IS A PREFERRED ALTERNATIVE TO ONSITE TREATMENT. THE PRIMARY OBJECTIVE OF THIS PROGRAM IS TO DETERMINE EXPERIMENTALLY THE CONDITIONS UNDER WHICH PHENOL CAN BE REMOVED FROM THE WASTEWATER IN A SEWAGE/SEWER SYSTEM, PRIOR TO TREATMENT IN THE POTW. THE LABORATORY PROGRAM INVOLVES DETERMINING THE KINETICS OF PHENOL BIO-OXIDATION AND ADSORPTION RELATIVE TO SEWAGE, AND ESTABLISHING THE CONTROLLING BIO-OXIDATION RATES. THE MAJORITY OF THE TESTS WILL BE CARRIED OUT IN A BATCH REACTOR WHERE THE FOLLOWING TEST VARIABLES WILL BE CONTROLLED: WASTEWATER AND SEWAGE COMPOSITION, PROPORTION OF WASTEWATER AND SEWAGE, TEMPERATURE, DISSOLVED OXYGEN LEVELS AND THE DEGREE OF STERILIZATION OF THE SEWAGE. THE EFFECT OF OXYGEN TRANSFER FROM THE HEADBOARD SPACE IN A SEWER TO THE MIXED SEWAGE/WASTEWATER FLOW WILL BE STUDIED UNDER DYNAMIC CONDITIONS IN A CLOSED-CIRCUIT CONTINUOUS FLOW REACTOR.

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| FOSTER-MILLER, INC.<br>350 SECOND AVENUE<br>WALTHAM, MA 02254<br>ANDREW HARVEY<br>TITLE:<br>LOW FLOW SEPARATOR FOR OILY BILGE WATER<br>TOPIC: 55                      OFFICE: NAVSEA | NAVY | \$ 49,999 |
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PRESENT NAVAL POLLUTION ABATEMENT SYSTEMS BEING USED FOR THE

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>----- | AWARDED<br>AMOUNT<br>----- |
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SEPARATION OF OILY CONTAMINANTS FROM THE BILGE WATER PRIOR TO DISCHARGE HAVE BEEN SIZED FOR 10 GPM AND 50 GPM FLOW RATES. THESE SYSTEMS, AT THEIR DESIGN FLOW RATES, ARE SUITABLE FOR APPROXIMATELY 70 PERCENT OF THE NAVY'S FLEET. THE REMAINING 30 PERCENT OF THE FLEET TYPICALLY REQUIRES A BILGE PROCESSING SYSTEM SIZED FOR FLOWS IN THE 1 TO 5 GPM RANGE. PRESENTLY, THERE ARE NO EFFORTS BEING DIRECTED TOWARDS THE DEVELOPMENT OF A LOW FLOW ON-BOARD POLLUTION ABATEMENT SYSTEM. UTILIZATION OF THE EXISTING SYSTEMS WOULD RESULT IN INEFFICIENT USE OF AVAILABLE SPACE. IN ADDITION, IT APPEARS THAT THE PERFORMANCE OF THESE EXISTING SYSTEMS WILL NOT MEET THE WATER QUALITY GUIDELINES FOR BILGE WATER DISCHARGE (15 PPM OIL OR LESS) ESTABLISHED BY THE MARPOL PROTOCOL. FOSTER-MILLER, INC. HAS CONCEPTUALLY DEVELOPED A NOVEL 1 TO 5 GPM CENTRIFUGAL OIL-WATER SEPARATOR WHICH IS SPECIFICALLY DESIGNED FOR THIS APPLICATION. THE DESIGN OF THIS LOW FLOW SEPARATOR IS BASED ON PROVEN MECHANICAL FEATURES FROM THE EXISTING FOSTER-MILLER CENTRIFUGAL COALESCER. WITH A PROJECTED SIZE OF ONLY 7 IN. IN DIAMETER AND 8 IN. IN LENGTH, THIS LIQUID/LIQUID SEPARATOR WOULD EASILY ADAPT TO THE SPACE CONSTRAINTS OF EVEN THE SMALLEST CRAFT.

FOUR DIMENSIONS, INC.  
3138 DIABLO AVENUE  
HAYWARD, CA 94545  
JAMES T. C. CHEN

AF \$ 50,000

TITLE:  
A FOUR-POINT-PROBE METER FOR NON-DESTRUCTIVE MEASUREMENTS OF RESISTIVITIES OF III-V COMPOUND SEMICONDUCTORS  
TOPIC: 34 OFFICE: AF

A METHOD TO USE THE FOUR-POINT-PROBE TECHNIQUE TO MEASURE RESISTIVITIES OF THE III-V AND II-VI COMPOUND SEMICONDUCTORS WITHOUT ALLOYING THE CONTACT SPOTS IS PROPOSED. IT WILL ENABLE US TO MAKE THOSE MEASUREMENTS WITH BETTER GEOGRAPHICAL RESOLUTION, MORE ACCURATELY AND IN WIDER RANGE THAN THE EXISTING METHODS. THE BACKGROUND OF THE TECHNIQUE AND ITS PRINCIPLE ARE DESCRIBED. THE BLOCK DIAGRAM OF THE DESIGN AND ITS EXPLANATION ARE PROVIDED. THE PLAN TO EXECUTE THE PROJECT IS DISCUSSED.

G.K.S., INC.  
25800 FIRST STREET  
WESTLAKE, OH 44145  
THOMAS R. RANKIN

NAVY \$ 48,601

TITLE:  
DETERMINATION OF SPARES AND REPAIR PARTS PRICES  
TOPIC: 40 OFFICE: NAVSUPSYS

TO DETERMINE THE FEASIBILITY OF DESIGNING A COMPUTER-AIDED SYSTEM

FISCAL YEAR 1984

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THAT WOULD PROVIDE AN ESTIMATE OF A REASONABLE COST FOR SPARE AND REPAIR PARTS. THE PROJECT WILL ADDRESS THE FEASIBILITY OF PROVIDING TWO METHODS OF PRICE DETERMINATION FOR COMPARISON PURPOSES. THE PROPOSAL WILL LIMIT ITS APPLICATIONS TO SPECIFIC FEDERAL STOCK CLASSES.

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| GENERAL TECHNOLOGY<br>2560 PRESCOTT ROAD<br>HAVERTOWN, PA 19083<br>MARTIN J. DEVINE<br>TITLE:<br>INVESTIGATION OF A SYSTEMS CONCEPT FOR HIGH TEMPERATURE SOLID LUBRICATED BEARINGS<br>TOPIC: 113      OFFICE: AFWAL | AF | \$ 49,820 |
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SOLID LUBRICATION OFFERS SIGNIFICANT ADVANTAGES FOR ROLLING ELEMENT BEARINGS AND MACHINERY EXPOSED TO EXTREME CONDITIONS. A MAJOR CONSTRAINT IS THAT CURRENT DESIGNS FOR SUCH BEARINGS ARE BASED ON HYDRODYNAMIC LUBRICATION (OIL AND GREASE). THE CHALLENGE IS TO IDENTIFY A NEW CONCEPT THAT FOCUSES THE REQUIREMENTS FOR THE EFFECTIVE USE OF SOLIDS AND A METHODOLOGY FOR SOLID LUBRICANT-BEARING SYSTEM INTEGRATION. THE CONCEPT BEING PROPOSED IS THAT THE BEARING AND LUBRICANT ARE INTERDEPENDENT AND COMPATIBILITY INVOLVING (1) ENVIRONMENT (2) LUBRICANT-BEARING INTERFACE AND (3) BEARING DESIGN PARAMETERS IS A CRITICAL FACTOR. FOR BEARING OPERATION TARGETED AT 1000/1500 DEGREE F AND DN IN EXCESS OF 1M, THE OPPORTUNITY TO PURSUE THIS CONCEPT WILL EMPHASIZE EMERGING COMPLEX SULFUR CONTAINING COMPOUNDS (E.G. OXYTHIOMOLYBDATES) COUPLED WITH TECHNICAL CERAMICS AS THE PRIMARY PHASE I EFFORT. CRITICAL INTERFACES WILL INVOLVE ROLLER-RACE, ROLLER-SEPARATOR AND SEPARATOR-LAND WITH SOLID LUBRICANT REPLENISHMENT FROM MULTIPLE SITES ON LAND-SEPARATOR WITH SOLID LUBRICANT REPLENISHMENT FROM MULTIPLE SITES ON LAND-SEPARATOR COMPONENTS. ANALYSES WILL INCLUDE THERMAL EFFECTS AND LOAD LIMITS. THE RESULTS WILL ESTABLISH IMPORTANT LIFE CONTROLLING PROPERTIES AND PRELIMINARY DESIGN GUIDES FOR SOLID LUBRICATED HIGH TEMPERATURE BEARINGS.

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| GENERAL TECHNOLOGY CORPORATION<br>701 HAINES AVE., N.W.<br>ALBUQUERQUE, NM 87102<br>DR. PATRICK M. DHOOGHE<br>TITLE:<br>ELECTROCATALYTIC WASTE REACTOR (EWR)<br>TOPIC: 247      OFFICE: BMO/PMX | AF | \$ 74,469 |
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THE AIR FORCE HAS A NEED FOR A MEANS TO RELIABLY PROCESS WASTE

FISCAL YEAR 1984

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WATER IN A "BUTTONED-UP" DEEP BASE. THIS PROPOSAL OUTLINES PRELIMINARY EXPERIMENTATION ON AN ELECTROCATALYTIC METHOD FOR DEGRADING WASTE MATERIALS WHICH WILL PRODUCE HYDROGEN. HYDROGEN CAN THEN BE USED IN FUEL CELLS TO GENERATE POWER AND PRODUCE WATER. PROPOSED EXPERIMENTS WILL EVALUATE A NUMBER OF ELECTRO-CATALYST/HOMOGENEOUS COCATALYST SYSTEMS WITH A SERIES OF TYPICAL ORGANIC WASTES TO FIND KINETIC AND THERMODYNAMIC DATA. PROMISING CATALYSTS WILL BE EVALUATED IN LONG-TERM TESTS TO DETERMINE THE EFFICIENCY OF THE REACTION AND THE REACTION PRODUCTS WITH VARIOUS WASTES.

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| GEO-CENTERS INC | DNA | \$ 49,458 |
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320 NEEDHAM ST  
 NEWTON UPPER FALL, MA 02164  
 W.B. SPILLMAN PHD

TITLE:  
 VERY HIGH PRESSURE FIBER OPTIC SENSOR FOR NTS EFFECTS MEASUREMENTS  
 TOPIC: 3 OFFICE: OAAM

A FIBER OPTIC PRESSURE SENSOR BASED ON THE PHOTOELASTIC EFFECT IS DISCUSSED. DUE TO INTRINSIC IMMUNITY TO ELECTROMAGNETIC INTERFERENCE, THE FIBER OPTIC SENSOR OFFERS THE PROMISE OF FUNDAMENTAL IMPROVEMENT RELIABILITY. A POLARIMETRIC SENSING TECHNIQUE MINIMIZES THE EFFECTS OF RADIATION DAMAGE TO FIBERS. THE SENSOR EXPLOITS THE CHANGES IN INDEX OF REFRACTION PRODUCED BY STRESS IN PHOTOELASTIC MATERIALS. THE OPERATING RANGE OF THE SENSOR HAS BEEN CHOSEN TO COINCIDE WITH ONE OF THE RANGES OF INTEREST FOR UNDERGROUND NUCLEAR TESTS. AN INVESTIGATION INTO PHOTOELASTIC SENSING ELEMENT DESIGN OPTIONS IS DISCUSSED.

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| GEO-CENTERS, INC. | NAVY | \$ 49,821 |
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320 NEEDHAM STREET  
 NEWTON UPPER FALL, MA 02164  
 DR. MARC D. MERMELSTEIN

TITLE:  
 NON-DESTRUCTIVE TESTING USING A FIBER OPTIC SENSORY SYSTEM  
 TOPIC: 121 OFFICE: NAVAIR

THIS RESEARCH PROPOSAL SEEKS TO DEVELOP A FIBER OPTIC SENSOR THAT WILL

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>---- | AWARDED<br>AMOUNT<br>----- |
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CONTINUOUSLY MONITOR THE LOCAL STATE OF STRESS/STRAIN INTERNAL TO FIBER REINFORCED COMPOSITE MATERIALS. THE SENSOR WILL CONSIST OF A SINGLE OPTICAL FIBER AND WILL BE AN INTEGRAL COMPONENT OF THE COMPOSITE MATERIAL. THE PROPOSED TECHNIQUE UTILIZES TIME RESOLVED LIGHT BACKSCATTERING WITHIN THE FIBER CORE THAT RESULTS FROM A MATERIAL-INDUCED LOCAL STRAINING OF THE OPTICAL FIBER. MAJOR GOALS OF THE PROGRAM INCLUDE THE DEVELOPMENT OF SENSITIZED FIBER SEGMENTS THAT WILL RESPOND TO INTERNAL STRESSES ACTING ON THE FIBER SURFACE, A DEFINITION OF THE SENSOR SYSTEM CHARACTERISTICS, AND A DETERMINATION OF THE SENSOR-COMPOSITE MATERIAL COMPATIBILITY. IT IS PROJECTED THAT THE SINGLE FIBER SENSOR WILL HAVE A SPATIAL RESOLUTION OF 3.0 CM, MINIMUM DETECTABLE STRESS LEVELS OF APPROXIMATELY 40 PSI, AND AN ESSENTIALLY CONTINUOUS REAL TIME INTERROGATION CAPABILITY. A FIBER OPTIC NERVOUS SYSTEM CAPABLE OF MONITORING THE INTERNAL STATE OF STRESS IN STRUCTURAL MATERIALS WILL PERMIT THE OPTIMAL UTILIZATION OF THE MATERIAL AND STRUCTURE. FOR EXAMPLE, A STRESS SENSOR INTERNAL TO AN AIRCRAFT WING COULD ALLOW THE PILOT TO HAVE CONTINUOUS KNOWLEDGE OF THE LOCAL STRESSES IN THE WING AND ALLOW HIM TO OPERATE HIS AIRCRAFT TO ITS MAXIMUM EFFICIENCY. THIS SENSOR WOULD HAVE WIDE SCALE APPLICATIONS IN ANY SYSTEM SUBJECTED TO SEVERE STRESSES WHERE THE SYSTEM PERFORMANCE IS DEPENDENT UPON THE OPTIMAL USE OF THE STRUCTURE'S MATERIAL STRENGTH.

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| GREEN MOUNTAIN RADIO RESEARCH COMPANY<br>50 VERMONT AVENUE, FORT ETHAN ALLEN<br>WINOOSKI, VT 05404<br>FREDERICK H. RAAB<br>TITLE:<br>SIGNAL PROCESSING FOR THROUGH-THE-EARTH COMMUNICATIONS<br>TOPIC: 250 OFFICE: BMO/PMX | AF | \$ 59,871 |
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RELIABLE THROUGH-THE-EARTH COMMUNICATIONS (TEC) ARE NEEDED FOR COMMAND AND CONTROL OF DEEP-BASED ICBM SITES. THE REQUIRED DATA RATES CAN BE ACHIEVED BY USING BOTH SIGNAL CODING AND SIGNAL-TO-NOISE-RATIO (SNR) ENHANCEMENT TECHNIQUES. THE KEY SIGNAL-PROCESSING ELEMENTS OF SUCH A SYSTEM ARE: NONLINEAR PROCESSING (NLP), ADAPTIVE NOISE CANCELLATION (ANC), QUADRATURE-AMPLITUDE MODULATION (QAM), ERROR-CORRECTING CODING (ECC), AND DECISION-AIDED FEEDBACK (DAFB). NONLINEAR PROCESSING BY AN ADAPTIVE CLIPPER REMOVES MOST THE POWER CONCENTRATED IN THE IMPULSIVE SPIKES OF VLF NOISE. ADAPTIVE NOISE

FISCAL YEAR 1984

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CANCELLATION COMBINES CORRELATED ELECTRIC-AND MAGNETIC-FIELD INPUTS TO MAXIMIZE THE SNR. QAM AND ECC MATCH THE REQUIRED DATA RATE TO THE CHARACTERISTICS OF THE COMMUNICATION CHANNEL. DECISION-AIDED FEEDBACK ALLOWS THE OTHER THREE SYSTEMS TO OPERATE TOGETHER IN A NEARLY OPTIMAL MANNER. THE PROPOSED PROGRAM WILL DEVELOP A PRACTICAL AND NEARLY OPTIMAL TEC SYSTEM CONCEPT THROUGH ANALYSIS AND SIMULATION OF EACH OF THE SYSTEM ELEMENTS AND THEIR INTERACTIONS.

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| GUYER SANTIN, INC.<br>455 CAPITAL MALL, SUITE 302<br>SACRAMENTO, CA 95814<br>JAMES NOLT<br>TITLE:<br>FIBER OPTIC ELECTROMAGNETIC PULSE ISOLATORS<br>TOPIC: 277            OFFICE: ESD/PKR | AF | \$ 47,279 |
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MICROPROCESSORS AND SIMILAR INTEGRATED CIRCUIT EQUIPMENT IN LOCAL AREA NETWORKS (LAN) ARE VULNERABLE TO DAMAGE FROM ELECTROMAGNETIC PULSE RESULTING FROM LIGHTNING, SHORT CIRCUITS IN NEARBY HIGH VOLTAGE CABLES AND NUCLEAR EXPLOSIONS. EXISTING CIRCUIT BREAKING DEVICES DO NOT PROVIDE ADEQUATE PROTECTION BECAUSE OF THEIR SLOW REACTION TIME. A DEVICE IS NEEDED TO ISOLATE SENSITIVE EQUIPMENT FROM LAN DISTRIBUTION CABLES WITHIN AND BETWEEN BUILDINGS SO PULSES WILL NOT BE TRANSMITTED TO THE INTEGRATED CIRCUITS AND RELATED COMPONENTS. FIBER OPTIC CABLES DO NOT TRANSMIT ELECTROMAGNETIC PULSES. THIS PROPOSAL IS TO RESEARCH THE FEASIBILITY OF A FIBER OPTIC ISOLATOR CONSISTING OF A TRANSMITTER CIRCUIT, LED CONNECTOR, LENGTH OF FIBER OPTIC CABLE, DETECTOR CONNECTOR, AND RECEIVER CIRCUIT MAY PROVIDE THE NEEDED PROTECTION.

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| HIGH TECHNOLOGY SENSORS, INC.<br>262 EAST HORNBEAM DRIVE<br>LONGWOOD, FL 32779<br>R. M. MINDOCK<br>TITLE:<br>NOVEL MULTISENSOR CHEMICAL DETECTOR<br>TOPIC: 93            OFFICE: SGRD-RMA | ARMY | \$ 48,361 |
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IT IS PROPOSED TO INVESTIGATE THE USE OF A NOVEL INFRARED SOURCE

FISCAL YEAR 1984

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TO BE USED IN THE DESIGN AND DEVELOPMENT OF A NOVEL MULTISENSOR CHEMICAL DETECTOR AND MEASUREMENT SYSTEM. THE SOURCE IS ALL SOLID STATE, ELECTRONICALLY CHOPPABLE AND OPERATES WITHOUT ANY COOLING. IT IS PROPOSED TO DETERMINE THE AMOUNT OF MODULATED OUTPUT WHICH CAN BE ACHIEVED FROM THE DEVICE, THE OPTIMAL SIZE OR CONFIGURATION FOR A GAS SENSOR AND TO FABRICATE A BREADBOARD GAS SENSOR AND MEASURE THE GAS DETECTION CAPABILITY UNDER LABORATORY CONDITIONS.

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| HORINE ENGINEERS, INC.<br>P. O. BOX 2027<br>LOS GATOS, CA 95031<br>CARLTON L. HORINE<br>TITLE:<br>NEW SEALING AND AUTOMATIC PRESSURIZATION SYSTEM FOR MUNITIONS CONTAINERS<br>TOPIC: 227            OFFICE: AD/CZO | AF | \$ 27,737 |
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THIS PROPOSAL PRESENTS A PLAN FOR STUDYING THE FEASIBILITY OF AN INNOVATIVE AUTOMATIC INERT GAS PRESSURIZATION METHOD AND NEW GASKET MATERIALS THAT WILL INCREASE THE SERVICE LIFE OF MUNITIONS WHILE IN CONTAINERS. TRANSFER OF STATE-OF-THE-ART ELASTOMER TECHNOLOGY FROM OTHER FIELDS THAT USE GASKETS WILL BE STUDIED, AS WELL AS THE FEASIBILITY AND VALUE OF INITIATING A GOVERNMENT SPONSORED DEVELOPMENT PROGRAM FOR A NEW GASKET MATERIAL SPECIFICALLY FOR MUNITIONS CONTAINERS. THE AUTOMATIC GAS PRESSURIZATION SYSTEM WILL UTILIZE ADVANCED AND INNOVATIVE TECHNOLOGY FOR LOW COST, HIGHLY RELIABLE UNITS. PHASE I WILL COME UP WITH A CONCEPTUAL DESIGN AND THE BASIS FOR DEVELOPMENT IN PHASE II.

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| HOWLETT & ASSOCIATES, INC.<br>800 J CEDAR VALLEY<br>REDFORD, VA 24141<br>JAMES F. HOWLETT<br>TITLE:<br>LIGHTWEIGHT DIRECT DRIVE ACTUATORS<br>TOPIC: 5            OFFICE: DARPA | DARPA | \$ 42,650 |
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WHAT IS BEING PROPOSED IS THE DEVELOPMENT OF PERMANENT MAGNET BRUSH-LESS DC MOTORS USING NEODYMIUM BORON IRON AS THE PERMANENT MAGNET

FISCAL YEAR 1984

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MATERIAL. THIS MATERIAL, NEWLY INTRODUCED AT THE MMM CONFERENCE IN PITTSBURGH ON NOVEMBER 10, 1983, SEEMS TO HOLD THE POTENTIAL FOR SIZE WEIGHT REDUCTIONS FOR A GIVEN LEVEL OF OUTPUT OVER ANY OTHER PM MATERIAL CURRENTLY AVAILABLE INCLUDING RARE EARTH COBALT MAGNETS AND AT A LOWER COST. MAGNETIC CIRCUIT MATERIAL REDUCTIONS OF 50% BELOW THOSE ACHIEVABLE WITH SmCo5 APPEAR POSSIBLE. THERE ARE HOWEVER DRAWBACKS, PARTICULARLY REGARDING LOSS OF COERCIVITY WITH INCREASING TEMPERATURE, WITH A RESULTING DECREASE IN ENERGY PRODUCT (BHmax). OF EVEN GREATER IMPORTANCE WOULD BE RAPIDLY INCREASING SUSCEPTIBILITY TO DEMAGNETIZATION DUE TO CROSS FIELD mmf. MEANS OF THERMALLY INSULATING THE ROTATING PERMANENT MAGNET STRUCTURE IN ORDER TO MINIMIZE THE DEGRADATION OF ITS OUTSTANDING PROPERTIES ARE PART OF THIS PROPOSAL.

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| HYBRID ENGINEERING AND TECHNOLOGY INC.<br>P.O. BOX 82932<br>SAN DIEGO, CA 92138<br>D. P. HAMMOCK<br>TITLE:<br>NAVY MEDICAL R&D INTEGRATED DATA NETWORK<br>TOPIC: 12            OFFICE: NMRDC | NAVY | \$ 47,354 |
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THE OBJECTIVE OF THIS PROJECT IS TO DEVELOP THE CONCEPT, FEASIBILITY, AND COST EFFECTIVENESS OF AN INTERNETTED TELECOMMUNICATIONS SYSTEM THAT WILL FACILITATE INTERACTION BETWEEN HOST COMPUTERS AND REMOTE DEVICES TO ENHANCE THE CAPABILITIES OF THE NAVY'S MEDICAL RESEARCH AND DEVELOPMENT SPECIALISTS. THE WORK WILL INCLUDE A DETERMINATION OF COMMUNICATION AND ADP REQUIREMENTS AND DEVELOPING A CONCEPT FOR A DISTRIBUTED DATA COMMUNICATIONS NETWORK. A SYSTEM ARCHITECTURE WILL BE DESIGNED BASED ON A STANDARDIZED NETWORK STRUCTURE PROVIDING MEDICAL RESEARCH SPECIALISTS THE CAPABILITY TO COMMUNICATE VIA DIVERSE REMOTE DEVICES AND SHARE HOST SYSTEMS RESOURCES.

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| II-VI INCORPORATED<br>SAXONBURG BOULEVARD<br>SAXONBURG, PA 16056<br>CARL J. JOHNSON<br>TITLE:<br>FINITE ELEMENT THERMODYNAMIC MODEL OF MULTI-ZONE CdTe VERTICAL BRIDGMAN GROWTH LEADING TO IMPROVED YIELDS OF ELECTROOPTIC MODULATOR<br>TOPIC: 40            OFFICE: AVPO | AF | \$ 75,000 |
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CdTe ELECTROOPTIC MODULATOR CRYSTALS UP TO 10x10x50MM3 WILL BE THE DE-

FISCAL YEAR 1984

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VICE OF CHOICE IN MANY CO2 LASER RADAR SYSTEMS UNDER DEVELOPMENT BY AFAL. THE OBJECTIVES OF THIS WORK IS TO SIGNIFICANTLY RAISE CURRENTLY LOW YIELDS IN THE MANUFACTURE OF LARGE ELECTROOPTIC GRADE CdTe SINGLE CRYSTALS THEREBY IMPROVING THE PPRODUCIBILITY OF CdTe MODULATORS. PHASE I WILL INCLUDE: 1. A LITERATURE SEARCH OF OPTIMUM CONDITIONS FOR CRYSTAL GROWTH GENERALLY AND FOR CdTe SPECIFICALLY. 2. ASSESSMENT OF THE VERTICAL BRIDGMAN (VB) METHOD AS THE MOST PROMISING TECHNOLOGY FOR DEVELOPMENT. 3. DEVELOPMENT OF A COMPUTERIZED FINITE ELEMENT THERMODYNAMIC MODEL OF THE VB PROCESS. 4. CORRELATION OF PREDICTED WITH ACTUAL VB GROWTH FURNANCE PERFORMANCE DATA TO ESTABLISH MODELING FEASIBILITY. 5. USE OF THE MODEL TO ANALYZE VB CONFIGURATIONS AND VARIATIONS AND TO DEVELOP RECOMMENDATIONS AS TO WHICH CONFIGURATIONS PRODUCE FAVORABLE GROWTH CONDITIONS.

PHASE II (NOT PART OF THIS PROPOSAL) IS ENVISIONED TO INCLUDE:

1. REFINEMENT OF MOST PROMISING VB CONFIGURATIONS. 2. VB GROWTH UTILIZING THESE CONFIGURATIONS. 3. ENHANCEMENT OF THE MODEL TO IMPROVE RESOLUTION AND SENSITIVITY. 4. DEVELOPMENT OF ACCURATE YIELD DATA AS GROWTH CONFIGURATION IMPROVE.

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| II-VI INCORPORATED<br>SAXONBURG BOULEVARD<br>SAXONBURG, PA 16056<br>DR. JOHN H. CHAFFIN<br>TITLE:<br>DEPOSITION OF LOW DEFECT DENSITY OPTICAL COATINGS<br>TOPIC: 94            OFFICE: NWC | NAVY | \$ 49,937 |
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THIS IS A PROPOSAL TO THE NAVAL WEAPONS CENTER FOR PREPARING LOW DEFECT DENSITY OPTICAL COATINGS (FEWER THAN 100/CM2, 1 - 10 UM IN SIZE). II-VI INCORPORATED WILL CONSTRUCT A BENT ION-PLATING COATING APPARATUS, PREPARE AND EVALUATE THE COATINGS, AND DELIVER SAMPLES TO THE NAVAL WEAPON CENTER.

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| IMI-TECH CORPORATION<br>701 FARGO AVE<br>ELK GROVE VILLAGE, IL 60007<br>RAY LEE<br>TITLE:<br>DEVELOPMENT OF A POLYIMIDE MULTILAYER BOARD<br>TOPIC: 68            OFFICE: NSWC | NAVY | \$ 45,461 |
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IMI-TECH CORPORATION PROPOSES TO DEVELOP A POLYIMIDE MULTILAYER

FISCAL YEAR 1984

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PRINTED CIRCUIT BOARD POSSESSING A COEFFICIENT OF LINEAR THERMAL EXPANSION MATCHED TO THAT OF CERAMIC. THE PROPOSED CIRCUIT BOARD WILL ALSO POSSESS STRONG BOND STRENGTH BETWEEN LAYERS AND EMBEDDED COPPER CONDUCTORS. THIS PROPOSED PROJECT BUILDS ON IMI-TECH'S PATENTED AND PROPRIETARY POLYIMIDE FOAMING RESIN AND MANUFACTURING TECHNIQUES.

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| IMI-TECH CORPORATION<br>701 FARGO AVENUE<br>ELK GROVE VILLAGE, IL 60007<br>RAY LEE<br>TITLE:<br>DEVELOPMENT OF HIGH TEMPERATURE POLYIMIDE RESIN<br>TOPIC: 142            OFFICE: NAVAIR | NAVY | \$ 38,900 |
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IMI-TECH CORPORATION PROPOSES TO MODIFY ITS EXISTING PROPRIETARY POLYIMIDE FOAMING RESIN, WHICH HAS DEMONSTRATED THERMAL STABILITIES IN EXCESS OF 500 DEGREES F, TO ACHIEVE INCREASED TEMPERATURE STABILITY UP TO 700 DEGREES F. THIS NEW POLYIMIDE RESIN WILL THEN BE USED TO PRODUCE HARD, DURABLE COATINGS. THE MODIFICATIONS TO BE INVESTIGATED INCLUDE CHANGES IN MATERIALS, PROCESS PARAMETERS, AND PRODUCTION TECHNIQUES.

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| IMPAR, INC.<br>BOX 2102<br>HUNTSVILLE, AL 35804<br>BEVERLY D. GEORGE<br>TITLE:<br>EVALUATION OF INDIVIDUAL BMD SOFTWARE ALGORITHMS<br>TOPIC: 111            OFFICE: BMDSC | ARMY | \$ 72,443 |
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THE PROPOSED PROJECT SEEKS TO DEVELOP AND DEMONSTRATE A METHODOLOGY FOR EVALUATING BMD SOFTWARE ALGORITHMS INDIVIDUALLY TO ESTABLISH SENSITIVITIES AND PERFORMANCE BOUNDS IN TERMS GENERIC TO THE ALGORITHMS. THE CONTRACTOR WILL SELECT PORTIONS OF SEVERAL BMD ALGORITHMS TO ANALYZE USING THE METHODOLOGY. A PRELIMINARY DESIGN FOR AN ALGORITHM TEST CELL WILL BE EXPANDED AND REFINED. THE FEASIBILITY OF THE TEST CELL CONCEPT AND THE METHODOLOGY FOR ITS USE WILL BE ESTAB-

FISCAL YEAR 1984

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LISHED. THE ARC VAX COMPUTER NETWORK IS PROPOSED AS THE HOST COMPUTER SYSTEM FOR EVALUATING THE ALGORITHMS.

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| INDUSTRIAL & BIOMEDICAL SENSORS CORP<br>1345 MAIN STREET<br>WALTHAM, MA 02154<br>KUO WEI CHANG, PH.D. | ARMY | \$ 69,976 |
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TITLE:  
 NON-DESTRUCTIVE REACTIVATION OF CHEMICAL WARFARE PROTECTIVE GARMENTS AND WRAPS  
 TOPIC: 56                      OFFICE: DRDNA-EPT

DURING PRACTICE MANEUVERS THE ARMED FORCES FREQUENTLY USE CHEMICAL PROTECTIVE GARMENTS IN WHICH ACTIVATED CARBON, THE OPERATIVE COMPONENT OF CW GARMENTS, IS RENDERED USELESS BY DIRT, EXHAUST FUMES, SWEAT, SMOKE, AND VAPOR POISONING. AT PRESENT THERE IS NO NON-DESTRUCTIVE METHOD OF REACTIVATING THE CARBON AFTER CONTAMINATION; CW GARMENTS ARE NOT REUSEABLE AND MUST BE DISCARDED. THERE IS A TREMENDOUS LOSS OF RESOURCES AND MONEY INVOLVED IN DISCARDING, AND REPLACING CW GARMENTS USED IN DRILLS, TRAINING, MANEUVERS, AND FALSE ALARMS IN COMBAT SITUATIONS.

THE PROPOSED METHOD OF REACTIVATING THE CONTAMINATED ACTIVATED CARBON INVOLVES, FIRST, A SIMPLE LAUNDERING PROCESS TO ELIMINATE DIRT, STAIN AND GREASE. NEXT THE GARMENT IS TREATED WITH A POWERFUL DISPLACING AGENT WHICH WILL DESORB THE HYDROCARBONS, CONTAMINANTS, AND OTHER ADSORBATES IN THE ACTIVATED CARBON. THE DISPLACING AGENT AND THE ENTRAPPED WATER VAPOR CAN THEN BE REMOVED BY LOWERING THE BOILING POINT THROUGH VACUUM EVAPORATION. THE HEAT LOSS DUE TO EVAPORATION IS REPLENISHED BY A LOW DUTY CYCLE MICROWAVE HEATING METHOD. THE HIGHLY EFFECTIVE DISPLACING AGENT CAN BE RECOVERED AND REUSED BY MEANS OF A COLD TRAP.

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| INDUSTRIAL QUALITY, INC.<br>9832 CANAL ROAD, P. O. BOX 2397<br>GAITHERSBURG, MD 20879<br>HAROLD BERGER | NAVY | \$ 49,900 |
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TITLE:  
 HIGH SENSITIVITY, ONE-SIDED X-RAY INSPECTION SYSTEM  
 TOPIC: 91                      OFFICE: NSWC

A SENSITIVE NONDESTRUCTIVE METHOD TO USE SCATTERED X-RAYS TO DETECT

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>----- | AWARDED<br>AMOUNT<br>----- |
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AND SIZE DEFECTS FROM ONE SIDE OF THE OBJECT IS DESCRIBED. RADIATION SCATTERED FROM A COLLIMATED X-RAY BEAM CAN BE DETECTED TO REVEAL INTERNAL INHOMOGENEITIES. A NOVEL DETECTOR COLLIMATION SLOT PROVIDES INCREASED DETECTION SENSITIVITY AND, BY ADJUSTMENT OF THE INSPECTION GEOMETRY, ALSO PROVIDES MAGNIFICATION OF THE SCATTERED BEAM. THIS CAN BE USED TO ENHANCE SENSITIVITY AND TO SIZE DEFECTS THAT MAY BE EXTREMELY SMALL. THE TECHNIQUE ALSO PROVIDES DEFECT DEPTH INFORMATION. THE OBJECTIVES OF THE PROGRAM ARE TO DETERMINE THE DEFECT DETECTION SENSITIVITY AND SIZING CAPABILITY FOR DAMAGE IN SIMULATED ROCKET PRESSURE VESSELS MADE FROM KEVLAR-EPOXY AND GRAPHITE-EPOXY. PRELIMINARY INDICATIONS ARE THAT THE METHOD WILL DETECT CRACKS, VOIDS AND EVEN THE SLIGHT GAP OF TWO SURFACES IN MECHANICAL CONTACT, IN BONDED STRUCTURES A PHENOMENON KNOWN AS A KISSING BOND. THE GEOMETRIES CHOSEN FOR STUDY WILL BE CYLINDERS WITH INTERNAL LAMINATED STRUCTURE MADE FROM THE MATERIALS OF INTEREST. THIS GEOMETRY WILL SIMULATE MANY WEAPONS SYSTEMS AND MILITARY HARDWARE SUCH AS MISSILES, ROCKETS AND ORDNANCE DEVICES. IT SHOULD BE EMPHASIZED THAT THIS ONE-SIDED X-RAY TECHNIQUE WILL PROVIDE AN INSPECTION METHOD FOR ROCKET MOTOR PRESSURE VESSELS AND OTHER MISSILE HARDWARE FOR BOTH FACTORY AND FIELD USE. IN THE FIELD, IT OFFERS UNIQUE INSPECTION CAPABILITY.

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| INFORMATION MANAGEMENT GROUP, INC.<br>P.O. BOX 2890<br>SATELLITE BEACH, FL 32937<br>CRAIG YOUNG<br>TITLE:<br>MINIATURE PERFORMANCE ASSESSMENT BATTERY<br>TOPIC: 92            OFFICE: SGRD-RMA | ARMY | \$ 37,500 |
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THE HUMAN PERFORMANCE ASSESSMENT BATTERY (PAB) CURRENTLY BEING USED BY THE US ARMY MEDICAL RESEARCH AND DEVELOPMENT COMMAND IS A MICRO-COMPUTER BASED TESTING DEVICE USED TO MONITOR CHANGES IN SOLDIER MOOD AND COGNITION. THE PAB IS CURRENTLY IMPLEMENTED ON A APPLE II PLUS MICROCOMPUTER WITH FLOPPY DISK. WHILE SUITABLE FOR LABORATORY USE, IT IS NOT ADEQUATELY MILITARIZED, MINIATURIZED, OR FLEXIBLE ENOUGH TO BE SUITABLE FOR LARGE-SCALE DATA COLLECTION IN A FIELD SETTING. THIS PROJECT SHALL TRANSPORT THE FUNCTIONAL CAPABILITIES OF THE EXISTING PAB SOFTWARE PROGRAM UNTO A COMMERCIALY AVAILABLE PORTABLE

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>----- | AWARDED<br>AMOUNT<br>----- |
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COMPUTER. THE PORTABLE COMPUTER WILL SUPPORT THREE MODES OF OPERATION: 1) CARRIED AROUND LIKE A POCKET CALCULATOR FOR USE IN DATA COLLECTION AND PREANALYSIS, 2) CONNECTED TO FLOPPY DISK DRIVES, A COLOR SCREEN AND A PRINTER AND/OR PLOTTER AT A CENTRAL OFFICE TO PERFORM MORE COMPLEX ANALYSIS, 3) USED TO TRANSMIT DATA TO OR RECEIVE DATA FROM A LARGER HOST COMPUTER EITHER DIRECTLY OR THROUGH A MODEM.

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| INFORMATION RESEARCH ASSOCIATES<br>911 WEST 29TH STREET<br>AUSTIN, TX 78705<br>DOUG NEUSE<br>TITLE:<br>HIGH LEVEL SIMULATION OF ELECTRONIC SYSTEMS<br>TOPIC: 89 OFFICE: NSWC | NAVY | \$ 56,260 |
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THE OBJECTIVE OF THE RESEARCH AND DEVELOPMENT PROPOSED HERE IS THE DEFINITION AND DESIGN OF A SIMULATION MODELING SYSTEM CAPABLE OF 1) REPRESENTING ELECTRONIC SYSTEMS OVER A RANGE OF RESOLUTION FROM CHIPS TO DEVICES AND 2) INTEGRATING VALIDATION AND VERIFICATION OF BOTH FUNCTIONALITY AND PERFORMANCE. THE DESIGN OF THIS MODELING SYSTEM WILL BE FOUNDED UPON PRINCIPLES THAT HAVE BEEN FOUND TO BE EFFECTIVE IN SIMULATION MODELING AT THE SOFTWARE AND DEVICE LEVELS. THESE PRINCIPLES ARE: 1. QUEUE/SERVER REPRESENTATION OF COMPONENTS AT ALL LEVELS OF ABSTRACTION. 2. A GRAPHICAL DESIGN LANGUAGE FOR SYSTEM MODELS. 3. A DECLARATIVE NON-PROCEDURAL LANGUAGE FOR MODEL DEFINITION AND EVALUATION. 4. HIERARCHICAL STRUCTURING THAT ALLOWS A MODEL TO REPRESENT COMPONENTS AT DIFFERENT LEVELS OF RESOLUTION. 5. INTEGRATION OF THE MODELING SYSTEM WITH A DATA BASE OF COMPONENT DEFINITIONS AND RELATIONSHIPS.

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| INTEGRAL SYSTEMS, INC.<br>8855 ANNAPOLIS ROAD, SUITE 101<br>LANHAM, MD 20706<br>RUSSELL E. TALCOTT<br>TITLE:<br>VERY HIGH LEVEL SIMULATION<br>TOPIC: 89 OFFICE: NSWC | NAVY | \$ 50,000 |
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THIS PROPOSAL DESCRIBES THE STEPS INVOLVED IN SCOPING AND PERFORMING

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>---- | AWARDED<br>AMOUNT<br>----- |
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THE PRELIMINARY DESIGN OF A MULTI-MICRO-COMPUTER BASED SYSTEM FOR SIMULATING ELECTRONIC (OR OTHER) SUBSYSTEMS IN REAL TIME IN A MODULAR, EXPANDABLE AND INEXPENSIVE FASHION. THE PHASE I STUDY EFFORT IS EXPECTED TO LEAD TO A PROTOTYPE DEVELOPMENT EFFORT WITH SPECIFIC SELECTED APPLICATIONS IMPLEMENTED IN SOFTWARE FOR FEASIBILITY DEMONSTRATION.

THE PROPOSAL DESCRIBES THE CURRENT STATE OF THE ART IN MULTI-COMPUTER SIMULATION SYSTEMS, EXPLAINING THE THREE BASIC TYPES OF STRUCTURES AND CHOOSING THE MULTIPLE-INSTRUCTION-MULTIPLE-DATA STREAM (MIMD) ARCHITECTURE AS MOSTS APPROPRIATE FOR THIS APPLICATION. CURRENT MIMD APPROACHES ARE DISCUSSED AS WELL AS RECOMMENDED CONCEPTS TO BE EXPLORED FOR THIS PARTICULAR SYSTEM.

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| INTEGRATED SYSTEMS, INC.<br>151 UNIVERSITY AVENUE<br>PALO ALTO, CA 94301<br>ROBERT L. KOSUT<br>TITLE:<br>ROBUST ADAPTIVE CONTROL<br>TOPIC: 175            OFFICE: AFOSR/XOT | AF | \$ 62,000 |
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THIS PROPOSAL ADDRESSES THE THEORETICAL ISSUES INVOLVED IN OBTAINING QUANTITATIVE ROBUSTNESS MEASURES FOR ADAPTIVE SYSTEMS. PRESENT ADAPTIVE THEORY REQUIRES THAT THE PLANT AND CONTROLLER ARE LINEAR AND FINITE DIMENSIONAL, WITH KNOWN ORDER SUCH THAT CONTROL OBJECTIVES ARE EXACTLY OBTAINED. SUCH STRINGENT CONDITIONS CANNOT BE OBTAINED IN AN ACTUAL SYSTEM WHERE UNCERTAIN PHENOMENA ABOUND, E.G., UNCERTAIN BOUNDED DISTURBANCES, PARAMETER UNCERTAINTY, AND MODELING UNCERTAINTY.

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| INTERCOMP, INC.<br>RT. 3, BX 274<br>STILLWATER, OK 74074<br>JAMES N. LANGE, PH.D.<br>TITLE:<br>MICROWAVE REFLECTIVITY OF DIELECTRIC LAYERS<br>TOPIC: 257            OFFICE: BMO/PMX | AF | \$ 45,172 |
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DIELECTRIC COATINGS ON VEHICLES CAN ALTER THEIR RADAR IMAGE SIGNIFI-

FISCAL YEAR 1984

| SUBMITTED BY | DEPT | AWARDED<br>AMOUNT |
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CANTLY. THIS PROPOSAL IS DIRECTED TO DETERMINING NUMERICALLY THE REFLECTIVITY FOR AN OBJECT COVERED BY A DIELECTRIC LAYER. A CALCULATION WILL BE DONE USING BASIC PHYSICAL PRINCIPLES TO DEFINE THE THEORETICAL BOUNDARY VALUE PROBLEM FOR THE DIELECTRIC LAYER. THE SOLUTION TO THIS PROBLEM WILL BE OBTAINED NUMERICALLY USING MATRIX INVERSION AS PART OF A COMPUTER PROGRAM WHICH ALSO PRESENTS THE RESULTS GRAPHICALLY. THE PHASE I PROBLEM WILL BE LIMITED TO REFLECTION FROM PLANES. EXTENSION OF THE PROBLEM TO OTHER GEOMETRIES WILL BE INITIATED IN PHASE II. A TRANSIENT SOLUTION TO THE BOUNDARY VALUE PROBLEM WILL BE OBTAINED IN ORDER TO SYNTHESIZE BOTH THE SHAPE AND THE AMPLITUDE OF THE REFLECTED IMPULSES. THE DIVERSITY OF INFORMATION DETERMINED FROM THE SOLUTION TO THE PROBLEM WILL BE PRESENTED IN A CONCISE, GRAPHICAL FORM TO ENCOURAGE AN INTUITIVE RESPONSE TO SUCH VARIATIONS AS THE ATTITUDE OF THE OBJECT, OR THE FREQUENCY SPECTRUM OF THE MICROWAVE IMPULSE. PROGRAMS AND GRAPHICAL TECHNIQUES DEVELOPED FOR THE PLANE, DIELECTRICALLY CLAD, METALLIC SURFACE WILL BE APPLIED TO MORE COMPLEX OBJECTS IN PHASE II.

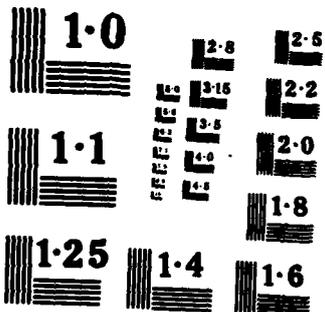
INTERCON SYSTEMS CORPORATION  
11306 EAST 183RD STREET  
CERRITOS, CA 90701  
WILLIAM R. HALL

NAVY \$ 63,103

TITLE:  
PREPLANNED PRODUCT IMPROVEMENT PROGRAM PLAN FOR MIFASS/TCO  
TOPIC: 51 OFFICE: MARINE CORPS

THERE IS A REQUIREMENT TO PRODUCE A PLAN TO DETERMINE THE PRODUCT IMPROVEMENT TO THE MIFASS/TCO SYSTEM, AND TO ESTABLISH A CHRONOLOGICAL IMPLEMENTATION PLAN FOR DEVELOPING AND INTEGRATING THESE PRODUCT IMPROVEMENTS. NUMEROUS SOFTWARE CAPABILITIES WERE DEFERRED OR DELETED IN THE CURRENT MIFASS ENGINEERING DEVELOPMENT. THE TCO SYSTEM HAS BEEN REDUCED IN SCOPE AND IS BEING REDEFINED. THE MARINE CORPS MISSION REQUIRES THAT THE COMMAND AND CONTROL PROCEDURES USED DURING OPERATIONS HAVE TIMELY AND ACCURATE INFORMATION. CURRENT DEVELOPMENT REDUCES THE CAPABILITIES DESIRED BY THE CORPS. THE PROPOSED RESEARCH WILL EVOLVE A TOP-DOWN STRUCTURED REQUIREMENTS DEFINITION FOR THE POTENTIAL IMPROVEMENT ITEMS, AND A PLAN FOR THEIR IMPLEMENTATION. THE PLAN WILL CONSIDER THE FEASIBILITY OF IMPLEMENTING EACH ITEM, AND ITS VALUE TO THE MIFASS/TCO PROGRAM. A TRADE-OFF ANALYSIS OF THE IMPROVEMENT ITEMS BY COST AND SCHEDULE WILL ALSO





FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>---- | AWARDED<br>AMOUNT<br>----- |
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BE ADDRESSED, AS WELL AS AN APPROPRIATE PRIORITORIZATION OF THE ITEMS.

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| INTERLAKEN TECHNOLOGY CORP.<br>6535 CECILIA CIRCLE<br>MINNEAPOLIS, MN 55435<br>F. DAVID WERNER<br>TITLE:<br>ANGLE OF ATTACK TRANSMITTER WITH DIGITAL OUTPUT FOR MIL-STD-1553B<br>DATA BUS<br>TOPIC:           2           OFFICE: ASD/AE | AF | \$ 49,760 |
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THE INCREASINGLY WIDESPREAD APPLICATION OF MIL-STD-1553B TO MILITARY AND, POTENTIALLY COMMERCIAL AIRCRAFT HAS CREATED A NEED FOR DIGITAL OUTPUT FLOW ANGLE TRANSMITTERS. THE CURRENT MEANS OF GENERATING A DIGITAL OUTPUT FROM EXISTING TRANSDUCERS HAS AN UNFLAVORABLE IMPACT ON SIZE, WEIGHT, POWER, COST AND RELIABILITY. DIGITAL ENCODING TECHNIQUES ARE BELIEVED TO HAVE BENEFICIAL APPLICATION TO EXISTING TO EXISTING TRANSMITTERS BY REPLACING THE ANALOG OUTPUT STATE, TO RESULT IN A DIRECT DIGITAL OUTPUT MORE SUITABLE FOR CONVERSION TO THE MIL-STD-1533B DATA BUS. A PROGRAM IS PROPOSED HEREIN TO DETERMINE THE BEST APPROACH FOR IMPLEMENTING AN ENCODER OUTPUT IN EXISTING ANGLE OF ATTACK TRANSMITTERS. COMPLEXITY OF REQUIRED INTERFACE ELECTRONICS FOR MIL-STD-1553 OUTPUT WILL ALSO BE RESEARCHED. OTHER WORK INCLUDES STUDY OF EXPECTED SIZE, WEIGHT, POWER AND RESPONSE DYNAMICS. COST IMPACT AND ABILITY TO MEET REDUNDANCY AND SELF TEST REQUIREMENTS ARE OTHER IMPORTANT ISSUES THAT WILL BE DEALT WITH BRIEFLY IN THIS PHASE. RESEARCH IN THIS PHASE WILL LAY THE GROUNDWORK FOR PRODUCT DEVELOPMENT, TESTING AND COMMERCIALIZATION IN LATER PHASES.

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| INTERSCIENCE, INC.<br>1 WASHINGTON AVE., SUITE 1<br>SCHENECTADY, NY 12305<br>JAMES T. WOO<br>TITLE:<br>THEORETICAL ANALYSIS ON THE MHD STABILITY OF LIQUID METAL CURRENT COLLECTORS<br>TOPIC:           98           OFFICE: DTNSRDC | NAVY | \$ 67,312 |
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CURRENT CARRYING CONDUCTING FLUIDS ARE KNOWN TO BE SUSCEPTIBLE TO

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>---- | AWARDED<br>AMOUNT<br>----- |
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A NUMBER OF MHD INSTABILITY MODES. THIS TYPE OF INSTABILITY IS EXPECTED TO OCCUR IN LIQUID METAL CURRENT COLLECTORS, WHICH CAN CAUSE SERIOUS DISRUPTION TO THEIR OPERATIONS. THE MECHANISMS THAT DRIVES THE INSTABILITY ARE WELL UNDERSTOOD AND THE INSTABILITY CAN BE STABILIZED BY THE APPLICATION OF A MAGNETIC FIELD ALONG THE CURRENT CHANNEL. THE REQUIREMENT FOR STABILIZATION AND THE THRESHOLD, IN TERMS OF THE CURRENT DENSITY AND BOUNDARY CONDITIONS FOR THE ONSET OF THE INSTABILITY CAN BE CALCULATED THEORETICALLY. WE PROPOSE, THEREFORE, TO CARRY OUT A THEORETICAL ANALYSIS ON THE MHD STABILITY OF THE CURRENT CHANNEL IN THESE SYSTEMS TO DETERMINE THE STABILITY THRESHOLDS BY UTILIZING NORMAL MODE ANALYSIS AND THE ENERGY PRINCIPLE. THE PHYSICAL MODEL OF THE INSTABILITY AND THE ANALYTICAL APPROACH TO BE FOLLOWED ARE DESCRIBED.

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| IRT CORPORATION<br>3030 CALLAN ROAD<br>SAN DIEGO, CA 92121<br>DR. DAVID MATHEWS<br>TITLE:<br>FEASIBILITY AND DESIGN OF A MICROWAVE WARHEAD<br>TOPIC: 229            OFFICE: AD/CZO | AF | \$ 74,243 |
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AVAILABILITY OF EXTREMELY HIGH-POWER PULSED MICROWAVE SOURCES AND COMPACT POWER SUPPLY CONCEPTS HAS LEAD TO INCREASING INTEREST IN MICROWAVE WEAPONS. BEFORE THE COST PER KILL AND EVENTUAL MILITARY UTILITY OF SUCH WEAPONS CAN BE ESTIMATED, AT LEAST THREE MAJOR TECHNICAL ISSUES MUST BE QUANTIFIED AND BOUNDED. THESE ARE THE MICROWAVE VULNERABILITY OF TARGET SOVIET SYSTEMS AND ITS VARIATION WITH FREQUENCY, PULSESHAPE, POLARIZATION AND SCENARIO-DEPENDENT PARAMETERS; THE FEASIBILITY AND COST OF BUILDING A WEAPON THAT OPTIMALLY CAPITALIZES ON SOVIET VULNERABILITY WHILE MINIMIZING U. S. AND ALLIED FRATRICIDE; AND, FINALLY, THE PRACTICALITY AND COSTS OF SOVIET COUNTERS TO SUCH A WEAPON. THE PROPOSED EFFORT WILL ANALYTICALLY TREAT THE FIRST TWO ISSUES, ESTABLISHING REASONABLE VULNERABILITY BOUNDS AND DESIGN APPROACHES BASED ON BOTH TEST DATA AND SYSTEM MODELING. THE OBJECTIVES IS TO PROVIDE PAPER DESIGNS OF SEVERAL WEAPONS THAT COULD BE PACKAGED IN TYPICAL AIR-DELIVERED WARHEAD VOLUMES, AND WOULD PROVE LETHAL AGAINST DEPLOYED SOVIET AIR DEFENSE SYSTEMS AT TACTIAL RANGES. FOLLOW-ON WORK WOULD THEN TREAT THE COUNTERMEASURES ISSUES

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>----- | AWARDED<br>AMOUNT<br>----- |
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AND FEASIBILITY DEMONSTRATION EXPERIMENTS.

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| J-TEC ASSOCIATES, INC.<br>317 - 7TH AVENUE S.E.<br>CEDAR RAPIDS, IA 52401<br>ROBERT D. JOY<br>TITLE:<br>WIND VECTOR MEASUREMENT SYSTEM FOR IN-FLIGHT RESEARCH<br>TOPIC: 98            OFFICE: SGRD-RMA | ARMY | \$ 44,236 |
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INVESTIGATIONS INTO HELICOPTER PILOT FATIGUE REQUIRE THAT EXTERNAL WIND FORCES BE KNOWN IN ORDER TO CORRELATE THE PILOT'S REACTION AND MOTIONS. TO FULLY SEPARATE THE FORCES AND RESPONSES, THE WIND SENSORS MUST HAVE A RESPONSE TIME SHORTER THAN EITHER THE PILOT OR VEHICLE REACTION TIMES.

THIS PROPOSAL DESCRIBES AN AIR VELOCITY SENSING TECHNIQUE WHICH DETECTS THE VORTICES THAT ARE SHED FROM A SMALL ROD HELD IN THE AIRSTREAM. THE VORTEX SHED FREQUENCY IS DIRECTLY PROPORTIONAL TO THE AIR VELOCITY AND WITH A SMALL VORTEX ROD SIZE, VORTEX FREQUENCIES OF SEVERAL THOUSAND PER SECOND ARE OBTAINED. SINCE EACH VORTEX IS AN INDEPENDENT MEASURE OF THE AIRSPEED DURING ITS FORMATION, RESPONSE TIMES OF LESS THAN ONE MILLISECOND CAN BE OBTAIN.

THE WIND VECTORS WILL BE SEPARATED INTO TWO COMPONENTS AND EACH COMPONENT MEASURED. THE VORTICES ARE DETECTED USING AN ULTRASONIC IMAGING TECHNIQUE.

INSTRUMENTS USING THIS TECHNIQUE HAVE BEEN TEST FLOWN ON HELICOPTERS AS AIRSPEED AND DIRECTION SENSORS. HOWEVER, IN THOSE APPLICATIONS, RESPONSE TIMES WERE NOT CRITICAL.

THE SAME SENSING TECHNIQUE HAS BEEN USED IN AUTOMOBILE AIR INTAKE SENSORS WHERE RESPONSE TIMES OF LESS THAN 10 MILLISECONDS WERE MEASURED. THIS LENDS PROMISE THAT THE AIRSPEED SENSOR, COMBINED WITH THE FAST PROCESSING OF THE AUTOMOBILE SENSOR WILL FULFILL THE REQUIREMENTS OF THIS PROGRAM.

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| J. A. GREEN CO.<br>P.O. BOX 874<br>TRINIDAD, CA 95570<br>ALBERT C. HOLT<br>TITLE:<br>ULTRASONIC STRESS MEASUREMENTS<br>TOPIC: 41            OFFICE: DRSTA-RGI | ARMY | \$ 69,660 |
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WE WISH TO INVESTIGATE THE FEASIBILITY OF MANUFACTURING AN

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>----- | AWARDED<br>AMOUNT<br>----- |
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INSTRUMENT WHICH WILL MEASURE TENSILE STRESS IN A BOLT INEXPENSIVELY, WITHOUT DISTURBING THE BOLTED JOINT, AND WITH ACCESS TO ONLY ONE END OF THE BOLT. COMMERCIALY AVAILABLE EQUIPMENT WILL BE USED TO TEST THE CONCEPT.

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| J. STAFFORD ASSOCIATES<br>20 WEST POINT PLACE<br>SAN MATEO, CA 94402<br>JOSEPH STAFFORD<br>TITLE:<br>IMPROVED DESIGN FOR ISOCON CAMERAS IN THE HERTR SYSTEM<br>TOPIC: 90 OFFICE: NSWC | NAVY | \$ 49,005 |
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THE ISOCON IS A UNIQUE CAMERA TUBE AND PARTICULARLY USEFUL FOR X-RAY APPLICATIONS. THE PROBLEM WITH THE HERTR CAMERA SYSTEM IS NOT WITH THE TUBE BUT RATHER WITH THE CAMERA DESIGN. THE PROPOSAL SUGGESTS THAT THE CAUSE OF THE EARLY TUBE FAILURE BE ISOLATED, AND WITH THIS INFORMATION, A NEW CAMERA BE DESIGNED WHICH REMOVES THIS WEAKNESS AND INCORPORATES INTO THE DESIGN THE LATEST IMPROVEMENTS IN SOME OF THE MAJOR COMPONENTS, I.E. CAMERA YOKE, AND HIGH VOLTAGE SUPPLIES, WHICH ARE BELIEVED TO UNDERLY THE CURRENT CAMERA'S DEFICIENCIES.

THIS INVESTIGATOR HAS EXPERIENCED THE SAME TYPE OF PROBLEM WITH THE PREVIOUS ISOCON CAMERA DESIGNS. THE PROBLEM WAS REMOVED AND NOW THERE ARE APPROXIMATELY 80 OF THESE CAMERAS INSTALLED WORLDWIDE. SINCE 1976 ONLY 2 CAMERA TUBES HAVE FAILED. THESE CAMERAS ARE INSTALLED IN INDUSTRIAL ENVIRONMENTS. THE NAVY HAS ONE OF THESE CAMERAS AT NWC CONCORD, CA.

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| JOHN BROWN ASSOCIATES, INC.<br>P.O. BOX 145<br>BERKELEY HEIGHTS, NJ 09722<br>DR. JOHN A. BROWN<br>TITLE:<br>OXYGEN SENSOR DEVELOPMENT<br>TOPIC: 9 OFFICE: ASD/ENO | AF | \$ 24,608 |
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THIS PROGRAM WILL DEVELOP AND CALIBRATE AN ELECTRONIC SENSOR TO

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>----- | AWARDED<br>AMOUNT<br>----- |
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VERIFY THE PARTIAL PRESSURE OF OXYGEN ACTUALLY BEING DELIVERED TO AIRCREWS AT BOTH HIGH AND LOW ALTITUDES. IT WILL READ OUT CONTINUOUSLY AND IN REAL TIME AND CAN BE SET TO TRIGGER AN ALARM IF THE OXYGEN PARTIAL PRESSURE VARIES OUTSIDE PREDETERMINED LIMITS.

THE SENSOR IS BASED ON THE REVERSIBLE SORPTION OF OXYGEN INTO A SUBSTRATE SUCH AS RUBRENE, SALCOMINE OR ONE OF SEVERAL METAL COMPLEXES ON VIBRATING PIEZOELECTRIC CRYSTAL WHOSE FREQUENCY DEPENDS UPON THE AMOUNT OF MATERIAL (OXYGEN) SORBED, SO THAT THE CRYSTAL'S FREQUENCY IS A DIRECT FUNCTION OF THE OXYGEN PARTIAL PRESSURE. THE GENERAL TECHNOLOGY, THE HARDWARE AND THE ELECTRONICS ARE ALL STANDARD; ONLY THE OXYGEN SUBSTRATE NEEDS TO BE DEMONSTRATED, AND THE ROUTE TO THAT IS CLEAR.

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| K F O ASSOCIATES, INC.<br>54 W. ALLENDALE AVENUE<br>ALLENDALE, NJ 07401<br>DR. ARTHUR COX<br>TITLE:<br>HIGH GAIN/DIRECTIVE SCREENS FOR VEHICLE SIMULATION<br>TOPIC: 113            OFFICE: NTEC | NAVY | \$ 66,257 |
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THE PRESENTATION SUBMITTED HERewith PROPOSES THAT A SPHERICAL SURFACE DOME BE APPROXIMATED BY COVERING ARRAY OF FLAT PANELS OF SUITABLE DIMENSIONS. THE SCREEN WOULD BE A COMPOUND STRUCTURE, HAVING A REFRACTING AS WELL AS A REFLECTING SURFACE. THE SECTION WOULD CARRY AN ARRAY OF PARALLEL CYLINDRICAL LENSES. THE FRESNEL SURFACE (THE SECOND PANEL) WOULD BE AT RIGHT ANGLES TO THE FIRST SURFACE AND CEMENTED TOGETHER.

THE SPREAD OF THE RAYS, AS THEY PASS THROUGH THIS FOCUS, IS DELINEATED BY THE RATIO OF THE PITCH BETWEEN SUCCESSIVE REFLECTING SURFACES AND THE RADIUS OF CURVATURE GIVEN TO EACH SURFACE. ACTUALLY, THE SPREAD OF LIGHT RETURNED BY THE PANELS IS GOVERNED IN ONE DIRECTION BY THE CURVATURE ON THE REFLECTING FRESNEL SURFACES, AND IN THE DIRECTION AT RIGHT ANGLES TO THIS SPREAD, IS GOVERNED BY THE PITCH AND CURVATURE OF THE CYLINDRICAL LENSES.

IF A DOME, HAVING A RADIUS OF TWENTY FEET, HAS A SIX FOOT DIAMETER SPHERE VIEWING AREA TO ACCOMODATE THE PILOT AND COPILOT; AND IF THE PITCH OF THE REFLECTING AND REFRACTING SURFACE ELEMENT IS .040 INCHES, THEN AN IDEA GOING 44:1 IS POSSIBLE.

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>---- | AWARDED<br>AMOUNT<br>----- |
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IT IS THE PURPOSE OF THIS PROPOSAL TO STUDY, ANALYZE AND COMPARE THE CURRENTLY AVAILABLE SCREEN AND TO EVALUATE THEM WITH RESPECT TO THE DESIGN PROPOSED HEREIN. A SUCCESSFUL CONCLUSION WOULD LEAD TO A PROTOTYPE ASSEMBLY FOR PURPOSES OF EVALUATION.

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| KETRON, INC.<br>HICKORY HILL PLAZA, 151 S. WARNER RD.<br>WAYNE, PA 19087<br>DR. WILLIAM DOUGLAS<br>TITLE:<br>POST ATTACK DAMAGE ASSESSMENT FOR A MANNED DEEP BASE<br>TOPIC: 251            OFFICE: BMO/PMX | AF | \$ 74,100 |
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DEEP BASING OF ICBM'S WHICH OFFERS DISTINCT ADVANTAGES IN TERMS OF FORCE SURVIVABILITY, MUST HAVE AN EFFECTIVE POST-ATTACK EGRESS SYSTEM. A PRINCIPAL CONCERN IS THE INABILITY TO ACHIEVE RAPID EGRESS FROM THE BASE THROUGH PARTIALLY FRACTURED GROUND. A SYSTEM IS NEEDED TO SUPPORT EGRESS OPERATIONS BY ASSESSING DAMAGE AND PROVIDING GRAPHICAL INFORMATION CONCERNING GEOLOGICAL CONDITIONS TO THE BASE COMMANDER. THIS PROPOSAL ADDRESSES THE ISSUE OF DAMAGE ASSESSMENT BY INTEGRATING EXISTING INFORMATION AND RESEARCH ACTIVITIES IN THE AREAS OF GROUND RADAR AND SEISMIC SYSTEMS, GEOSTATISTICS, AND COMPUTERIZED MAPPING INTO THE CONCEPTUAL DESIGN OF A DAMAGE ASSESSMENT SYSTEM. A COMPUTERIZED MAPPING INTO THE CONCEPTUAL OF A DAMAGE ASSESSMENT SYSTEM. A COMPUTERIZED ANALYTICAL MODEL OF SYSTEM PERFORMANCE WILL BE DEVELOPED AND APPLIED TO EVALUATE CANDIDATE SYSTEM CONFIGURATIONS. THE MODEL WILL BE EXERCISED TO EVALUATE PERFORMANCE OF THESE SYSTEMS IN CONJUNCTION WITH GEOLOGIC CHARACTERISTICS OF THE DEEP BASE AND RELATED DAMAGE SCENARIOS. THE RESULTS OF THE PHASE I RESEARCH WILL ESTABLISH THOSE SYSTEM CONFIGURATIONS FOR WHICH ENGINEERING DESIGN AND EVALUATION ARE TO BE CONDUCTED DURING THE PHASE II RESEARCH PROGRAM.

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| KLEIN ASSOCIATES<br>740 WRIGHT ST<br>YELLOW SPRINGS,, OH 45387<br>GARY A. KLEIN PH.D.<br>TITLE:<br>A NATURALISTIC STUDY OF DECISION MAKING UNDER TIME STRESS<br>TOPIC: 110            OFFICE: PERI-PO | ARMY | \$ 49,722 |
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IT IS ESSENTIAL THAT WE UNDERSTAND THE COGNITIVE PROCESS UNDERLYING

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>---- | AWARDED<br>AMOUNT<br>----- |
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STRATEGIC AND TACTICAL DECISIONMAKING IN ORDER TO PROVIDE THE MOST USEFUL TYPES OF DECISION SUPPORT. UNFORTUNATELY, MOST OF THE RESEARCH ON DECISIONMAKING HAS AIMED AT ASSESSING THE APPLICABILITY OF FORMAL STATISTICAL DECISION MODELS UNDER HIGHLY STRUCTURED AND ARTIFICIAL LABORATORY CONDITIONS. IT IS NOT SURPRISING THAT THIS RESEARCH HAS FAILED TO PROVIDE AN UNDERSTANDING OF NATURAL DECISIONMAKING PROCESSES UNDER COMPLEX AND STRESSFUL REAL-WORLD CONDITIONS.

THE PROPOSED RESEARCH IS BASED ON A HEURISTIC MODEL FORMULATED WITHIN A NATURALISTIC FRAMEWORK RATHER THAN A CONTEXT OF DECISION ANALYSIS. THE OBJECTIVES OF THE PROPOSED RESEARCH ARE TO ASSESS THE VALUE OF THE MODEL AS A DESCRIPTION OF DECISIONMAKING UNDER COMPLEX AND STRESSFUL CONDITIONS, AND TO INCREASE OUR UNDERSTANDING OF THESE ASPECTS OF DECISIONMAKING. THE RESEARCH WILL FOCUS ON NATURALISTIC OBSERVATION OF DECISIONMAKING IN THE CONTEXT OF EMERGENCY FIREFIGHTING. THESE CONDITIONS INCLUDE THE CRITICAL DIMENSIONS OF HIGH STRESS, INFORMATION UNCERTAINTY, PERSONAL INVOLVEMENT, AND RISK OF HUMAN LIFE. THE RESULTS WILL BE ASSESSED TO DETERMINE THE PARAMETERS THAT AFFECT NATURALISTIC DECISIONMAKING UNDER STRESS AND UNCERTAINTY, AND TO SUGGEST AN APPROACH FOR DECISION-AID SYSTEMS.

KLM TECHNOLOGIES, INC.  
1776 YGNACIO VALLEY ROAD, SUITE 204  
WALNUT CREEK, CA 94958  
B. GEORGE KNIAZEWYCZ

AF \$ 48,504

TITLE:  
DEVELOPMENT OF AN INTEGRATED WASTE WATER TREATMENT/PURIFICATION SYSTEM  
TOPIC: 247 OFFICE: BMO/PMX

THE AIR FORCE DEEP BASE FACILITIES MUST OPERATE AS AN ISOLATED ENVIRONMENT FOR UPWARD OF ONE YEAR. KLM TECHNOLOGIES IS PROPOSING TO DEVELOP A WASTE WATER TREATMENT AND PURIFICATION SYSTEM TO HANDLE LIQUID DOMESTIC, INDUSTRIAL AND MEDICAL WASTE STREAMS. THESE WASTES POSE A CHALLENGE TO PROVIDING A HIGHLY RELIABLE, LOW MAINTENANCE, LOW COST AND LOW ENERGY SYSTEM WITH MINIMAL RESIDUE AND DISCHARGES. KLM IS PROPOSING A PHASE I PROGRAM TO EVALUATE NUMEROUS ALTERNATIVES AND TO DETERMINE A RECOMMENDED APPROACH FOR PROTOTYPE DEVELOPMENT IN PHASE II. KLM'S APPROACH IS BASED UPON PROVEN TECHNOLOGY FOR TREATMENT OF HUMAN WASTE, DOMESTIC GREYWATER

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>----- | AWARDED<br>AMOUNT<br>----- |
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AND VARIOUS INDUSTRIAL WASTE STREAMS. KLM IS SUGGESTING THE USE OF MEMBRANCE TECHNOLOGIES - INCLUDING REVERSE OSMOSIS AND ULTRAFILTRATION IN CONJUNCTION WITH A BIOLOGICAL BLACKWATER TREATMENT SYSTEM AS THE BASES FOR OUR APPROACH. HOWEVER, PHASE I WILL EMPHASIZE A THOROUGH EVALUATION OF THE NEEDS AND FEASIBLE ALTERNATIVES. PHASE II WILL INVOLVE ACTUAL DEVELOPMENT.

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| KMS FUSION INC<br>PO BOX 1567 3621 S. STATE RD<br>ANN ARBOR, MI 48106<br>GEORGE E. BUSCH<br>TITLE:<br>LIE DETECTOR FOR O2 SUPER SCRIPT 1 DELTA G<br>TOPIC: 219                      OFFICE: AFWL/PRP | AF | \$ 75,000 |
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SINGLET DELTA OXYGEN PROVIDES A SOURCE OF ELECTRONIC ENERGY FOR CHEMICALLY PUMPED LASER SYSTEMS, MOST NOTABLE THE OXYGEN-IODINE LASER. SEVERAL IMPORTANT REACTIONS IN THE OXYGEN-IODINE LASER MAY DEPEND CRITICALLY ON THE AMOUNT OF VIBRATIONAL EXCITATION IN THE SUPER SCRIPT 1 DELTA G STATE. IN THIS PROPOSAL, WE EVALUATE SEVERAL TECHNIQUES FOR MEASURING THE POPULATION OF VIBRATIONALLY EXCITED O2 SUPER SCRIPT 1 DELTA G. THE LASER-INDUCED EMISSION (LIE) DETECTION METHOD IS SELECTED BECAUSE OF SUPERIOR SIGNAL-TO-NOISE CHARACTERISTICS AND EXCELLENT SENSITIVITY. THE LIE DETECTOR FOR O2 SUPER SCRIPT 1 DELTA G CONSISTS OF A PHOTODETECTOR AND A TUNABLE, PULSED LASER OPERATING IN THE NEIGHBORHOOD OF 1.9 MICROMETERS, THE WAVELENGTH REQUIRED FOR EXCITATION OF THE SUPER SCRIPT 1 DELTA G YIELDS SUPER SCRIPT 1 SIGMA G ELECTRONIC TRANSITION IN O2. THE NARROW BANDWIDTH OF THE LASER WILL ALLOW SELECTIVE EXCITATION OF ROTATIONAL STATES IN THE V = 0 OR V = 1 LEVEL OF O2 SUPER SCRIPT 1 DELTA G. EMISSION FROM THE SUPER SCRIPT SIGMA G YIELDS SUPER SCRIPT 3 SIGMA G TRANSITION, MODULATED BY THE 10 HZ LASER, WILL BE SYNCHRONOUSLY DETECTED. IN PHASE I, THE TUNABLE LASER WILL BE CONSTRUCTED AND THE SENSITIVITY OF LIE DETECTOR FOR O2 SUPER SCRIPT 1 DELTA G WILL BE EVALUATED.

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| KMS FUSION, INC.<br>3621 SOUTH STATE ROAD, P.O. BOX 1567<br>ANN ARBOR, MI 48106<br>JOSEPH F. MCGRATH<br>TITLE:<br>THE DEVELOPMENT OF HYDROCODES ON THE HEP<br>TOPIC: 179                      OFFICE: AFOSR/XOT | AF | \$ 75,000 |
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ATTAINABLE COMPUTATION RATES ON COMPUTERS WITH SERIAL ARCHITECTURE

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>----- | AWARDED<br>AMOUNT<br>----- |
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ARE A SERIOUS LIMITATION FOR THE SIMULATION OF THE HYDRODYNAMIC BEHAVIOR OF FLUIDS. COMPUTERS WITH PARALLEL PROCESSING ARCHITECTURE CAN ACHIEVE MUCH HIGHER RATES. THE COMPUTER RESEARCH AND APPLICATIONS GROUP AT LOS ALAMOS NATIONAL LABORATORIES IS MAKING THEIR DENELCOR HEP COMPUTER AVAILABLE FOR RESEARCH PROJECTS CONDUCTED BY OTHER INSTITUTIONS. THIS MACHINE IS A PARALLEL PROCESSOR. FOR A PHASE I RESEARCH CONTRACT, KMS FUSION PROPOSES A THREE-STEP PLAN FOR THE DEVELOPMENT OF HYDROCODES ON THE HEP. FIRST, WE WILL WRITE AN EXPLICIT, ONE-DIMENSIONAL LAGRANGIAN CODE. IN THIS CASE, THE DIFFERENCE EQUATIONS CAN BE READILY FORMULATED FOR CONCURRENT PROCESSING. SECOND, AN IMPLICIT VERSION WILL BE DEVELOPED IN ORDER TO ACHIEVE UNCONDITIONAL STABILITY. PARALLELIZATION WILL BE ACCOMPLISHED VIA AN A PRIORI, SYMBOLIC INVERSION OF THE UNDERLYING LINEAR SYSTEM. THIRD, A REZONING ALGORITHM WILL BE USED AFTER LAGRANGIAN TIME STEP TO CONVERT THE PROGRAM TO AN IMPLICIT EULERIAN HYDROCODE.

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| KMS FUSION, INC.<br>P.O. BOX 1567<br>ANN ARBOR, MI 48106<br>STEPHEN W. SMITH<br>TITLE:<br>DEVELOPMENT OF A RUGGEDIZED LOW COST MICROCOMPUTER<br>TOPIC: 134            OFFICE: NASC | NAVY | \$ 64,310 |
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STATE-OF-THE-ART COMPUTER TECHNOLOGY IS CURRENTLY UNDER-UTILIZED IN SEVERE ENVIRONMENT APPLICATIONS. THIS SITUATION IS A DIRECT RESULT OF THE SEVERE ENVIRONMENTS. LOW COST COMPUTER SYSTEMS ARE NOT SUFFICIENTLY RUGGEDIZED TO PROVIDE RELIABLE OPERATION IN THESE ENVIRONMENTS WHILE FULLY MILITARIZED COMPUTERS ARE PROHIBITIVELY EXPENSIVE FOR USE IN THESE APPLICATIONS. THIS PROPOSED DEVELOPMENT EFFORT WILL APPLY INNOVATIVE RUGGEDIZATION TECHNIQUES TO STATE-OF-THE-ART COMPUTER HARDWARE. THE RUGGEDIZED MICROCOMPUTER TO BE DEVELOPED WILL UTILIZE MICROPROCESSORS SUCH AS THE Z-80 AND 8088 TO INSURE SOFTWARE COMPATABILITY WITH DEFACTO OPERATING SYSTEMS SUCH AS CP/M AND MS-DOS WITH THEIR LARGE BASE OF APPLICATIONS SOFTWARE.

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| KNIGHTRONIX, INC.<br>2105 MISSISSIPPI CIRCLE<br>NEW BRIGHTON, MN 55112<br>ARNOLD W. KNIGHT<br>TITLE:<br>RAPID AND ACCURATE PERSONNEL IDENTIFICATION<br>TOPIC: 248            OFFICE: BMO/PMX | AF | \$ 48,579 |
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THE POSIDENT CONCEPT USES FINGER PRINT IDENTIFICATION SYSTEM TO

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>---- | AWARDED<br>AMOUNT<br>----- |
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COMPARE THE SUBJECTS LIVE FINGER PRINT WITH A STORED FINGER PRINT. THE STORAGE MEDIUM CAN BE ONE OF SEVERAL TYPES. A PHOTOGRAPHIC IMAGE IS ONE METHOD OF STORAGE. DIGITAL DATA IN PROM IS A SECOND METHOD. THE ID CARD IS PLACED ON THE ELECTRO-OPTICAL CORRELATION DEVICE. A VIDEO CAMERA (VIDICON OR SOLID STATE CCD CAMERA) IS USED TO SCAN THE FINGER PRINT PHOTO AS WELL AS THE ACTUAL FINGER PRINT. THE KEY AND UNIQUE FEATURE OF THE OPTICAL SYSTEM IS THAT IT CAN UTILIZE VISIBLE OR NEAR INFRA-RED LIGHT TO SCAN THE FINGER PRINT IMAGES. THE CONTRAST BETWEEN THE FINGER PRINT RIDGES THAT CONTACT THE GLASS AND THE VALLEYS BETWEEN IS VERY DISTINCT. THE RESULT IS A HIGH CONTRAST, BINARY LEVEL SIGNAL, WHICH IS EASILY USED BY A DIGITAL PROCESSOR TO CORRELATE THE FINGER PRINT IMAGES.

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| KOFORD ENGINEERING<br>234 LALONDE AVE<br>ADDISON, IL 60101<br>STUART KOFORD<br>TITLE:<br>MANUFACTURING METHODS FOR THE ECONOMIC FABRICATION AND STRUCTURAL APPLICATION OF FIBER REINFORCING ORGANIC MATRIX COMPOSITES<br>TOPIC: 45 OFFICE: DRXMR-PP | ARMY | \$ 39,387 |
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THIS PROJECT INVOLVES FORMULATION OF HIGH PERFORMANCE ADHESIVES WHICH CURE RAPIDLY AT AMBIENT TEMPERATURE OR SLIGHTLY ELEVATED TEMPERATURES SUCH AS CAN BE PROVIDED WITH A HEAT GUN. EMPHASIS WILL BE PLACED ON HIGH PERFORMANCE SYSTEMS INCLUDING RUBBER MODIFIED SYSTEMS AND PREPREG SYSTEMS WHICH CAN BE STORED IN FROZEN CONDITIONS AND WILL CURE IN 2 TO 4 HOURS AT ROOM TEMPERATURE. PHASE I WILL INVOLVE FEASIBILITY AND PRELIMINARY SCREENING INCLUDING: GELL TIME, RT AND ELEVATED TEMPERATURE LAP SHEAR FOR ADHESIVES AND TENSILE TESTING FOR PREPREGS.

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| KOFORD ENGINEERING<br>234 LALONDE AVE<br>ADDISON, IL 60101<br>STUART KOFORD<br>TITLE:<br>IMPROVED AIRCRAFT WIRING AND CONNECTOR PERFORMANCE<br>TOPIC: 6 OFFICE: ASD/AE | AF | \$ 45,000 |
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TECHNICAL CRITERIA FOR THE DESIGN AND EVALUATION TESTING OF

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>----- | AWARDED<br>AMOUNT<br>----- |
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ELECTRICAL CONNECTORS AND WIRING WILL BE DEVELOPED WITH THE OBJECTIVE OF IMPROVING MTBF AND REDUCING MANPOWER ASSOCIATED WIRING. A PORTION OF THIS WORK WILL INCLUDE ANALYSIS OF THE EXTENT AND SOLUTIONS FOR INTERMITTENT "CANNOT DUPLICATE FAILURE" CONDITIONS.

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| L'GARDE, INC.<br>1555 PLACENTIA AVENUE<br>NEW RT BEACH, CA 92663<br>GAYLE D. BILYEU<br>TITLE:<br>MAGNETIC INDUCTION DATA TRANSFER SYSTEM<br>TOPIC: 9 OFFICE: DRDAV-PD | ARMY | \$ 65,603 |
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A SCHEME IS PROPOSED TO ALLOW DATA TRANSFER ACROSS ROTATING INTERFACES USING MAGNETIC INDUCTION. SEVERAL MECHANIZATIONS WILL BE STUDIED IN THE LABORATORY USING SIMPLE TEST, AND ANALYSIS WILL BE PERFORMED OF SUPPORTING ELECTRONICS. THE OBJECTIVE OF PHASE I IS TO DETERMINE THE BEST CONFIGURATION THAT WILL RESULT IN HIGH-QUALITY DATA TRANSMISSION AT LOWEST COST.

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| LABUDDE ENGINEERING CORPORATION<br>650 HAMPSHIRE ROAD, SUITE 200<br>WESTLAKE VILLAGE, CA 91361<br>DR. ROBERT HAZEL<br>TITLE:<br>READ/WRITE/ERASE MATERIALS FOR OPTICAL DIGITAL DISK APPLICATIONS<br>TOPIC: 240 OFFICE: DORM | AF | \$ 75,000 |
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THE PHASE I PROPOSAL IS FOR THE EXPLORATORY RESEARCH INTO MATERIALS FOR ERASABLE OPTICAL DISKS. THE MAJOR EFFORT IN PHASE I WILL BE: (1) THE DEVELOPMENT OF A BASIC MEDIA TEST STAND FOR TESTING SMALL MEDIA SAMPLES, (2) THE EVALUATION OF CANDIDATE MEDIA SAMPLES FROM VARIOUS RESEARCHERS IN THE FIELD AND (3) A FINAL REPORT WITH A COMPARISON OF TEST RESULTS AND RECOMMENDATIONS AS TO THE MOST VIABLE MATERIALS FOR FUTURE RESEARCH.

FISCAL YEAR 1984

| SUBMITTED BY<br>-----   | DEPT<br>---- | AWARDED<br>AMOUNT<br>----- |
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| LAUREN MFG. COMPANY<br>2228 REISER AVENUE, S.E.<br>NEW PHILADELPHIA, OH 44663<br>JAMES R. HAMILTON, III<br>TITLE:<br>SEALING SYSTEM FOR MUNITIONS CONTAINER<br>TOPIC: 227            OFFICE: AD/CZO | AF           | \$ 13,700                  |

LAUREN IS THE LEADING U.S. DEVELOPER AND PRODUCER OF HIGH-PERFORMANCE RUBBER EXTRUSIONS FOR SEALS AND GASKETS. THE COMPANY OFFERS THE STATE-OF-THE-ART IN GASKET DESIGNS, MATERIALS FORMULATION AND COMPOUNDING, AND PRODUCTION QUALITY AND DIMENSIONAL CONTROL. FURTHER, ADVANCED GASKET ADHENSION SYSTEMS HAVE BEEN DEVELOPED JOINTLY WITH 3M COMPANY AND OTHERS, AND ARE ROUTINELY INCORPORATED IN LAUREN PRODUCTS THROUGH LAUREN'S ADVANCED EXTRUSION PROCESS LINE. LAUREN PROPOSES TO INVESTIGATE ARAMAMENT DIVISION'S MUNITION CONTAINER SEALING NEEDS AND OBJECTIVES. AN IMPROVED SEALING SYSTEM WILL BE RECOMMENDED, DEVELOPED AND TESTED. THE RESULTING SYSTEM SPECIFICATIONS WILL INCLUDE MECHANICAL SEAL DESIGN, MATERIALS, MATERIALS PROCESSING REQUIREMENTS, EXTRUSION DIE DESIGN, ADHESIVE SYSTEMS AND PROCESSING, AND FINAL PRODUCTION PROCESSING REQUIREMENTS.

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| LEHRER-PEARSON INC.<br>1175 KOTTINGER DRIVE<br>PLEASANTON, CA 94566<br>J. W. PEARSON<br>TITLE:<br>PRECISION CATHODE FABRICATION PROCESS AND TESTING<br>TOPIC: 160            OFFICE: AFOSR/XOT | AF | \$ 31,900 |
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USE OF A SPECIAL, HIGH STIFFNESS PRECISION TURNING MACHINE WITH A POLYCRYSTAL CUBIC BORON NITRIDE TOOL BIT PROMISES TO ALLOW CATHODE EMITTER SURFACE FINISHING FREE, OR AT LEAST FREER, OF THE SMEARING, TEARING, AND PLASTIC FLOW OF CATHODE MATERIAL (SINTERED TUNGSTEN) COMMON TO CONVENTIONAL PROCESS. MICROSCOPIC COMPARISON OF A CONVENTIONAL DISPENSER CATHODE SURFACE FINISH USING A HARDINGE LATHE AND A TUNGSTEN CARBIDE TOOL BIT, WITH A PRECISION FINISHED CATHODE, SHOWED THE PRECISION FINISHED SURFACE APPARENTLY FREE OF TUNGSTEN CRYSTAL DAMAGE. THIS PROCESS PROMISES TO IMPROVE BOTH

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>---- | AWARDED<br>AMOUNT<br>----- |
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UNIFORMITY OF SINTERED TUNGSTEN POROSITY AND AN IMPROVED WORK FUNCTION. THE PROCESS IS THE SUBJECT OF A PATENT APPLICATION AND ALL RIGHTS THERETO ARE RESERVED.

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| LINK TELECOMMUNICATIONS<br>2400 COMPUTER DRIVE<br>WESTBOROUGH, MA 01581<br>PETER C. DUNHAM<br>TITLE:<br>LOCAL AREA NETWORK (LAN) COMPONENTS<br>TOPIC: 277            OFFICE: ESD/PKR | AF | \$ 56,959 |
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BROADBAND LOCAL AREA NETWORK PRODUCTS ARE REACHING A NEW LEVEL OF CAPABILITY. THIS NEW GENERATION OF PRODUCTS APPEARS TO PROVIDE SOLUTIONS TO SECURITY AND MULTI DISCIPLINE PROTOCOL TRANSLATION REQUIREMENTS FOR MILITARY NETWORKS. THIS PROJECT WILL EVALUATE AND DETERMINE OPTIMUM APPROACHES FOR INCORPORATING THESE CAPABILITIES WHILE UPGRADING THEIR EQUIPMENT DESIGN TO ALLOW OPERATION IN HARSH MILITARY ENVIRONMENTS. THE OBJECTIVE IS TO INCORPORATE THESE IMPROVEMENTS WHILE MAINTAINING LOW COST AND COMMERCIAL SUITABILITY, THEREBY ENABLING HIGH VOLUME PRODUCTION OF BOTH MILITARY AND COMMERCIAL LAN COMPONENTS.

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| LORD AND GRAYSON, INC.<br>11-15 RIVER ROAD<br>FAIR LAWN, NJ 07410<br>DR DANIEL RAICHEL<br>TITLE:<br>USE OF ROBOTICS IN AUTOMATIC FACTORY ASSEMBLY<br>TOPIC: 70            OFFICE: NSWC | NAVY | \$ 49,775 |
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AN EXISTING ROBOTICS DEVICE, NAMELY THE UNIMATE 1000, WHICH INCORPORATES FIVE DEGREES OF MOTIONAL FREEDOM, WILL BE USED IN THE DEVELOPMENT OF MANUFACTURING PROCEDURES WHICH RENDER SMALL SCALE PRODUCTION RUNS ECONOMICALLY FEASIBLE. EMPHASIS WILL BE PLACED ON USING EXISTING TOOLING ATTACHMENTS OR ADAPTING OR MODIFYING SUCH DEVICES TO MACHINE METAL OR PLASTIC PIECEWORK WITH A HIGH DEGREE OF PRECISION AND TO PREFORM SIMPLE

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>---- | AWARDED<br>AMOUNT<br>----- |
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(BUT PRECISE) ASSEMBLY OPERATIONS. MACHINING AND/OR ASSEMBLING TOLERANCES WOULD BE IN THE ORDER OF 5 MILS OR LESS. MACHINING OPERATIONS WHICH WILL BE INVESTIGATED INCLUDE: MILLING, BORING, TAPPING, REAMING AND PLANNING. OPERATIONAL RELIABILITY, IN TERMS OF UNFAILING REPEATABILITY OF MANUFACTURING PROCESSES, CONSTITUTE A FACTOR IN ESTABLISHING QUALITY CONTROL AN ECONOMIC FEASIBILITY.

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| LOS ALAMOS TECHNICAL ASSOCIATES, INC.<br>1650 TRINITY DRIVE, P.O. 410<br>LOS ALAMOS, NM 87544<br>DR. MARVIN HOFFMAN<br>TITLE:<br>DEVELOPMENT OF A METHOD FOR FRONT SURFACE PYROMETRY AT THE TRI-SERVICES THERMAL FLASH FACILITY<br>TOPIC:       2           OFFICE: OAAM | DNA | \$ 48,934 |
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AN IMPROVED TECHNIQUE FOR MEASURING THE FRONT-SURFACE TEMPERATURE OF SAMPLES BEING TESTED AT THE TRI-SERVICES THERMAL RADIATION TEST FACILITY, WRIGHT-PATTERSON AFB, IS PROPOSED. THE NEW METHOD WILL BE DESIGNED TO TAKE ADVANTAGE OF THE SPECTRAL CHARACTERISTICS OF THIS FACILITY. RADIATION PYROMETRY HAS BEEN SELECTED AS THE ONLY VIABLE TECHNIQUE THAT CAN PROPERLY MEASURE THE SURFACE TEMPERATURE BECAUSE IT IS CAPABLE OF MEASURING VERY HIGH TEMPERATURES, DOES NOT REQUIRE CONTACT WITH THE SURFACE, HAS A VERY SHORT TIME CONSTANT, AND CAN TAKE MEASUREMENT AT VARIOUS DISTANCES FROM THE SAMPLE. A PROTOTYPE RADIATION PYROMETRY DEVICE WILL BE DESIGNED AND FABRICATED FOR THE FACILITY. IT WILL BE TESTED TO VERIFY THAT THE PROPOSED DESIGN OBJECTIVES HAVE BEEN MET. A CALIBRATION TECHNIQUE WILL BE DEVELOPED AND DOCUMENTED FOR USE WITH THE SYSTEM.

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| LOS ALAMOS TECHNICAL ASSOCIATES, INC.<br>1650 TRINITY DRIVE, P.O. BOX 410<br>LOS ALAMOS, NM 87544<br>HELEN F. GRAM<br>TITLE:<br>ELECTROLYTIC STERILIZATION OF POTABLE WATER ON SHIPBOARD<br>TOPIC:       100           OFFICE: NSRDC | NAVY | \$ 49,627 |
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A SAFE, AESTHETICALLY ACCEPTABLE POTABLE WATER SUPPLY CAN BE PRODUCED

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>----- | AWARDED<br>AMOUNT<br>----- |
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ON SHIPBOARD BY ELECTROLYTICALLY GENERATING OZONE AND CHLORINE DIRECTLY IN THE WATER SUPPLY. THIS METHOD DOES NOT REQUIRE A SUPPLY OF HEAVY, HAZARDOUS CHEMICALS BUT GENERATES OZONE AND CHLORINE ELECTROLYTICALLY FROM SEA WATER AT AMBIENT TEMPERATURES, REQUIRING LITTLE POWER. OZONE AND CHLORINE IN COMBINATION ARE EXTREMELY EFFECTIVE IN KILLING MICROORGANISMS. THE OZONE BREAKS DOWN READILY TO OXYGEN, WHICH POSES NO HAZARD; THE CHLORINE RESIDUAL REMAINS TO PROVIDE BACTERIOSTATIC PROTECTION. UNDER THE PROPOSED PROJECT, AN ELECTROLYTIC CELL WILL BE MODIFIED FOR OPERATION AND MAINTENANCE UNDER ADVERSE SHIPBOARD CONDITIONS. THE CELL WILL BE TESTED USING SEA WATER AS THE ELECTROLYTE. THE RELATIONSHIP OF VOLTAGE AND AMPERAGE TO THE PRODUCTION RATE OF EACH CHEMICAL SPECIES WILL BE DETERMINED. THE MAXIMUM DILUTION RATIO OF BACTERIALLY CONTAMINATED FRESH WATER TO ELECTROLYZED SOLUTION AND THE TIME REQUIRED TO KILL ALL MICROORGANISMS WILL BE DETERMINED. RESIDUAL CHLORINE LEVEL IN THE STERILIZED SAMPLES WILL BE MEASURED AS A MEANS OF CONFIRMING ADEQUATE TREATMENT. A LABORATORY-SCALE DEMONSTRATION UNIT CAPABLE OF PRODUCING STERILE WATER AT A MINIMUM RATE OF 300 GAL/HR (7,000 GPD) WILL BE CONSTRUCTED AND TESTED, USING SEA WATER.

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| M. C. ROSEN<br>233-20 COLONNADE DRIVE<br>CHARLOTTESVILLE, VA 22901<br>R. J. SCHNECK<br>TITLE:<br>METHODOLOGY FOR THE PREDICTION OF SPARE AND REPAIR PART PRICES<br>TOPIC:        40                    OFFICE: NAVSUPSYS | NAVY | \$ 38,088 |
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A METHOD OF PREDICTION IS PROPOSED TO PROVIDE CREDIBLE, TIMELY AND COMPLETE PRICE INFORMATION ON SPARE PARTS AND REPAIR PARTS. THE METHODOLOGY, A NOVEL COMPUTER-BASED SYSTEMS APPROACH, IS ALSO APPLICABLE TO COMPLETE UNIT AND SUBASSEMBLY COST AND PRICE ESTIMATES. TECHNIQUES ARE PROPOSED TO ESTABLISH CRITERIA FOR MINIMUM EXPENDITURES AND REASONABLENESS OF PRICES PRIOR TO CONTRACT AWARD, AS WELL AS METHODS FOR A PROCUREMENT STRATEGY TO MATCH CHANGING CIRCUMSTANCES IN THE ECONOMY AND MODE OF OPERATION. THE CONCEPTS OF MATERIAL AND INFORMATION FLOW ARE INTRODUCED, AND A MEANS TO SEPARATE COST FROM PRICE IS PROPOSED. FOUR MAJOR PROBLEM CATEGORIES ARE IDENTIFIED: PARTS-SYSTEM, PROCESS-SYSTEM, COST-STRUCTURE AND DYNAMIC INVENTORY, AND ARE DISCUSSED IN DETAIL.

FISCAL YEAR 1984

| SUBMITTED BY<br>-----  | DEPT<br>---- | AWARDED<br>AMOUNT<br>----- |
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| MACHINE DESIGN ENGINEERS, INC.<br>19226 66TH AVENUE, S., SUITE L-109<br>KENT, WA 98032<br>VERN GOODWIN<br>TITLE:<br>DEVELOPMENT OF AN AIR-DEPLOYED FIBER OPTIC CABLE FLAT WINDER<br>TOPIC: 6 OFFICE: DARPA | DARPA        | \$ 54,462                  |

THE PHASE I PROPOSED WORK WILL PROVE THE FEASIBILITY OF A CONCEPT OF A MACHINE TO FLAT WIND FIBER OPTIC CABLE INTO PACKS SUITABLE FOR AIR DEPLOYMENT. THE WORK WILL INCLUDE EVALUATION OF THE CONCEPT AS TO THE MACHINE'S CAPABILITY TO WIND THE VARIOUS TYPES OF CABLE INTO FLAT LAYERS, SUCCESSFULLY TRANSITION FROM ONE LAYER TO THE NEXT, PROVIDE A PRE-TWIST, APPLY GLUE AND MATRIX COMPOUNDS, INTERFACE WITH CANNISTERS AND ADAPT TO COMPUTER CONTROL. A CLEAR PLASTIC, WORKING MODEL OF THE MACHINE WILL BE CONSTRUCTED AND USED FOR CONCEPT EVALUATION. A HAND OPERATED PROTOTYPE WILL BE DESIGNED AND BUILT FOR TESTING TO IDENTIFY PROBLEMS AND TO PROVE FEASIBILITY. A FINAL SUMMARY REPORT WILL BE PREPARED.

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| MARITIME ASSOCIATES, INC.<br>6211 OLD KEENE MILL COURT<br>SPRINGFIELD, VA 21152<br>LAWRENCE BALDWIN<br>TITLE:<br>LITERATURE REVIEW AND CRITIQUE OF METHODS OF ASSESS HUMAN PERFORMANCE IN DYNAMIC VEHICLE/OPERATOR SETTINGS<br>TOPIC: 97 OFFICE: SGRD-RMA | ARMY | \$ 27,395 |
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THIS PROPOSAL DESCRIBES THE APPROACH OFFERED BY MARITIME ASSOCIATES FOR EXECUTION OF A LITERATURE REVIEW AND CRITIQUE OF METHODS FOR ASSESSMENT OF HUMAN PERFORMANCE IN DYNAMIC VEHICLE/OPERATOR SETTINGS. THE REVIEW WILL HELP DETERMINE SUITABILITY OF TESTING AND EXPERIMENTAL METHODS USED FOR THIS PURPOSE. THE APPROACH PROPOSED WILL DRAW UPON HIGHLY RELEVANT EXPERIENCE OF MAI IN THE EXPERIMENT DESIGN, AND ANALYSIS OF DATA ACQUIRED IN DEVELOPMENT OF ADVANCED HELICOPTER FLIGHT CONTROL DISPLAY. PRIOR LITERATURE REVIEWS ON THIS TOPIC HAVE BEEN PERFORMED. RECENT WORK

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>----- | AWARDED<br>AMOUNT<br>----- |
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INCLUDED MATHEMATICAL MODEL DEVELOPMENT WHICH SPECIFICALLY ADDRESSES THIS ASSESSMENT PROBLEM.

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| MARLOWE ASSOCIATES INC.<br>4514 OLD COLUMBIA PIKE<br>ANNADALE, VA 22003<br>D.R. MOELLER<br>TITLE:<br>TACTICAL AIR OPERATIONS CENTRAL (TAOC) - 1985 SYSTEM RECONFIGURATION<br>TOPIC: 46            OFFICE: MARINE CORPS | NAVY | \$ 49,988 |
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THE OBJECTIVES OF THE TAOC-85 SYSTEM RECONFIGURATION-PHASE I STUDY ARE TO DETERMINE THE FEASIBILITY OF REDUCING THE WEIGHT OF THE TACTICAL AIR OPERATION MODULE SHELTER. THE SPECIFIED WEIGHT OF 10,000 LBS. IS BEING PREDICTED 15,000 LBS. BY THE PRIME CONTRACTOR. THE TAOM WILL BE TOO HEAVY FOR THE SUPPORTING MATERIAL HANDLING EQUIPMENT UNLESS THE WEIGHT IS REDUCED. THE STUDY WILL LOOK AT REDUCING UNIT WEIGHT OF ITEMS IN THE SHELTER, REDUCING THE STAND-ALONE SHELTER WEIGHT, AND DEFINING ALTERNATIVE SHELTER SIZES/CONFIGURATIONS WHICH WILL RESULT IN SMALLER, LIGHTER SHELTERS.

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| MARTIN ACOUSTICS SOFTWARE TECHNOLOGY<br>2627 BURGNER BLVD.<br>SAN DIEGO, CA 92110<br>GORDON E. MARTIN, PH.D<br>TITLE:<br>HIGH-RESOLUTION BEAMFORMING WITH GEVEV PROCESSING<br>TOPIC: 24            OFFICE: NESC | NAVY | \$ 49,988 |
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NEW GEVEV DIGITAL SIGNAL PROCESSING TECHNIQUES CAN PROVIDE SIGNIFICANTLY IMPROVED PERFORMANCE WITH HIGH RESOLUTION EVEN FOR SMALL ARRAYS. THE SIGNAL PROCESSORS USE GENERALIZED EIGENVECTOR/EIGENVALUE (GEVEV) SOLUTIONS FOR THE ESTIMATED SIGNAL-PLUS-NOISE MATRIX IN THE METRIC OF THE ESTIMATED NOISE-ONLY MATRIX. ALMOST ALL SIMILAR INVESTIGATIONS HAVE RELATED TO INCOHERENT NOISE (THAT WE CALL THE EVEV CASE); RESULTS WITH VERY HIGH RESOLUTION WERE ACHIEVED, EVEN WITH OTHER SIGNALS NEARBY. FAVORABLE SEPARATION

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>---- | AWARDED<br>AMOUNT<br>----- |
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IS EXPECTED OF COHERENT INTERFERENCE (INCLUDING MULTIPATHS) AND BROADBAND SIGNALS. GEVEV PROCESSORS HAVE GOOD RESOLUTION FOR LINEAR ARRAYS EVEN WITH ISOTROPIC INSTEAD OF INCOHERENT NOISE BUT SIGNIFICANT ANGULAR ERRORS OCCUR FOR NEAR-ENDFIRE ARRIVALS, SHOWING THE NEED FOR GEVEV. GEVEV IS COMPUTATIONALLY INTENSIVE, BUT NEW VLSI DEVELOPMENTS GUARANTEE PRACTICAL DESIGNS FOR DOD. PROPOSED GEVEV EFFORTS INVOLVE SIMULATIONS TO VERIFY ALGORITHM DEVELOPMENTS AND ANALYSES WITH DATA FROM REAL ARRAYS. THE PHASE I EFFORT WILL INVESTIGATE BOTH ACOUSTIC AND HF SETS OF REAL DATA AND WILL EVALUATE AT LEAST ONE SET. APPLICATIONS WILL BE SOUGHT IN WHICH THE NOISE-ONLY MATRIX FOR REAL ARRAYS CAN BE ESTIMATED EFFECTIVELY. CRITICAL INVESTIGATIONS WILL BE CONDUCTED TO ESTABLISH GEVEV REQUIREMENTS FOR PHASE II. HIGH-RESOLUTION GEVEV SYSTEMS ARE EXPECTED TO HAVE NEW BETTER LIMITS OF RESOLUTION AS A FUNCTION OF GAIN AND ARRAY DIMENSIONS, AND LIFE-CYCLE COST REDUCED BY NEW VLSI REAL-TIME HARDWARE.

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| MATERIAL CONCEPTS, INC.<br>666 NORTH HAGUE AVENUE<br>COLUMBUS, OH 43204<br>JOSEPH A. MOORE | ARMY | \$ 49,401 |
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TITLE:  
 THE FEASIBILITY OF USING ULTRASONICS TO ENHANCE LIQUID METAL INFILTRATION OF REINFORCING YARNS AND FIBERS  
 TOPIC: 22 OFFICE: DRDME-PM

SEVERAL NEW CLASSES OF LOW DENSITY, HIGH STRENGTH, HIGH MODULUS YARNS AND FIBERS SUITABLE FOR REINFORCING METAL MATRIX COMPOSITES HAVE EMERGED WITHIN THE LAST DECADE; AMONGST THESE ARE THE GRAPHITE YARNS, THE SILICON CARBIDE FIBERS AND YARNS. UNFORTUNATELY, THESE YARNS ARE NOT READILY WETTED BY METALS AT STANDARD MELT TEMPERATURES, BUT REQUIRE EITHER COATINGS OR SUPERHEATED MELTS TO ACCOMPLISH WETTING. MCI HAS DEVELOPED THE TiB COATING PROCESS WHICH HAS BEEN SUCCESSFUL FOR CONVERTING THESE FIBERS INTO PRECURSOR METAL MATRIX COMPOSITES. OCCASIONALLY THE COATING DOES NOT COMPLETELY PENETRATE THE YARN TOW CAUSING A VOID OR UNINFILTRATED ZONE. THE USE OF ULTRASONICALLY ENHANCED INFILTRATION MAY: ELIMINATE DEFECTS, VOIDS IN INFILTRATED AREAS, PERMIT DIRECT INFILTRATION WITHOUT ACTIVATION COATING(S), REDUCE NECESSITY FOR SUPERHEATED MELTS TO INFILTRATE YARNS AND FIBERS. THIS CONCEPT, IF FEASIBLE, MAYBE TRANSITIONED TO THE INFILTRATION OF WOVEN TAPES AND FIBER PREFORMS. THE OBJECTIVE OF THIS PROPOSED

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>---- | AWARDED<br>AMOUNT<br>----- |
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PHASE I EFFORT IS TO ESTABLISH THE FEASIBILITY FOR ENHANCING THE KINETICS OF INFILTRATING YARNS AND FIBERS TO INCREASE THE QUALITY OF COMPOSITES AND LOWER COSTS.

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| MATERIALS SCIENCES CORP<br>GWYNEDD PLAZA II BETHLEHEM PIKE<br>SPRING HOUSE, PA 19477<br>JONATHAN GOERING<br>TITLE:<br>INITIAL IMPACT DAMAGE OF COMPOSITES<br>TOPIC: 76 OFFICE: AFWAL/XRPM | AF | \$ 50,000 |
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A TECHNICAL RESEARCH PROGRAM AIMED AT DEVELOPING AN ANALYTICAL PROCEDURE FOR INVESTIGATING THE DAMAGE PRODUCED IN COMPOSITE PLATES, DUE TO LOW VELOCITY IMPACT, IS PROPOSED. THE METHOD OUTLINED IN THIS PROPOSAL UTILIZES A HIGHER ORDER, SHEAR FLEXIBLE, PLATE BENDING FINITE ELEMENT. THIS ELEMENT INCORPORATES SHEAR DEFORMATION EFFECTS AND INCLUDES COUPLING BETWEEN MEMBRANE AND BENDING DEGREES OF FREEDOM. THE PROPOSED MODEL ALSO INCLUDES A NON-LINEAR CONTACT FORCE SPRING AND INDENTATION LAW FOR MODELING THE IMPACTOR AND CONTACT AREA. THIS MODEL WILL ALLOW COMPLETE GENERALITY IN DEFINING PLATE GEOMETRY, BOUNDARY CONDITIONS, MATERIAL PROPERTIES, LAMINATE CONFIGURATION AND IMPACTOR PARAMETERS.

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| MATERIALS SCIENCES CORPORATION<br>GWYNEDD PLAZA II, BETHLEHEM PIKE<br>SPRING HOUSE, PA 19477<br>NORRIS F. DOW<br>TITLE:<br>WOVEN FABRIC REINFORCEMENTS FOR COMPOSITES<br>TOPIC: 7 OFFICE: DRDAV-PD | ARMY | \$ 49,257 |
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A STUDY IS PROPOSED TO DEVELOP GUIDELINES FOR THE EXTENSION OF THE TECHNOLOGY OF WEAVING TRIAXIAL FABRICS TO PROVIDE WOVEN STRUCTURES HAVING THROUGH-THE-THICKNESS-RUNNING YARNS IN ADDITION TO IN-PLANE TRIAXIAL CONSTRUCTIONS. RELATED WORKS ARE CITED TO SHOW THAT SUCH WOVEN STRUCTURES USED AS REINFORCEMENTS FOR COMPOSITE HAVE POTENTIALS FOR IMPROVED BOLTED JOINTS, IMPROVED RESISTANCE TO INTERLAMINAR

FISCAL YEAR 1984

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STRESSES; AND GREATER FRACTURE TOUGHNESS, - AS WELL AS ISOTROPY IN INDIVIDUAL PLIES. THE OBJECTIVE IS THE ELIMINATION OF THE SEPARATION OR DELAMINATION MODE OF FAILURE TO WHICH CONVENTIONAL COMPOSITE LAMINATES ARE SUBJECT, WITH MINIMAL REDUCTION IN IN-PLANE PROPERTIES.

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| MATERIALS SCIENCES CORPORATION<br>GWYNEDD PLAZA II, BETHLEHEM PIKE<br>SPRING HOUSE, PA 19477<br>V. RAMNATH<br>TITLE:<br>STRUCTURAL EVALUATION OF HIGH ELONGATION CARBON FIBER COMPOSITES<br>TOPIC: 45 OFFICE: AFWAL/XRPF | AF | \$ 49,268 |
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THIS PROPOSAL PRESENTS A PROGRAM FOR THE STRUCTURAL EVALUATIONS OF COMPOSITE LAMINATES CONTAINING HIGH STRAIN GRAPHITE FIBERS AND COMPATIBLE RESIN SYSTEMS. THE FAILURE ANALYSIS METHODOLOGY WILL INVOLVE THE DEVELOPMENT OF LAMINA ALLOWABLES BASED ON FIBER AND MATRIX PROPERTIES. THE LAMINATE FAILURE ANALYSES ARE TO BE CONDUCTED BY ACCOUNTING FOR SEQUENTIAL FAILURES IN THE VARIOUS PLIES. PARAMETRIC STUDIES WILL BE CONDUCTED TO IDENTIFY THE CRITICAL REQUIREMENTS WHICH MUST BE MET BY THE CONSTITUENT FIBER AND MATRIX TO FULLY UTILIZE THE HIGH STRAIN FIBER CAPABILITY. THE FAILURE ANALYSIS WILL ACCOUNT FOR THE DIFFERENT FAILURE MECHANISMS OF A UNI-DIRECTIONAL COMPOSITE SO THAT THE EFFECTS OF HIGH STRAIN FIBERS ON FAILURE MECHANISMS CAN BE STUDIED. THE TECHNICAL EFFORT WILL THEN BE EXTENDED TO THE PREDICTION OF THE INITIATION OF FAILURE IN LAMINATES CONTAINING STRESS CONCENTRATIONS TO IDENTIFY THE POTENTIAL OF THESE FIBERS IN REALISTIC CONFIGURATIONS.

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| MAXFIELD ASSOCIATES, LTD.<br>3 SKYLINE PLACE, 5201 LEESBURG PK #200<br>FALLS CHURCH, VA 22041<br>T. J. ALLSHOUSE<br>TITLE:<br>THE USE OF "EXPERT SYSTEMS" THEORY IN INVENTORY CONTROL APPLICATIONS<br>TOPIC: 38 OFFICE: NAVSUPSYS | NAVY | \$ 64,024 |
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THE OBJECTIVE OF THIS EFFORT IS TO DEVELOP AND TEST THE PROCEDURES

FISCAL YEAR 1984

| SUBMITTED BY<br>-----  | DEPT<br>----- | AWARDED<br>AMOUNT<br>----- |
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| <p>REQUIRED TO UTILIZE "EXPERT SYSTEMS" THEORY IN INVENTORY CONTROL AND MAINTENANCE REPAIR DECISION MAKING. THE INVENTORY MANAGERS ARE REQUIRED TO UTILIZE THEIR EXPERTISE AND EXPERIENCE IN EVALUATING THE MACHINE GENERATED RECOMMENDATIONS FOR PROCUREMENT AND/OR REPAIR ACTIONS. THE EFFORT WILL BE TO REVIEW AND ANALYZE THE EXISTING PROCEDURES AND COMPUTATIONAL RULES WHICH ARE USED TO PRODUCE THE RECOMMENDATIONS AND DEFINE AND CATALOG THE EXPERTISE APPLIED BY THE INVENTORY MANAGERS SO THAT AN "EXPERT SYSTEMS" THEORY PROCEDURE CAN BE DEVELOPED WHICH WILL RESULT IN A MORE STRUCTURED AND STANDARDIZED INVENTORY MANAGEMENT PROCEDURE. THE BENEFITS OF THIS PROCEDURE WILL BE AN INVENTORY MANAGEMENT SYSTEM WHICH WILL PRODUCE HIGHER LEVELS OF MATERIAL AVAILABILITY AND CUSTOMER RESPONSE WHILE OPERATING WITHIN THE PRESCRIBED BUDGETS PROVIDED FOR PROCUREMENT AND REPAIR OF SECONDARY ITEMS OF SUPPLY.</p> |               |                            |

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| <p>MAXFIELD ASSOCIATES, LTD.<br/>3 SKYLINE PLACE, 5201 LEESBURG PK #200<br/>FALLS CHURCH, VA 22041<br/>MR. T. J. ALLSHOUSE<br/>TITLE:<br/>DETERMINATION OF SPARE AND REPAIR PART PRICES<br/>TOPIC: 40 OFFICE: NAVSUPSYS</p> | <p>NAVY</p> | <p>\$ 63,918</p> |
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THE OBJECTIVES OF THIS PROJECT ARE TO DEVELOP TECHNIQUES WHICH WILL ALLOW CONTRACTING OFFICIALS TO VERIFY THE REASONABLENESS OF PRICES FOR SPARES AND REPAIR PARTS PRIOR TO ACTUAL AWARD OF CONTRACT. THE EFFORT WILL INCLUDE AN EXAMINATION OF HOW SPARES AND REPAIR PARTS ARE CATALOGUED AND GROUPED, E.G., COMMODITY MANAGEMENT, TECHNICAL SPECIFICATION, AND APPLICATION IN EQUIPMENTS AND END ITEMS, TO DETERMINE IF PAST CONTRACT PRICES CAN BEST BE USED TO PROVIDE A BASIS FOR PRICING NEW PROCUREMENTS. AN ANALYSIS WILL BE CONDUCTED OF HOW PRICES PAID IN THE PAST FOR AN ITEM OR SIMILAR ITEMS CAN BE UTILIZED IN EVALUATING PRICE QUOTES ON BIDS NOW BEING PROCESSED. THIS ANALYSIS WILL INCLUDE AN EVALUATION OF HISTORICAL PRICING DATA WITHIN A PRE-IDENTIFIED GROUP OF PARTS TO DETERMINE THE STATISTICAL VALIDITY OF USING THIS DATA IN FORECASTING CURRENT PRICES. IN ADDITION, EXAMINATION OF OTHER PRICING DATA SUCH AS PUBLISHED CATALOGS COVERING SPECIFIC COMMODITIES WILL BE CONDUCTED TO DETERMINE IF THESE CAN BE OF ASSISTANCE IN DEVELOPING TARGET PRICES. ALSO, THE INTEGRATION OF TECHNICAL EVALUATION INCLUDING ON-LINE EXAMINATION OF DRAWINGS .

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>---- | AWARDED<br>AMOUNT<br>----- |
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AND TECHNICAL SPECIFICATIONS JUST PRIOR TO AWARD BY QUALIFIED  
TECHNICIANS WILL BE EVALUATED.

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| MEMBRANE TECHNOLOGY AND RESEARCH INC<br>1030 HAMILTON CT<br>MENLO PARK, CA 94025<br>RICHARD W BAKER<br>TITLE:<br>COMPOSITE MATERIALS FOR INTERMEDIATE PROTECTIVE CLOTHING<br>TOPIC: 191            OFFICE: AFSTC | AF | \$ 65,000 |
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CURRENT CLOTHING ISSUED TO AIR FORCE WORKERS DOES NOT PROVIDE PROTECTION TO THOSE EXPOSED TO HAZARDOUS ENVIRONMENTS. DEVELOPMENT OF A NEW COMPOSITE FABRIC MATERIAL IS PROPOSED FOR THIS APPLICATION. THE PROPOSED MATERIAL IS A THREE-LAYER COMPOSITE STRUCTURE CONSISTING OF A NON-WOVEN POLYESTER FABRIC SUPPORT, A MICROPOROUS MEMBRANE LAYER, AND AN ULTRATHIN SURFACE COATING. THE SURFACE COATING IS THE CRITICAL COMPONENT. THE CHEMISTRY OF THIS COATING IS SUCH THAT THE COATING IS ESSENTIALLY IMPERMEABLE TO ORGANIC CHEMICAL AGENTS, BUT FREELY PERMEABLE TO WATER VAPOR FROM THE BODY. THIS COMPOSITE STRUCTURE WOULD BE PREPARED USING THE TECHNOLOGY NOW USED TO PREPARE COMPOSITE MEMBRANE SYSTEMS FOR LIQUID AND GAS PERMEATION PROCESSES. IN THIS PHASE I PROGRAM, THE OVERALL FEASIBILITY OF THE APPROACH WOULD BE DETERMINED. IN A LATER PHASE II PROGRAM, THE MATERIAL WOULD BE DEVELOPED TO THE POINT OF PROTOTYPE DEMONSTRATION.

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| MEMBRANE TECHNOLOGY AND RESEARCH, INC.<br>1030 HAMILTON COURT<br>MENLO PARK, CA 94025<br>RICHARD W. BAKER<br>TITLE:<br>NEW MEMBRANE PRECONCENTRATION DEVICES FOR TRACE VAPOR DETECTION SYSTEMS<br>TOPIC: 21            OFFICE: DRDME-PM | ARMY | \$ 64,500 |
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THE DEVELOPMENT OF A MEMBRANE VAPOR CONCENTRATION DEVICE IS PROPOSED. THE DEVICE WOULD BE USED TO CONCENTRATE TRACE ORGANIC VAPORS IN AIR PRIOR TO INTRODUCTION TO A DETECTOR INSTRUMENT. IN THIS WAY,

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>---- | AWARDED<br>AMOUNT<br>----- |
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THE COMPLEXITY AND COST OF THE INSTRUMENTATION REQUIRED TO DETECT VAPORS EMITTED FROM HIDDEN EXPLOSIVES COULD BE REDUCED. THE DEVICE UTILIZES THE CONTINUOUS MEMBRANE COLUMN CONCEPT TO PRODUCE THE HIGH SEPARATION FACTORS ACHIEVED WITH MULTI-STAGE MEMBRANE CONCENTRATORS, BUT AT MUCH HIGHER YIELDS AND VAPOR THROUGHPUTS. THE MEMBRANE COLUMN WILL BE FORMED USING HIGH-PERFORMANCE COMPOSITE MEMBRANES IN A COUNTER FLOW SPIRAL WOUND MODULE CONFIGURATION. THE MEMBRANE MODULE WILL BE APPROXIMATELY TWO INCHES IN DIAMETER AND THREE TO FOUR INCHES LONG. THE TOTAL MEMBRANE AREA WILL BE APPROXIMATELY ONE SQUARE FOOT. IN PHASE I, THE CONCEPT WILL BE DEMONSTRATED USING AN EXISTING PERMEATION SYSTEM AND GC DETECTOR. MEMBRANES ALREADY MADE IN OUR LABORATORY AS PART OF AN INDUSTRIAL ORGANIC VAPOR RECOVERY SYSTEM WILL BE USED.

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| MERIDIAN CORP<br>5113 LEESBURG PIKE SUITE 700<br>FALLS CHURCH, VA 22041<br>PETER BORGO<br>TITLE:<br>APPLICATION OF THE SIMRAND COMPUTER MODEL TO WEAPON SYSTEM R&D<br>FUNDING DECISIONS<br>TOPIC: 21 OFFICE: ASD/XRZ | AF | \$ 47,960 |
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THE "ACCURACY AND VALIDITY" OF R&D OPTIONS FOR ENGINEERING AND MANAGEMENT DECISION-MAKERS IS DEPENDENT ON A HOST OF DEPENDENT AND INDEPENDENT VARIABLES. THESE VARIABLES ARE QUANTITATIVE AND QUALITATIVE, SUCH AS BUDGET LIMITATIONS, PERSONNEL/FACILITY RESTRICTIONS, EXPECTED PERFORMANCE OR R&D COST AND SCHEDULE. VERY FEW QUANTITATIVE MODELS OF THE R&D PROJECT SELECTION PROCESS AND RESOURCE ALLOCATION DECISION PROCESS HAVE BEEN IMPLEMENTED AND USED BY R&D MANAGERS BECAUSE PERCEIVED LIMITATIONS. A GENERAL METHODOLOGY HAS BEEN DEVELOPED THAT ALLEVIATES THESE LIMITATIONS TO VARYING DEGREES. AN OPPORTUNITY EXISTS TO EXPLORE THE POTENTIAL OF APPLYING THIS GENERAL METHODOLOGY, AUTOMATED AS THE SIMRAND (SIMULATION OF RESEARCH AND DEVELOPMENT) COMPUTER MODEL, TO THE OPTIMAL SELECTION OF WEAPON SYSTEM R&D PROJECTS. EXAMPLE CASES WILL BE PERFORMED USING THE MODEL. RESULTS WILL BE ANALYZED TO VALIDATE THE USE OF THE SIMRAND MODEL AND THE INPUT DATA SET AND TO DETERMINE THE FEASIBILITY OF A PHASE II EFFORT. THE PHASE II EFFORT COULD INCLUDE AND ENHANCEMENT OF THE SIMRAND METHODOLOGY THROUGH AN OPTIMIZATION BASED ON UNIQUE WEAPON SYSTEM R&D VARIABLES, THE INCLUSION OF

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>---- | AWARDED<br>AMOUNT<br>----- |
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ADDITIONAL DECISION ANALYSIS METHODS THAT MORE CLOSELY MODEL MILITARY WEAPON SYSTEM DEVELOPMENT REQUIREMENTS, OR THE EXPANSION OF THE DECISION MAKING PHILOSOPHY TO INCLUDE GROUP DECISIONS AS MIGHT BE EXPERIENCED IN INTERSERVICE R&D PROGRAMS.

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| METECH INCORPORATED<br>762 HIGH STREET<br>POTTSTOWN, PA 19464<br>AL ZEINSKI | DARPA | \$ 41,895 |
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TITLE:  
 THE REPLACEMENT OF PRECIOUS METAL THICK FILM INKS USING NEW CONDUCTIVE POLYMER TECHNOLOGY  
 TOPIC: 2 OFFICE: DARPA

A GREAT DEAL OF PROGRESS HAS BEEN MADE IN THE PRODUCTION OF ELECTRICALLY CONDUCTIVE POLYMERS. HEAVILY DOPED VERSIONS OF POLYACETYLENE SHOW CONDUCTIVITIES EQUIVALENT TO PURE METALS. UNFORTUNATELY, THESE POLYMERS ARE VERY UNSTABLE IN AIR AND SHOW LITTLE OR NO SOLUBILITY. IT IS THE INTENT OF THIS INVESTIGATION TO EVALUATE THE POSSIBILITY OF USING SMALL PLATELETS OF CONDUCTIVE POLYMER AS SUBSTITUTES FOR PRECIOUS METAL PARTICLES THAT GENERALLY COMPOSE THE CONDUCTIVE PORTION OF POLYMER THICK FILM CONDUCTORS AND RESISTORS. IT MAY BE POSSIBLE TO IMBED SMALL PARTICLES OF CONDUCTIVE POLYMER INTO GENERAL POLYMERIC VEHICLES, SUCH AS VINYL OR EPOXY, AND PROVIDE THE CONDUCTIVE POLYMERS WITH THE NECESSARY ENVIRONMENTAL PROTECTION TO PREVENT DECOMPOSITION AND LOSS OF CONDUCTIVITY. THE RESULTS OF THIS STUDY WILL SHOW THE FEASIBILITY OF ELIMINATING OR GREATLY REDUCING THE USE OF HIGH COST STRATEGIC MATERIALS IN CONDUCTIVE AND RESISTIVE THICK FILM INKS.

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| METRON CORPORATION<br>9681 BUSINESS CENTER DRIVE<br>RANCHO CUCAMONGA, CA 91730<br>ARTHUR J. PLOURDE | NAVY | \$ 49,710 |
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TITLE:  
 NON-FLOODING PORTABLE PRESSURE CALIBRATOR  
 TOPIC: 108 OFFICE: NWSA

THE OBJECTIVE OF THIS STUDY IS TO DETERMINE THE FEASIBILITY OF DEVELOPING A NON-FLOODING PORTABLE PRESSURE CALIBRATOR (PPC) THAT IS

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>----- | AWARDED<br>AMOUNT<br>----- |
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IMPERVIOUS TO OPERATOR ERROR, PREVENTS CONTAMINATION IN THE LIQUID SYSTEMS IN WHICH THE TEST DEVICE IS LOCATED AND IS EASY TO OPERATE. THE FLOODING INHIBITING TECHNIQUE OR DEVICE SHALL BE SUITABLE FOR LOCATION IN THE BODY OF NEWLY MANUFACTURED UNITS OR RETROFITTED TO EXISTING PORTABLE PRESSURE CALIBRATORS. IT MUST BE SMALL IN SIZE FOR EASE IN TRANSPORTABILITY, AND BE COST EFFECTIVE. THE EFFORT WILL INCLUDE THE STUDY OF THE CAUSE OF FLOODING AND THE TYPE OF MATERIALS AND DEVICES WHICH MAY BE USED AS A SOLUTION TO THE FLOODING PROBLEM. A NON-FLOODING AND NON-CONTAMINATING LIQUID TRAP WILL BE INVESTIGATED AND TESTED. AN INVESTIGATION WILL ALSO BE CONDUCTED TO DETERMINE IF A SUBSTANCE IS AVAILABLE TO BE USED AS A MOLECULAR SIEVE LIQUID CUT-OFF DEVICE. COST, RISK FACTORS ASSOCIATED WITH FLOODING AND CONTAMINATION WILL BE STUDIED, AND THE EXTENT OF POTENTIAL CONTAMINATION TO LIQUID SYSTEMS USING EXISTING METHODS, WILL BE ANALYZED.

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| MILLIMETER WAVE TECHNOLOGY, INC.<br>770 SPRING STREET, N.W., SUITE 204<br>ATLANTA, GA 30308<br>D. J. KOZAKOFF<br>TITLE:<br>THIN MICROWAVE ATTENUATING MATERIALS<br>TOPIC: 24 OFFICE: DRDME-PM | ARMY | \$ 54,929 |
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A BROADBAND (5-20 GHZ) HIGH PERFORMANCE THIN ABSORBER THAT UTILIZES FERRITES AND IS BASED ON THE FERROMAGNETIC RESONANCE (FMR) PHENOMENA IS PROPOSED. CRYSTALLINE STRUCTURES THAT HAVE A HIGH RESIDUAL MAGNETIZATION (ANISOTROPIC FIELD) AND WHICH WILL BE USED A MIXTURE OF FERRITE MATERIALS WITH DIFFERENT FMR'S (ACHIEVED BY DOPING) ARE SUSPENDED IN A FLEXIBLE MATRIX. THE EFFECTS OF ALIGNMENT DURING CURE ARE CONSIDERED, IN ADDITION TO THE INTRODUCTION OF NONALIGNED CRYSTALS INTO THE COMPOSITE. THE FOCI OF THE PHASE I RESEARCH ARE MANUFACTURING METHODOLOGY, ALTERNATE APPROACHES TO ACHIEVE BROADBANDING, AND PERFORMANCE TRADES FOR DIFFERENT CONFIGURATIONS. CALCULATIONS WILL BE PERFORMED ON MWT'S VAX 11/730 COMPUTER. DURING THE PHASE I STUDY, A FEASIBILITY DEMONSTRATION WILL BE CONDUCTED UTILIZING CURRENTLY AVAILABLE FERRITE MATERIALS.

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| MILLIMETER WAVE TECHNOLOGY, INC.<br>770 SPRING ST. N.W., SUITE 204<br>ATLANTA, GA 30308<br>THOMAS P. MORTON<br>TITLE:<br>MILLIMETER WAVE EMERGENCY COMMUNICATIONS<br>TOPIC: 142 OFFICE: ESD/PKR | AF | \$ 49,894 |
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THE RESEARCH PROPOSED INVESTIGATES THE FEASIBILITY OF SMALL

FISCAL YEAR 1984

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MILLIMETER WAVE RADIOS WITH SERVO DRIVEN ANTENNAS FOR EMERGENCY LINE-OF-SIGHT COMMUNICATIONS FOR BOTH GROUND-TO-GROUND AND GROUND-TO-AIR USE. THE CONSIDERATIONS IMPACTING DESIRABILITY OF THE CONCEPT INCLUDE THE SEARCH MODE METHOD, DATA CAPACITY, MODULATION METHODOLOGY, OPERATING FREQUENCY, COST, SIZE AND WEIGHT. TRANSMISSION RANGE IS TO BE STUDIED BASED ON ACHIEVABLE POWER LEVELS WITH STATE-OF-THE-ART DEVICES, ATMOSPHERIC PHENOMENA, EFFECTS OF TERRAIN AND FOLIAGE, AND ANTENNA POLARIZATION. THE DESIRABILITY FOR LOW PROBABILITY OF INTERCEPT REQUIRES OPERATING NEAR THE 60 GHZ OXYGEN CONTINUUM, WHICH FURTHER CONSTRAINS MAXIMUM TRANSMISSION RANGE. THIS STUDY INVESTIGATES RELATIONSHIPS BETWEEN EQUIPMENT PARAMETERS AND THIS MAXIMUM TRANSMISSION DISTANCE.

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| MISSION RESEARCH CORP<br>1720 RANDOLPH ROAD, S.E.<br>ALBUQUERQUE, NM 87106<br>DONALD SULLIVAN<br>TITLE:<br>FEASIBILITY STUDY FOR A MICROWAVE WRHEAD<br>TOPIC: 229      OFFICE: AD/CZO | AF | \$ 69,149 |
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| MKM RESEARCH/OHMICRON<br>P.O. BOX 1<br>WASHINGTON CROSS, PA 18977<br>MARK KENT MALMROS<br>TITLE:<br>USE OF CONDUCTIVE/SEMICONDUCTIVE ORGANIC POLYMERS IN BIOSENSOR APPLICATIONS: EVALUATION IN IMMUNODIAGNOSTIC TECHNIQUES<br>TOPIC: 245      OFFICE: BMO/PMX | AF | \$ 49,595 |
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THE USE OF CONDUCTIVE/SEMICONDUCTIVE POLYACETYLENE FILMS AS A SUBSTRATE FOR THE ADSORPTION OR COVALENT COUPLING OF BIOMOLECULES OFFERS THE POTENTIAL OF SIMPLE, LOW COST, DIRECT BIOSENSOR DEVICES. PRELIMINARY FEASIBILITY EXPERIMENTATION ON THIS CONCEPT HAS DEMONSTRATED A SIMPLE MEHTOD FOR THE DIRECT ELECTRICAL MEASUREMENT OF AN IMMUNOCHEMICAL BINDING REACTION. AT THE PRESENT TIME, NO ANALYTICAL TECHNIQUES OR DEVICES HAVE BEEN REPORTED WHICH UTILIZE THE UNIQUE PROPERTIES OF CONDUCTIVE ORGANIC POLYMERS. CURRENT DEVELOPMENT OF BIOSENSOR TECHNOLOGY IS BASED ON CONVENTIONAL APPROACHES; USE OF ION SELECTIVE ELECTRODES, THERMISTORS, CHEMFET'S AND RELATED MICRO-

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>---- | AWARDED<br>AMOUNT<br>----- |
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ELECTRONIC TECHNIQUES. POLYACETYLENE FILMS, AS THE PROTOTYPE CONDUCTIVE POLYMER, DISPLAYS A WIDE RANGE OF ELECTRONIC PROPERTIES IN RESPONSE TO MODIFICATION (DOPING) BY A VARIETY OF CHEMICAL SPECIES. THIS PROPOSAL OUTLINES A UNIQUE, SPECIFIC EXPERIMENTAL PROTOCOL FOR FURTHER EVALUATING THE USE OF POLYACETYLENE COMPOSITES IN IMMUNODIAGNOSTIC TECHNIQUES.

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| MSNW, INC.<br>P.O. BOX 865<br>SAN MARCOS, CA 92069<br>DR. GEORGE H. REYNOLDS<br>TITLE:<br>CERAMIC/METAL JOINING PROCESS<br>TOPIC: 42 OFFICE: DRXMR-PP | ARMY | \$ 39,765 |
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GRADED COMPOSITION/PROPERTY INSERT MATERIALS ARE PROPOSED FOR TWO STEP BRAZING OF BULK SILICON NITRIDE TO DUCTILE IRON, 4340 STEEL OR WARPALLOY. THE INSERT MATERIALS PROVIDE GRADED MECHANICAL AND THERMAL EXPANSION PROPERTIES BETWEEN THOSE OF SILICON NITRIDE AND THOSE OF THE METALLIC MATERIAL OF INTEREST. BRAZED JOINTS BETWEEN SILICON NITRIDE/SILICON NITRIDE AND METAL/METAL ARE REQUIRED TO EFFECT BULK CERAMIC/METAL COMPONENT JOINING. A NOVEL METHOD OF PRODUCING THE GRADED COMPOSITION/PROPERTY INSERT MATERIALS IS PROPOSED. INSERT MATERIALS AND PROTOTYPE CERAMIC/METAL JOINTS PREPARED USING EACH OF THE THREE METALLIC MATERIALS OF INTEREST WILL BE EVALUATED ON THE BASIS OF METALLOGRAPHIC EXAMINATION AND MECHANICAL PROPERTY MEASUREMENTS.

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| N.J. DAMASKOS, INC.<br>P.O. BOX 469<br>CONCORDVILLE, PA 19331<br>DOUGLAS J. BUCHANAN<br>TITLE:<br>ELECTROMAGNETIC SCATTERING BY REACTIVE SURFACES<br>TOPIC: 180 OFFICE: AFOSR/XOT | AF | \$ 50,000 |
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THE ANALYTICAL PREDICTION OF THE ELECTROMAGNETIC BEHAVIOR OF DIELECTRICALLY CLAD VEHICLES IS BECOMING INCREASINGLY IMPORTANT.

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>---- | AWARDED<br>AMOUNT<br>----- |
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THE PROPOSED EFFORT CONSISTS OF PRODUCING A GTD-BASED FORMULATION FOR THE PREDICTION OF ELECTROMAGNETIC SCATTERING BY CONFORMAL REACTIVE SURFACES, THE FORMULATION INCLUDING BOTH SPECULAR AND CREEPING RAY TERMS. COMPUTER CODE WILL BE DEVELOPED SPECIFICALLY FOR THE CONE-SPHERE CLAD IN A SINGLE LOSSY LAYER. THE FORMULATION WILL BE TESTED AGAINST RESULTS FROM PSEUDO-PHYSICAL OPTICS INTEGRALS FOR THE SPECIAL CASE OF AN AXIALLY INCIDENT PLANE WAVE, AND AGAINST ANY USEFUL SCATTERING RESULTS IN THE OPEN LITERATURE.

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| N.J. DAMASKOS, INC.<br>P.O. BOX 469<br>CONCORDVILLE, PA 19331<br>GREGORY B. SENFT<br>TITLE:<br>A NOVEL APPROACH TO RAM COATING<br>TOPIC: 119      OFFICE: NASC | NAVY | \$ 49,647 |
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CERTAIN MILITARY APPLICATIONS REQUIRE A RAM TO FUNCTION AT HIGH TEMPERATURES. A NOVEL METHOD OF FORMING SUCH A RAM COATING IS DESCRIBED. AN EXPERIMENTAL PROCEDURE FOR FABRICATING AND EVALUATING THE MATERIAL IS OUTLINED.

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| NAPP, INC.<br>2104 KRAMER LANE<br>AUSTIN, TX 78758<br>CHARLES E. JENKINS<br>TITLE:<br>MULTISENSOR CHEMICAL DETECTOR AND MEASUREMENT SYSTEM<br>TOPIC: 93      OFFICE: SGRD-RMA | ARMY | \$ 62,570 |
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IT IS PROPOSED TO UTILIZE A GAS DENSITY DETECTOR FOR PROFILING GASES ENCOUNTERED IN THE HELICOPTER ENVIRONMENT. THE DETECTOR, COUPLED WITH AN APPROPRIATE GAS CHROMATOGRAPH COLUMN, HAS BEEN PROVED IN IDENTIFYING AND QUANTIFYING INDIVIDUAL COMPONENTS IN COMPLEX GAS MIXTURES. THE GAS DENSITY DETECTOR GIVES A RESPONSE THAT IS A FUNCTION OF THE DIFFERENCE IN DENSITY OF THE SELECTED CARRIER GAS AND THE COMPONENT GAS. THIS FIXED RELATIONSHIP ALLOWS QUANTITATIVE

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>----- | AWARDED<br>AMOUNT<br>----- |
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ANALYSIS OF COMPLEX MIXTURES WITHOUT CALIBRATION.  
 IT IS PROPOSED THAT A SINGLE DETECTOR TYPE (GAS DENSITY DETECTOR) CAN BE USED TO PROFILE GASES ENCOUNTERED IN THE HELICOPTER ENVIRONMENT. THIS IS CONTRASTED TO MULTISENSOR DETECTORS. THE ATTENDANT BENEFITS OF A SINGLE DETECTOR TYPE COMPARED TO MULTISENSOR DETECTORS ARE OBVIOUS. IN ADDITION, THE PARTICULAR DETECTOR PROPOSED IS A PRIMARY INSTRUMENT. THE PRINCIPLE OF OPERATION IS DIFFERENTIAL DENSITY BETWEEN A KNOWN REFERENCE GAS AND THE COMPONENT GAS TO BE MEASURED. THIS IS A PRIMARY MEASUREMENT IN THE SAME SENSE AS A MANOMETER OR MERCURY BAROMETER.

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| NDE TECHNOLOGY INC<br>2909 OREGON COURTC-8<br>TORRANCE, CA 90503<br>JOHN R. MASTANDREA<br>TITLE:<br>VERIFICATION OF MASTAN GAGE CAPABILITIES FOR BLAST AND SHOCK INSTRUMENTATION<br>TOPIC: 218 | AF                 | \$ 49,919 |
|  | OFFICE: AFWL/PRPAF |           |

A NEED EXISTS TO MEASURE BLAST AND SHOCK EFFECTS IN AIR, EARTH MATERIALS AND STRUCTURAL MATERIALS. OF INTEREST ARE PEAK STRESSES/PRESSURES IN THE RANGE OF ABOUT 10 GPA. DETERMINATION OF THE PEAK VALUE AND PREFERABLY, THE COMPLETE HISTORY IS REQUIRED. THIS NEED HAS EXISTED FOR OVER 10 YEARS BECAUSE NO DEVICE PREVIOUSLY COULD PROVIDE SUCH INFORMATION.

THE NDE TECHNOLOGY, INC. (NDE) MASTAN GAGE HAS SUCCESSFULLY MEASURED HIGH PEAK VALUES AND COMPLETE HISTORIES FOR HIGH PRESSURES AND THUS OFFERS A VIABLE SOLUTION. THE MASTAN GAGE HAS DETECTED HYPERVELOCITY PARTICLES IMPACTING AT THE RATE OF A MILLION IMPACTS A SECOND. THE GAGE PROVIDES AN OUTPUT CHARACTERISTIC OF THE NUMBER, MOMENTUM, ENERGY, MASS, SIZE AND/OR VELOCITY OF PARTICLES. THE MASTAN GAGE IS PIEZOELECTRIC/ELECTRET TYPE, ACOUSTIC/ULTRASONIC DEVICE WITH AN INTERNAL LIQUID MEDIUM AND PATENTED IN 1978 BY THE PRINCIPLE INVESTIGATOR OF THE PROPOSED PROJECT.

THE PROPOSED RESEARCH PROJECT CONSISTS OF A SYSTEMATIC INTENSIVE STUDY DIRECTED SPECIFICALLY TOWARD APPLYING NEW KNOWLEDGE (MASTAN GAGE) TO MEET A RECOGNIZED NEED. PHASE I WORK WILL INVOLVE AN IN-DEPTH THEORETICAL ANALYSIS OF THE MASTAN GAGE AND SCALED LABORATORY TESTS TO ESTABLISH AND DEMONSTRATE FEASIBILITY. PHASE II WILL INVOLVE THE DEVELOPMENT OF A PROTOTYPE GAGE FOR ACTUAL USE IN TESTS

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>---- | AWARDED<br>AMOUNT<br>----- |
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FOR MEASUREMENT OF BLAST AND SHOCK EFFECTS IN AIR, EARTH MATERIALS AND STRUCTURAL MATERIALS.

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| NELSON AND JOHNSON ENGINEERING, INC.<br>1680 38TH STREET, SUITE 100<br>BOULDER, CO 80301<br>ARNOLD J. FARSTAD<br>TITLE:<br>RAPID AND ACCURATE PERSONNEL IDENTIFICATION<br>TOPIC: 248            OFFICE: BMO/PMX | AF | \$ 49,256 |
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THE PURPOSE OF THIS PROJECT IS TO TEST THE FEASIBILITY OF SPEAKER VERIFICATION TECHNOLOGY AS A VIABLE METHOD TO PROVIDE RAPID AND ACCURATE PERSONNEL IDENTIFICATION. IN ADDITION, THE ADAPTATION OF A NELSON AND JOHNSON ENGINEERING DESIGNED PERSONNEL LOCATOR WILL BE STUDIED FOR POSSIBLE USE IN PERSONNEL LOCATION IN A DEEP BASE APPLICATION. THE IDENTIFICATION AND LOCATION SYSTEM WILL BE COMPUTER CONTROLLED, ULTRASECURE, CAPABLE OF ACCOMMODATING LARGE NUMBERS OF PERSONNEL DURING INGRESS AND EGRESS OF A SECURE FACILITY. A BADGE-SIZED IDENTIFICATION/LOCATOR UNIT WILL COMMUNICATE WITH A COMPUTER SYSTEM CONTAINING SPEAKER IDENTIFICATION TEMPLATES AND SECURITY CODING.

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| NICHOLS RESEARCH CORP<br>4040 S. MEMORIAL PARKWAY<br>HUNTSVILLE, AL 35802<br>KENNETH H DENT<br>TITLE:<br>EMISSIVITY AND SPECTRAL MEASUREMENTS OF CARBON CONTAINING FLAMES FOR THERMAL RADIATION SIMULATION TECHNIQUES<br>TOPIC: 2            OFFICE: OAAM | DNA | \$ 57,500 |
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THIS PROJECT WILL PRODUCE THE RESULTS NECESSARY TO DETERMINE IF ULTR-HIGH TEMPERATURE FUELS PRODUCE FLAMES WITH SUFFICIENT EMISSIVITY TO BE CONSIDERED AS A CANDIDATE FOR THE DNA THERMAL RADIATION SOURCE TEST FACILITY. A SMALL TORCH WILL BE CONSTRUCTED WHICH WILL BURN COMMERCIALY AVAILABLE CHEMICALS SIMILAR TO ULTRA-HIGH TEMPERATURE FUELS OF THE CMNN CLASS. THERMAL FLUX AND SPECTRAL MEASUREMENTS OF THE FLAME WILL BE MADE IN ORDER TO DETERMINE THE RADIATIVE OUTPUT.

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>----- | AWARDED<br>AMOUNT<br>----- |
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SUFFICIENT RESULTS WILL BE OBTAINED FROM THIS EXERCISE SO THAT DNA CAN DETERMINE IF FURTHER PURSUIT OF USING SUCH FUELS FOR THERMAL RADIATION SIMULATION IS WORTHWHILE.

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| NIELSEN ENGINEERING & RESEARCH, INC.<br>510 CLYDE AVENUE<br>MOUNTAIN VIEW, CA 94043<br>MICHAEL R. MENDENHALL<br>TITLE:<br>MODELING SLBM UNDERWATER LAUNCH TRAJECTORIES<br>TOPIC: 83 OFFICE: NSWC | NAVY | \$ 59,724 |
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THE OBJECTIVE OF THE PROPOSED INVESTIGATION IS TO DEVELOP A METHOD TO PREDICT THE TRAJECTORY OF A SUBMARINE LAUNCHED BALLISTIC MISSILE (SLBM) BETWEEN LAUNCH AND BROACH. THE METHOD WILL CONSIDER SUCH EFFECTS AS THE UNSTEADY MOTION OF THE SUBMARINE DURING LAUNCH, SUBMARINE WAKE-INDUCED EFFECTS, AND USER-SPECIFIED CURRENTS, WAVE, AND WIND EFFECTS. THE METHOD WILL INCLUDE THE PREDICTION OF THE NONLINEAR, UNSTEADY HYDRODYNAMIC CHARACTERISTICS OF THE MISSILE THROUGHOUT THE TRAJECTORY, INCLUDING LEE SIDE SEPARATION EFFECTS. THE MISSILE HYDRODYNAMIC PREDICTION METHOD WILL BE COUPLED WITH A SIX-DEGREE-OF-FREEDOM EQUATION-OF-MOTION SOLVER FOR TRAJECTORY PREDICTIONS. THE BASIS FOR THE PROPOSED METHOD IS AN EXISTING CODE FOR PREDICTING THE NONLINEAR, UNSTEADY HYDRODYNAMIC CHARACTERISTICS OF A SUBMARINE UNDERGOING ARBITRARY MANEUVERS.

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| OCEAN & ATMOSPHERIC SCIENCE, INC.<br>145 PALISADE STREET<br>DOBBS FERRY, NY 10522<br>DR. ROSS WILLIAMS<br>TITLE:<br>DEVELOPMENT OF ALGORITHMS USING SPECTRAL AND TEXTURAL ANALYSIS FOR AUTOMATIC DETECTION OF SURFACE MINES<br>TOPIC: 69 OFFICE: WESVB | ARMY | \$ 38,497 |
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THIS PHASE I PROPOSAL SUGGESTS THE APPLICATION OF TWO-DIMENSIONAL TRANSFORMS TO THE SPACE DOMAIN DATA HOLDING SURFACE MINE IMAGERY TO PRODUCE A TWO-DIMENSIONAL SPATIAL SPECTRUM OF THE MINE TEXTURE

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>---- | AWARDED<br>AMOUNT<br>----- |
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AND SHAPES AS WELL AS OF THE BACKGROUND. SPATIAL, FREQUENCY MATCHED FILTERS CAN BE DEvised THAT ARE INVARIANT TO OBJECT LOCATION, ROTATION AND SIZE (MAGNIFICATION), BUT OTHERWISE DISCRIMINATE AGAINST THE BACKGROUND ON THE BASIS OF OBJECT SHAPE AND TEXTURE. BY USING ALGORITHMS BASED UPON SUCH TRANSFORMS, ONLY THE DESIRED SPATIAL FREQUENCIES ARE ACCEPTED. INVERSE TRANSFORMS APPLIED TO THESE FILTERED OUTPUTS CAN THEN RE-CREATE THE MINE IMAGES IN THEIR PROPER LOCATIONS IN A BACKGROUND THAT HAS BEEN CLEANSSED OF INTERFERING FEATURES. THE APPLICABILITY OF SEVERAL TRANSFORMS WILL BE INVESTIGATED, AND POSSIBLE PERFORMANCE LEVELS WILL BE ESTIMATED.

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| OCEAN & ATMOSPHERIC SCIENCE, INC.<br>145 PALISADE ST.<br>DOBBS FERRY, NY 10522<br>DR. FREDRICK COTTON<br>TITLE:<br>FAULT ACTIVATION IN ELECTRONIC MODULES<br>TOPIC: 109            OFFICE: NWSO | NAVY | \$ 37,794 |
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ELECTRONIC MODULES THAT CAN BE FAULTED BY REMOTELY CONTROLLED SWITCHING ARE POTENTIALLY VALUABLE AIDS IN THE TRAINING OF OPERATING AND MAINTENANCE PERSONNEL IN THE RECOGNITION AND DIAGNOSIS OF FAILURES AND PERFORMANCE DEGRADATION IN COMPLEX ELECTRONIC SYSTEMS. OAS, INC., PROPOSES AN INVESTIGATION OF LOW-LEVEL MICROWAVE AND SUPERSONIC SWITCHING DEVICES THAT MIGHT BE ATTACHED TO AN ELECTRONIC MODULE TO BE FAULTED BY AN INSTRUCTOR OPERATING A REMOTE MICROWAVE OR SUPERSONIC TRANSMITTER. ALTERNATIVELY, A MINIATURE TIMER THAT ALLOWS ARBITRARY SWITCH CLOSING TIMES TO BE PROGRAMMED WITHIN IT WILL BE EVALUATED AND COMPARED WITH THE REMOTE SWITCHING DEVICES. THIS PHASE I EFFORT WILL INVOLVE A SEARCH FOR SUITABLE COMPONENTS, MINIATURIZED DESIGNS OF CHOSEN COMPONENTS, AN EVALUATION OF EXPECTED PERFORMANCE, AND TESTING OF COMPONENTS WHOSE PERFORMANCE CANNOT BE PREDICTED.

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| OCEANOGRAPHIC SERVICES, INC.<br>25 CASTILIAN DRIVE<br>SANTA BARBARA, CA 93117<br>J. M. BLUMBERG<br>TITLE:<br>CORRELATION SONAR SYSTEM FOR IMPROVED PLATFORM<br>MOTION MEASUREMENTS<br>TOPIC: 60            OFFICE: NAVSEA | NAVY | \$ 48,938 |
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STATE-OF-THE-ART DOPPLER SONAR NAVIGATORS DO NOT PROVIDE SUFFICIENTLY

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>----- | AWARDED<br>AMOUNT<br>----- |
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PRECISE MEASUREMENT OF RELATIVE MOTION FOR USE WITH ADVANCED, HIGH DEFINITION, SONAR MAPPING SYSTEMS. THIS SHORT-COMING IS PARTICULARLY ACUTE WHERE THE REFLECTIVE SURFACE IS HIGHLY IRREGULAR, RELATIVE VELOCITIES ARE LOW, AND AVERAGING PERIODS ARE SHORT. IN CONTRAST, CORRELATION SONAR TECHNIQUES OVERCOME MANY OF THE INHERENT LIMITATIONS OF THE DOPPLER MODE. THE CORRELATION MEASUREMENT SENSITIVITY IS GREATEST NORMAL TO THE ACOUSTIC AXIS AND IS ENHANCED BY REFLECTIVE SURFACE IRREGULARITIES. RESEARCH IS PROPOSED TO COMPLETE A SYSTEM DESIGN FOR A CORRELATION SONAR APPLICABLE TO HIGH DEFINITION SONAR PLATFORM MOTION MEASUREMENTS. HARDWARE AND SOFTWARE ELEMENTS OF THE DESIGN WILL BE EVALUATED AND OPTIMIZED. SYSTEM PERFORMANCE WILL BE PREDICTED BASED UPON COMPUTER SIMULATION. A COST ESTIMATE FOR A PROTOTYPE SYSTEM WILL BE PREPARED TO FACILITATE AN OBJECTIVE COST VS. PERFORMANCE ANALYSIS.

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| ODETICS INC.<br>1380 S. ANAHEIM BLVD.<br>ANAHEIM, CA 92805<br>STEPHEN J. BARTHOLET<br>TITLE:<br>ROBOTIC (HIGH PAYLOAD-TO-WEIGHT MANIPULATOR STRUCTURE)<br>TOPIC: 46                      OFFICE: DRXHE-SS | ARMY | \$ 49,971 |
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AI/ROBOTICS HAS RECENTLY BECOME AN EXTREMELY ACTIVE AREA FOR RESEARCH AND DEVELOPMENT THROUGHOUT DOD AND, SPECIFICALLY, WITHIN THE DEPARTMENT OF ARMY. OF THE FOUR PLANNED GENERAL AREAS THAT ARE TARGETED FOR DEPARTMENT OF THE ARMY R&D (RECONNAISSANCE/SURVEILLANCE, MATERIAL HANDLING, BATTLEFIELD AND ARTIFICIAL INTELLIGENCE). TRADOC AND DARCOM HAVE PLACED A HIGH PRIORITY ON THE MISSION AREA ENTITLED COMBAT SERVICE SUPPORT WITH SPECIAL EMPHASIS ON NEAR-TERM MATERIAL HANDLING APPLICATIONS. SINCE A MAJORITY OF THESE APPLICATIONS INVOLVE A DYNAMIC FIELD SITUATION RATHER THAN A FIXED OR STATIC MANUFACTURING ENVIRONMENT. HEL HAS RECOGNIZED THE TECHNICAL REQUIREMENT FOR A "HIGH PAYLOAD-TO-WEIGHT MANIPULATOR STRUCTURE" FOR SUCH HIGHLY MOBILE, MATERIAL HANDLING APPLICATIONS IN THE FIELD. AS OF THIS DATE, MANIPULATOR DEVELOPMENT HAS MAINLY CONCENTRATED ON THE DESIGN OF SPECIALIZED AND EFFECTORS, SENSOR INTEGRATION AND SOFTWARE CONTROL USING OFF-THE-SHELF, EXTREMELY HEAVY MANIPULATOR STRUCTURES AND LARGE, BULKY COMPUTER HARDWARE WHICH HAS BEEN DESIGNED PRIMARILY

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>---- | AWARDED<br>AMOUNT<br>----- |
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FOR INDUSTRIAL ROBOTIC APPLICATIONS. THESE INDUSTRIAL MANIPULATOR STRUCTURES WERE TYPICALLY DESIGNED TO LIFT A SMALL PERCENTAGE OF THEIR OWN WEIGHT. THIS PROPOSAL IS TO PERFORM A SIX-MONTH ANALYSIS AND PRELIMINARY DESIGN OF A "HIGH PAYLOAD-TO-WEIGHT MANIPULATOR STRUCTURE" THAT WILL BE CAPABLE OF LIFTING AND MANEUVERING A LOAD EXCEEDING ITS OWN WEIGHT.

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| ODETICS INC.<br>1380 S. ANAHEIM BLVD.<br>ANAHEIM, CA 92805<br>STEPHEN J. BARTHOLET<br>TITLE:<br>MOBILE ROBOT FOR HAZARDOUS DUTY (TELEOPERATED FIREFIGHTING HOSE DELIVERY SYSTEM)<br>TOPIC: 92      OFFICE: NSWC | NAVY | \$ 49,294 |
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ONE OF THE MOST HAZARDOUS DUTY ASSIGNMENTS IN THE NAVY DURING BOTH PEACETIME AND CONFLICT IS FIGHTING FIRES ON BOARD AIRCRAFT CARRIERS. MOST OF THE WORST DISASTERS ON BOARD CARRIERS HAVE STARTED ON THE FLIGHT DECK. MOST OF THESE FIRES SPREAD TO LOWER DECKS BECAUSE THEY WERE NEVER QUICKLY CONTAINED AND ESCALATED BEYOND THE CAPABILITIES OF EXISTING FIREFIGHTING SYSTEMS. THIS PROPOSAL IS FOR A DETAILED INVESTIGATION OF THE HAZARDOUS DUTY OPERATIONS ASSOCIATED WITH FIGHTING FIRES ON THE FLIGHT DECK OF AIRCRAFT CARRIERS. THE OBJECTIVE OF THE INVESTIGATION WILL BE TO DEFINE BASIC FIREFIGHTING REQUIREMENTS, DEFINE ALTERNATIVE APPROACHES WHICH OFFER SAFE, TELEOPERATED CONTROL FOR FIREFIGHTERS, ANALYZE AND ESTABLISH THE FEASIBILITY OF THE VARIOUS APPROACHES AND RECOMMEND THE MOST COST-EFFECTIVE APPROACH THAT WILL REDUCE THE HUMAN RISK AND QUICKLY CONTAIN THE FIRE. THE RESULT OF THE INVESTIGATION WILL BE TO PROVIDE THE NAVY WITH A PRELIMINARY DESIGN SPECIFICATION OF THE RECOMMENDED APPROACH.

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| OPCA, INC.<br>1202 NORTH BROADWAY<br>SANTA ANA, CA 92701<br>DR. WILLIAM H. QUICK<br>TITLE:<br>BIOLOGICAL AND TOXIN DETECTION AND SAMPLING<br>TOPIC: 4      OFFICE: DRSMC-CLY-L | ARMY | \$ 41,120 |
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NEW AND EMERGENCY TECHNOLOGIES HAVE MADE POSSIBLE THE DEVELOPMENT OF

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>---- | AWARDED<br>AMOUNT<br>----- |
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A "POCKET-SIZED, INFRARED SPECTROPHOTOMETER. SUCH AN INSTRUMENT WOULD HAVE APPLICATION IN THE ACCURATE AND RELIABLE REAL-TIME DETECTION OF BIOLOGICAL AND TOXIN AEROSOLS. OPCOA PROPOSES TO USE MICROELECTRONICS AND MICRO-OPTICS TO REDUCE THE SIZE AND POWER REQUIREMENTS CONVENTIONAL IR SPECTROPHOTOMETERS AND DEVELOP A "SECOND GENERATION" INSTRUMENT. OPCOA HAS FOUR (4) BASIC TECHNICAL OBJECTIVES IN PHASE I OF THIS PROPOSAL: (1) DESIGN AN ELECTRONICALLY TUNABLE, PIEZOELECTRIC, FABRY-PEROT FILTER FOR PRODUCING A NARROW-BAND IR SPECTRUM. (2) EXPERIMENTALLY DEMONSTRATE THE EVANESCENT FIELD OF A HELICAL CONFIGURATION OF IR OPTICAL FIBER WILL ACT AS A SUITABLE IR ABSORPTION PATH. (3) SPECIFY A SEMI-CONDUCTOR DETECTOR/SOLID STATE COOLER COMBINATION FOR OPTIMIZED IR SPECTROPHOTOMETER PERFORMANCE. (4) APPLY MICROPROCESSOR, DATA ANALYSIS SOFTWARE TO BOTH AUTOMATICALLY CONTROL AND ENHANCE PERFORMANCE OF THE IR SPECTROPHOTOMETER. SUCCESSFUL COMPLETION OF PHASE I WILL FACILITATE FABRICATION OF A BRASSBOARD MODEL.

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| OPCOA, INC.<br>1202 NORTH BROADWAY<br>SANTA ANA, CA 92701<br>DR. WILLIAM H. QUICK<br>TITLE:<br>TOXIC GAS DETECTION EQUIPMENT<br>TOPIC: 75            OFFICE: NSWC | NAVY | \$ 40,593 |
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NEW AND IMMERSING TECHNOLOGIES HAVE MADE POSSIBLE THE DEVELOPMENT OF A "POCKET-SIZED" INFRARED SPECTROPHOTOMETER. SUCH AN INSTRUMENT WOULD HAVE APPLICATION IN THE ACCURATE AND RELIABLE REAL-TIME DETECTION OF TOXIC GASES FROM BURNT PROPELANTS SUCH AS LEAD OXIDES, HYDROGEN SULFIDE, HYDROGEN CYANIDE AND NITROUS OXIDES. OPCOA PROPOSES TO USE MICROELECTRONICS AND MICRO-OPTICS TO REDUCE THE SIZE AND POWER REQUIREMENTS CONVENTIONAL IR SPECTROPHOTOMETERS AND DEVELOP A "SECOND GENERATION" INSTRUMENT. OPCOA HAS FOUR (4) BASIC TECHNICAL OBJECTIVES IN PHASE I OF THIS PROPOSAL: (1) DESIGN AN ELECTRONICALLY TUNABLE, PIEZOELETRIC, FABRY-PEROT FILTER FOR PRODUCING A NARROW-BAND IR SPECTRUM; (2) EXPERIMENTALLY DEMONSTRATE THE EVANESCENT FIELD OF A HELICAL CONFIGURATION OF IR OPTICAL FIBER WILL ACT AS A SUITABLE IR ABSORPTION PATH; (3) SPECIFY A SEMICONDUCTOR DETECTOR/SOLID STATE COOLER COMBINATION FOR OPTIMIZED IR SPECTROPHOTOMETER PERFORMANCE AND (4) APPLY MICROPROCESSOR, DATA

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>---- | AWARDED<br>AMOUNT<br>----- |
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ANALYSIS SOFTWARE TO BOTH AUTOMATICALLY CONTROL AND ENHANCE PERFORMANCE OF THE IR SPECTROPHOTOMETER. SUCCESSFUL COMPLETION OF PHASE I WILL FACILITATE FABRICATION OF A BRASSBOARD MODEL.

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| OPTELECOM, INC.<br>15940 LUANNE DRIVE<br>GAITHERBBURG, MD 20877<br>WILLIAM H. CULVER<br>TITLE:<br>AIR DEPLOYED FIBER OPTIC CABLE FLAT WINDER<br>TOPIC:        6            OFFICE: DARPA | DARPA | \$ 49,900 |
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TWO GENERAL APPROACHES TO FLAT WINDING ARE DISCUSSED. IN ONE METHOD, THE WINDING SEQUENCE BEGINS BY WINDING THE FIRST LAYER ON A SPIRAL PATTERN INSIDE TO OUT, THEN WINDING THE NEXT LAYER OUTSIDE TO IN. IN ANOTHER METHOD, TWO SUCCESSIVE LAYERS ARE WOUND BY METERING OUT A PREDETERMINED LENGTH SUFFICIENT FOR A WINDING OUT FROM THE CORE AND BACK, HOLDING METERED FIBER ON AN AUXILIARY SPOOL, WINDING FROM CENTER TO PERIPHERY ON TWO LAYERS SIMULTANEOUSLY WITH COUNTER ROTATING DRIVES WHILE PAYING METERED FIBER OFF THE AUXILIARY SPOOL. OPTELECOM PROPOSES TO DOCUMENT THE REQUIREMENTS FOR FLAT WINDING FROM A FUNCTIONAL POINT OF VIEW, TO PRODUCE DRAWINGS AND/OR MODELS ILLUSTRATING TWO OR MORE FLAT WINDING MECHANISMS, TO EVALUATE MECHANISMS AND SELECT ONE FOR FURTHER DEVELOPMENT, TO BUILD A PROOF OF CONCEPT VERSION OF THE SELECTED MECHANISM, TO PRODUCE AND TEST FLAT WINDINGS, AND TO DEVISE AN ADHESIVE METHODOLOGY SUITABLE FOR FLAT WINDINGS.

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| OPTELECOM, INC.<br>15940 LUANNE DRIVE<br>GAITHERSBURG, MD 20877<br>WILLIAM H. CULVER<br>TITLE:<br>THIN BUFFER SINGLE MODE FIBER FOR LONG RANGE FIBER OPTICS GUIDANCE TRANSMISSION<br>TOPIC:        29            OFFICE: DRSMI-ICDA | ARMY | \$ 49,990 |
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SEVERAL FACTORS CAN DISTURB THE PERFECTION OF A WINDING AND LIMIT THE LENGTH WHICH CAN WOUND SUCCESSFULLY. THESE FACTORS INCLUDE TEMPERATURE CYCLING OF WOUND SPOOLS, IMPERFECTIONS OR VARIABILITY

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>----- | AWARDED<br>AMOUNT<br>----- |
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OF FIBER DIAMETER, SPOOL CONTOUR IRREGULARITIES, AND CROSSOVER LINES NOT FOLLOWING A REGULAR PATTERN LAYER AFTER LAYER. THIS PROPOSAL OFFERS DEVELOPMENT WORK LEADING TO A BETTER UNDERSTANDING OF WINDING EFFECTS AND TO METHODS AND HARDWARE THAT WILL ALLOW MORE PERFECTLY WOUND SPOOLS AND LONGER WOUND LENGTHS. PROPOSED WORK IS DIVIDED INTO WINDING PATTERNS SURVEY, AND SPOOL DESIGN.

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| OPTELECOM, INC.<br>15940 LUANNE DRIVE<br>GAITHERSBURG, MD 20877<br>WILLIAM H. CULVER<br>TITLE:<br>ROTATION MEASUREMENT TECHNIQUES<br>TOPIC: 76            OFFICE: NSWC | NAVY | \$ 49,990 |
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THE REQUIREMENT FOR ANGLE MEASUREMENT IN THE PRESENCE OF TRANSLATION IS NOT UNCOMMON, YET TRADITIONAL ANGLE ENCODERS DO NOT ACCOMMODATE TRANSLATION, EVEN WHEN THE MEASUREMENT ANGLE IS SMALL. THE PROPOSED TECHNICAL APPROACH INVOLVES A NOVEL POSITION ENCODING ARRANGEMENT IN WHICH AN ABSOLUTE POSITION MEASUREMENT IS DERIVED FROM A SINGLE WIDE ENCODED TRACK WITH A NOVEL PATTERN OF DARK AND LIGHT BARS IMAGED ONTO A DETECTOR ARRAY ARRANGED PERPENDICULAR TO THE BARS. OPTELECOM PROPOSES TO DOCUMENT FUNCTIONAL SPECIFICATIONS, DEVELOP A PRELIMINARY ANGLE ENCODER DESIGN, WRITE A COMPUTER MODEL TO PREDICT DEVICE PERFORMANCE AND DEVELOP A PHASE II PROGRAM PLAN.

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| OPTIMA SYSTEMS, INC.<br>121 MIDDLESEX TURNPIKE<br>BURLINGTON, MA 01803<br>ROBERT HOFFMAN<br>TITLE:<br>IMPROVED REMOTE DISTANCE MEASUREMENT TECHNIQUES<br>TOPIC: 79            OFFICE: NSWC | NAVY | \$ 46,417 |
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THERE ARE VARIOUS METHODS PRESENTLY IN USE FOR ACCURATE MEASUREMENT OF DISTANCES INVOLVING LASER TECHNOLOGY. THESE DEVICES, IN-

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>----- | AWARDED<br>AMOUNT<br>----- |
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TERFEROMETERS, USE COHERENT LIGHT WAVES TO INTERPRET DISTANCES. MEASUREMENT IS QUITE PRECISE; HOWEVER, THE UNIT IS COSTLY AND MUCH MORE PRECISE THAN MANY APPLICATIONS REQUIRE. THEY ARE ALSO BULKY, DIFFICULT TO IMPLEMENT, AND USUALLY DESIGNED FOR OPERATION IN A FIXED POSITION. THE DEVELOPMENT OF A MORE PRACTICAL AND SIGNIFICANTLY LESS EXPENSIVE MEASURING DEVICE USING LASER TECHNOLOGY IS AN OPPORTUNITY TO IMPROVE UPON THESE INTERFEROMETERS. OPTIMA PROPOSES A UNIT THAT INCORPORATES A LASER WHICH PRODUCES MODULATED LIGHT WAVES. THIS MODULATED LIGHT WOULD BE DIRECTED AT A TARGET OBJECT. THE OBJECT WOULD REFLECT THIS LIGHT BACK TO A BEAM SPLITTER, WHERE THE RETURNED MODULATION WOULD TRAVEL TO A PHOTOCCELL. THE PHASE OF THE RETURNED LIGHT WOULD BE PROCESSED THROUGH A PHASE COMPARATOR. THE RESULT OF THIS PROCESS WOULD BE A DC VOLTAGE WHICH WOULD THEN BE DIGITIZED USING AN A/D CONVERTER AND THE DISTANCE DISPLAYED ON A LED OR LCD DISPLAY. A SIMPLE MICROPROCESSOR WOULD CONTROL DISPLAY FUNCTIONS, TEMPERATURE COMPENSATION, AND NORMALIZE ANY PHASE NON-LINEARITY.

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| OPTIMA SYSTEMS, INC.<br>ONE NORTH AVENUE<br>BURLINGTON, MA 01803<br>SANJAI KOHLI<br>TITLE:<br>USE OF GPS FOR DETERMINING ACCURATE VEHICLE HEADING AND ATTITUDE | NAVY         | \$ 49,844 |
| TOPIC: 84  | OFFICE: NSWC |           |

IN THIS PROPOSAL A RESEARCH PROGRAM IS DESCRIBED FOR DETERMINING THE FEASIBILITY OF USING THE GLOBAL POSITIONING SYSTEM (GPS) FOR OBTAINING VEHICLES HEADING AND ATTITUDE ACCURACIES WITHIN+1. BOTH INTERFEROMETRIC TECHNIQUES AND DOUBLE DIFFERENCING WILL BE CONSIDERED IN DETERMINING THE MOST APPROPRIATE APPROACH TO IMPLEMENT IN DERIVING THE VEHICLE HEADING AND ATTITUDE. A SIMULATOR WILL BE DEVELOPED TO SUPPORT ANALYSIS, IMPLEMENTATION AND TEST EFFORTS. THIS SIMULATOR WILL PROVIDE A PRECISE REPRESENTATION OF THE GPS SPACE AND CONTROL SEGMENTS.

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| OPTIMETRICS, INC.<br>2000 HOGBACK ROAD<br>ANN ARBOR, MI 48104<br>MERLE J. PERSKY<br>TITLE:<br>GAS FILTER CORRELATION IMAGERY FOR HCl VAPOR MONITORING | AF            | \$ 45,500 |
| TOPIC: 190  | OFFICE: OL-AB |           |

NASA'S SPACE SHUTTLE IS LAUNCHED BY THREE LIQUID PROPELLANT ENGINES

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>---- | AWARDED<br>AMOUNT<br>----- |
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AND TWO SOLID MOTOR BOOSTERS. THESE BOOSTERS PRODUCE LARGE AMOUNTS OF HYDROGEN CHLORIDE CREATING A POTENTIAL HAZARD TO PERSONNEL AND PROPERTY. THEREFORE, A DEVICE IS NEEDED TO PROVIDE HCl LOCATION AND CONCENTRATION DATA FOR USE IN TOXIC HAZARD PREDICTIONS AND TO PROTECT THE GOVERNMENT AGAINST LEGAL ACTIONS.

WE PROPOSE TO USE A NEW TECHNIQUE DEVELOPED BY OPTIMETRICS, INC. TERMED GAS FILTER CORRELATION IMAGERY (GFCI) TO SOLVE THE INSTRUMENTATION PROBLEM. THE GFCI TECHNIQUE IS THE COMBINATION OF TWO EXISTING WIDELY APPLIED REMOTE SENSING INFRARED TECHNIQUES. THE TECHNIQUES ARE GAS FILTER CORRELATION SPECTROSCOPY (GFCS) AND INFRARED IMAGING. THE GFCS TECHNIQUE (4, 5, 6, 7) HAS BEEN DEVELOPED OVER THE PAST 15 YEARS AND HAS BEEN PARTICULARLY USEFUL IN THE MEASUREMENT OF ATMOSPHERIC POLLUTANTS. THE ESSENCE OF GFCS IS TO COMPARE THE TARGET RADIATION PASSING THROUGH A GAS FILTER CONTAINING THE GAS TO BE DETECTED WITH THE SAME RADIATION PASSING THROUGH A NEUTRAL FILTER. THE DIFFERENCE SIGNAL IS A MEASURE OF THE GAS CONCENTRATION IN THE OPTICAL PATH BEING EXAMINED. THE INFRARED IMAGER [8] HAS BEEN DEVELOPED TO SPATIALLY EXAMINE TARGETS AND SCENES IN THE INFRARED. THE COMBINATION OF THESE TWO TECHNIQUES WILL PROVIDE A SPATIAL EXAMINATION OF AN HCl PLUME WHICH HAS BEEN SPECTRALLY SEPARATED FROM THE REMAINING INFRARED BACKGROUND.

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| OPTIMIZATION INCORPORATED<br>29 HIGH MEADOW DRIVE<br>BLACKBURG,, VA 24060<br>DR. HENRY J. KELLEY<br>TITLE:<br>STATE-SPACE MODELS AND ADVANCE CONTROL CONCEPTS FOR LARGE SPACE STRUCTURES<br>TOPIC: 204 | AF | \$ 68,228 |
| OFFICE: AFRPL/TSTR   |    |           |

STUDIES OF THE DYNAMICS AND CONTROL OF FLEXIBLE SPACE STRUCTURES ARE COMPLICATED BY THE DISTRIBUTED-PARAMETER NATURE (PARTIAL-DIFFERENTIAL EQUATIONS) OF THE FUNDAMENTAL DESCRIPTION. RATHER THAN INTRODUCE LUMPED (FINITE-DIMENSIONAL) APPROXIMATIONS AT THE OUTSET, IT IS PROPOSED TO USE MODERN MATHEMATICAL FORMULATIONS TO DEVELOP STATE-SPACE MODELS THAT RETAIN THIS DISTRIBUTED-PARAMETER NATURE. A PRACTICAL PROTOTYPE STRUCTURE IS SUGGESTED FOR STUDY.

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| OPTRA INC<br>1727 REVERE BEACH PARKWAY<br>EVERETT, MA 02149<br>MICHAEL HERCHER<br>TITLE:<br>STRESS-OPTIC DYNAMIC BLAST & SHOCKS GAUGE<br>TOPIC: 218 | AF | \$ 57,899 |
| OFFICE: AFWL/PRP  |    |           |

OPTRA, INC. PROPOSES TO DEVELOP AND DEMONSTRATE A DYNAMIC BLAST AND

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>----- | AWARDED<br>AMOUNT<br>----- |
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SHOCK GAUGE BASED ON THE STRESS-OPTIC EFFECT IN COMBINATION WITH AN OPTICAL READOUT. THE PROPOSED TECHNIQUE HAS THE ADVANTAGES OF EXCELLENT TEMPORAL RESOLUTION (PROJECTED TO EXCEED 1 MHz), SMALL SIZE AND PHYSICAL ROBUSTNESS, ISOLATION FROM APPLIED ACCELERATIONS, EXCELLENT SENSITIVITY AND DYNAMIC RANGE, AND IMMUNITY FROM EMI (ELECTRO-MAGNETIC INTERFERENCE). DIFFERENT PROPOSED DESIGN CONFIGURATIONS PERMIT READOUT VIA OPTICAL FIBER, SHIELDED ELECTRICAL CABLE, OR REMOTE READOUT USING A LOW POWER HELIUM LASER BEAM.

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| OPTRA, INC.<br>1727 REVERE BEACH PARKWAY<br>EVERETT, MA 02149<br>MICHAEL HERCHER<br>TITLE:<br>ROTATION MEASUREMENT TECHNIQUES<br>TOPIC: 76            OFFICE: NSWC | NAVY | \$ 53,711 |
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AN ELECTRO-OPTICAL TECHNIQUE FOR THE MEASUREMENT OF RELATIVE MOTION BETWEEN COMPONENTS WITH ARC-SECOND ACCURACY IS PROPOSED. THE MEASUREMENT RANGE IS FUNDAMENTALLY UNLIMITED, QUITE PRACTICAL OVER SEVERAL DEGREES, AND PERMITS TRANSLATIONS IN EXCESS OF ONE INCH BETWEEN COMPONENTS. TWO APPLICATION ARRANGEMENTS ARE DISCUSSED. THE FIRST IS THAT OF TWO (OR MORE) SHAFTS ROTATING WITH RESPECT TO A STABLE REFERENCE. BY SENSING THE TANGENTIAL MOTION OF THE SHAFT SURFACES THE ROTATIONAL ANGLE IS KNOWN THROUGH THE SHAFT RADIUS IN A MANNER FREE FROM ERRORS DUE TO DEFECTS SUCH AS SHAFT WOBBLE OR ECCENTRICITY. THE SECOND IS THAT OF TWO PARALLEL FLAT SURFACES WHICH CAN ROTATE AND TRANSLATE WITH RESPECT TO EACH OTHER IN THEIR RESPECTIVE PLANES. THE PROPOSED TECHNIQUE WILL ALLOW THE ROTATION MEASUREMENT TO BE UNCOUPLED FROM THE TRANSLATION. BOTH APPLICATIONS EMPLOY THE OPTRA TWO-FREQUENCY LASER AND UTILIZE A TECHNIQUE BY WHICH THE MOTION OF A SURFACE ONTO WHICH A INTERFERENCE PATTERN IS PROJECTED PRODUCES A MODULATION OF THE AMPLITUDE OF THIS FRINGE PATTERN FROM WHICH CAN BE INFERRED THE MOTION OF THE SURFACE.

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| PACER SYSTEMS, INC.<br>410 COMMERCE DRIVE<br>FORT WASHINGTON, PA 19034<br>ROGER SMITH<br>TITLE:<br>ISAR PART TASK TRAINER<br>TOPIC: 115            OFFICE: NTEC | NAVY | \$ 49,930 |
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THE ISAR PART TASK TRAINER IS A TRAINING SYSTEM WHICH WILL

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>---- | AWARDED<br>AMOUNT<br>----- |
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MAINTAIN THE PROFICIENCY OF ISAR OPERATORS IN THE AREA OF IMAGE ANALYSIS AND CLASSIFICATION. THE SYSTEM WILL BE PORTABLE AND SUPPORT MULTI-PLATFORMS. THE SYSTEM WILL BE COMPRISED OF A HIGH RESOLUTION DISPLAY, A VIDEO DISK, MICROPROCESSORS AND OPERATOR ORIENTED INPUT DEVICES.

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| PACIFIC WESTERN SERVICES<br>P.O. BOX 100<br>TRACYTON, WA 98393<br>MARK I. GOOD<br>TITLE:<br>EFFECT OF PRINT ON DEMAND CAPABILITIES ON DOCUMENTATION MANAGEMENT<br>TOPIC: 37      OFFICE: NAVSUPSYS | NAVY | \$ 33,037 |
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A PRINT ON DEMAND (POD) CAPABILITY HAS A MAJOR POTENTIAL IN AN ENVIRONMENT WHERE A LARGE VARIETY OF FORMS ARE PREPARED RANDOMLY, OFTEN FROM AN AUTOMATED DATABASE. POD EQUIPMENT CAN PERMIT COMMON ITEMS FROM THE DATABASE TO BE PRE-INSERTED ON A VISUAL DISPLAY TERMINAL (VDT) FOR THE CLERK, ELIMINATING REDUNDANT KEY STROKING, REDUCING ERRORS, REDUCING FORM COST AND MAINTENANCE, AND MINIMIZING RETYPING. THE NAVY PERSONNEL SUPPORT ACTIVITIES (PSAs) AND LARGE SHIPS PROVIDE AN ENVIRONMENT WHERE HUNDREDS OF FORMS MUST BE ORDERED, STOCKED, AND UTILIZED BY PEOPLE UNFAMILIAR WITH THE FORMS. THEY ARE USED FOR CLAIMS, TRAVEL DISBURSEMENT, SEPARATION, REENLISTMENT, TRANSFER, EVALUATION, PROMOTION, AND SECURITY CLEARANCES, ETC. THE OBJECTIVES OF THE RESEARCH WOULD BE: 1) SUMMARIZE AND PROJECT POD EQUIPMENT CAPABILITIES BASED ON DATA SOLICITED FROM LEADING VENDORS; 2) IDENTIFY AND CATEGORIZED ALL THE FORMS USED AT A PSA; DETERMINE INTERFACE PROBLEMS AND ISSUES RELATE TO LINKING POD EQUIPMENT WITH PSA COMPUTERS; 4) DESIGN A COMPREHENSIVE TEST APPLICATION SCENARIO TO PROVIDE QUANTITATIVE DATA TO SUBSTANTIATE POD FEASIBILITY IN A PSA AND SHIPBOARD ENVIRONMENTS; AND 5) PREPARE A PLAN OF ACTION AND MILESTONES.

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| PACIFIC-SIERRA RESEARCH CORPORATION<br>1401 WILSON BOULEVARD, SUITE 1100<br>ARLINGTON, VA 22209<br>DR. GENE E. MCCLELLAN<br>TITLE:<br>CONUS STRATEGIC POSTATTACK RECOVERY - RADIOBIOLOGICAL CONSIDERATIONS<br>TOPIC: 1      OFFICE: OAAM | DNA | \$ 99,090 |
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THE RADIOBIOLOGICAL EFFECTS FROM INITIAL AND LINGERING AIRBORNE AND

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>---- | AWARDED<br>AMOUNT<br>----- |
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SURFACE FALLOUT NUCLEAR RADIATION ARE KEY CONSIDERATIONS FOR CONUS POSTATTACK STRATEGIC RECOVERY OPERATIONS PLANNING. IN THIS PROPOSED EFFORT WE INTEND TO APPLY THE KNOWLEDGE GAINED FROM THE DNA INTERMEDIATE DOSE PROGRAM (IDP) AND PROVIDE A TIMELY UPDATE OF THE SCOPE OF RADIOBIOLOGICAL EFFECTS ON INDIVIDUALS ASSUMING VARIOUS ROLES IN RECOVERY OPERATIONS AND MILITARY MISSION ASSIGNMENTS. OUR APPROACH WILL BE TO DEVELOP ESTIMATES OF THE RADIOBIOLOGICAL IMPACT ON THE PERFORMANCE OF STRATEGIC MILITARY PERSONNEL WITHIN THE FRAMEWORK OF CONUS ATTACK SCENARIOS AND ATTENDANT RADIATION ENVIRONMENTS.

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| PACIFIC-SIERRA RESEARCH CORPORATION<br>12340 SANTA MONICA BOULEVARD<br>LOS ANGELES, CA 90025<br>HAROLD L. BRODE<br>TITLE:<br>SMOKE AND ASH IN THE ATMOSPHERE FROM NUCLEAR WAR<br>TOPIC: 1                      OFFICE: OAMM | DNA | \$ 59,983 |
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IT HAS BEEN SUGGESTED THAT MOST NUCLEAR WARS IMAGINED WOULD CAUSE DECREASED SOLAR ENERGY AT THE GROUND OVER MUCH OF THE WORLD AND THAT THE SMOKE AND DUST CAUSING THE SUNLIGHT ATTENUATION WOULD PERSIST FOR MONTHS TO YEARS. THE ASSUMPTIONS INVOKED IN REACHING SUCH ESTIMATED EFFECTS ARE SUBJECT TO GREAT UNCERTAINTY AND MERIT MORE ATTENTION. WE PROPOSE TO PROVIDE INDEPENDENT BEST ESTIMATES OF MEAN VALUES AND A MEASURE OF THE UNCERTAINTY/VARIABILITY OF EACH CONTRIBUTING FACTOR, TOGETHER WITH SUPPORTING DOCUMENTATION. AREAS AT RISK, BOTH URBAN/SUBURBAN AND WILDLAND, FUEL LOADING, BURN RATES AND WEIGHTS, SMOKE VOLUME (MASS) GENERATED, SOOT AND ASH PARTICLE SIZE DISTRIBUTIONS, ALTITUDES ACHIEVED, AND SOME MEASURES OF THE RATES OF DISPERSION, CONVERSION, AND SETTLEMENT. THE POSSIBLE VARIANCE IS LARGE, SINCE MOST OF THESE UNCERTAIN FACTORS ENTER AN OPTICAL THICKNESS MEASURE IN THE EXPONENT OF AN EXPONENTIAL FACTOR.

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| PATEL ENGINEERS<br>P.O. BOX 3531<br>HUNTSVILLE, AL 35810<br>RALPH L. MORRIS<br>TITLE:<br>DEVELOPMENT OF TIME-TEMPERATURE EFFECTS DATA BASE FOR NON-METALLIC MATERIALS<br>TOPIC: 77                      OFFICE: NSWC | NAVY | \$ 50,050 |
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THE ARRHENIUS METHODOLOGY IS CURRENTLY ACCEPTED AS STATE-OF-THE-ART

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>----- | AWARDED<br>AMOUNT<br>----- |
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IN THE REALM OF PREDICTING THERMAL LIFE ON NON-METALLIC MATERIALS. APPLICATION OF THE ARRHENIUS METHODOLOGY REQUIRES THE AVAILABILITY OF EMPIRICAL LIFE TESTING DATA, WHICH MAY BE GENERATED FOR A VARIETY OF PHYSICAL/ELECTRICAL PROPERTIES FOR ANY GIVEN MATERIAL. A LARGE QUANTITY OF SUCH DATA HAS BEEN GENERATED BY A MULTITUDE OF SOURCES. HOWEVER, THE EXISTING INFORMATION IS FRAGMENTED. THIS PROPOSAL ADVOCATES A PROGRAM TO DEVELOP A COMPUTERIZED DATA BASE SPECIFICALLY TAILORED TO LIFE PREDICTION OF NON-METALLIC MATERIALS. OF PRIMARY IMPORTANCE WOULD BE THE COLLECTION ASSIMILATION OF EXISTING DATA, RESULTING IN A COMPREHENSIVE DATA BASE. SUBSEQUENTLY, SOFTWARE WILL BE DEVELOPED TO ACCESS THE DATA AND GENERATE LIFE PREDICTIONS, BASED ON BASIC OR MODIFIED ARRHENIUS LIFE EQUATIONS. THE SOFTWARE WOULD BE DEVELOPED IN A MANNER WHICH WOULD EASE ITS "TRANSPORTATION" BETWEEN VARIOUS HARDWARE SYSTEMS. IN ADDITION TO SINGULAR NON-METALLIC MATERIALS DATA, AGING PARAMETERS APPLICABLE TO ELECTRONIC COMPONENTS AND INSULATION SYSTEMS WOULD BE INCLUDED IN THE SYSTEM, WHERE APPLICABLE.

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| PDA ENGINEERING<br>1560 BROOKHOLLOW DRIVE<br>SANTA ANA, CA 92705<br>L. S. GROENER<br>TITLE:<br>LASER HARDENED MATERIAL EFFECTS ANALYSES<br>TOPIC: 256            OFFICE: BMO/PMX | AF | \$ 49,190 |
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SOME PROPOSED CW LASER WEAPONS HAVE BEAM DIAMETERS ON THE ORDER OF A METER WITH FLUX LEVELS EXCEEDING 2KW/cm. THERE IS EVIDENCE THAT LASER BEAM ATTENUATION BY ABLATION PRODUCTS WILL BE SIGNIFICANT FOR THIS TYPE OF WEAPON IN SOME TARGET FLIGHT REGIMES. THE OBJECTIVES OF THE PROJECT WILL BE TO: (1) THEORETICALLY INVESTIGATE THE EFFECTS OF THE LASER DESIGN PARAMETERS (WAVELENGTH, POWER, AND DIAMETER) AND THE TARGET FLIGHT REGIME ON ATTENUATION, (2) ESTABLISH THE PROBABLE BOUNDS ON ATTENUATION FOR THE PRINCIPAL FLOW REGIMES, AND (3) DEFINE THE GROUND TESTS THAT WILL BE NECESSARY TO RESOLVE SIGNIFICANTLY UNCERTAINTIES IN THE ATTENUATION MAGNITUDE.

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| PDA ENGINEERING<br>1560 BROOKHOLLOW DRIVE<br>SANTA ANA, CA 92705<br>H. L. MOODY<br>TITLE:<br>U.S. ICBM DIRECTED ENERGY WEAPON VULNERABILITY STUDY<br>TOPIC: 283            OFFICE: BMO/PMX | AF | \$ 48,631 |
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FOUR MAJOR CLASSES OF DIRECTED ENERGY WEAPONS ARE BEING EVALUATED

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>----- | AWARDED<br>AMOUNT<br>----- |
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FOR DEFENSE AGAINST ICBMS: CW LASER, PULSE LASER, PARTICLE BEAMS, AND X-RAY LASERS. THE VULNERABILITY AND FIRST-ORDER HARDENING METHODS FOR AN EXISTING U.S. ICBM (PEACEKEEPER) WILL BE IDENTIFIED AND EVALUATED IN THE PROPOSED EFFORT. THE CRITICAL COMPONENTS, THEIR RESPONSE DURING IRRADIATION AND THEIR EFFECT ON OVERALL SYSTEM PERFORMANCE WILL BE ANALYZED FOR EACH CLASS OF DIRECTED ENERGY WEAPON. THE FAILURE MODES AND THE LEVEL OF THREAT IRRADIATION FOR COMPONENT FAILURE WILL BE DETERMINED. FIRST-ORDER HARDENING METHODS WILL BE IDENTIFIED FOR THE CRITICAL COMPONENTS AND EVALUATED TO ASSESS HARDNESS AND IMPLICATIONS ON THE SYSTEM PERFORMANCE.

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| PHOENIX COMMUNICATIONS, INC.<br>4220 YORK ROAD<br>BALTIMORE, MD 21212<br>M.K. MILLIKEN, JR.<br>TITLE:<br>FRONT/REAR PROJECTION SCREENS FOR TACTICAL AIR VISUAL SIMULATORS<br>TOPIC: 57      OFFICE: AFWAL/XRPF | AF | \$ 49,865 |
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PROJECT 57 EFFORTS WILL CONCENTRATE UPON THE DESIGN OF FACETS AND ORIENTATIONS OF LINEAR FRESNEL LENSES AND THE REDESIGN OF THE CONTOURS OF THE REAR PROFILES AND FRONT PROFILES OF LENTICULAR MATERIALS TO PRODUCE THE REQUISITE DIRECTIONALITY AND RESOLUTION OF THE FRONT/REAR SCREEN. THE COMPATIBILITY OF THE FRONT AND REAR PROFILES OF THE SCREEN, WITH SPECIAL ATTENTION TO COLOR BALANCE AND BRIGHTNESS, AS WELL AS CONTRAST, IS A PRIORITY TECHNICAL OBJECTIVE. CRITICAL ATTENTION WILL BE GIVEN TO THE DESIGN OF THE MECHANICAL STRUCTURE, ENVISIONED AS A MULTI-FACETED DOME, INTO WHICH THE FLAT SCREEN PANELS WILL BE PLACED.

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| PHOTOFABRICATION TECH., INC.<br>P.O. BOX 3209<br>DERRY, NH 03038<br>R. E. HOWE<br>TITLE:<br>LOW COST SEAWATER CORROSION SENSORS<br>TOPIC: 78      OFFICE: NSWC | NAVY | \$ 49,976 |
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THIS PROPOSAL ENVISIONS DETERMINING THE FEASIBILITY OF USING

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>---- | AWARDED<br>AMOUNT<br>----- |
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PHOTOFABRICATION TECHNOLOGY TO PRODUCE LOW COST SEAWATER CORROSION SENSORS. UNLIKE CONVENTIONAL ELECTROCHEMICAL CORROSION SENSORS WHICH MEASURE ONLY INSTANTANEOUS CORROSION RATE, THE PROPOSED SENSORS WILL MEASURE BOTH INSTANTANEOUS RATE AND CUMULATIVE CORROSION. THE TENTATIVE DESIGN OF THESE SENSORS IS VERY COMPACT, ABOUT THE SIZE OF A POSTAGE STAMP. THE RESEARCH PROPOSED HEREIN COVERS BOTH THE DESIGN AND PROOF OF CONCEPT TESTING OF THE PROPOSED SENSORS. BECAUSE OF ITS WIDE USAGE IN SEAWATER PIPING SYSTEMS, 90/10 COPPER NICKEL, (C70600), WILL BE ONE OF THE ALLOYS STUDIED IN THIS RESEARCH; STEEL WILL BE THE OTHER. THE PRINCIPLES DEVELOPED IN THE RESEARCH ARE APPLICABLE TO OTHER MARINE ALLOYS, WHICH WOULD BE EVALUATED IN PHASE II.

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| PHOTOMETRICS INC<br>4 ARROW DR<br>WOBURN, MA 01801<br>ANDREW R BOGDAN<br>TITLE:<br>PICOSECOND LASER PROBE OF MATERIAL BLOWOFF<br>TOPIC: 4 OFFICE: OAAM | DNA | \$ 49,473 |
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A LASER MICROPROBE FOR ANALYZING LASER PRODUCED MATERIAL BLOWOFF FROM BULK MATERIALS IS TO BE DEVELOPED. MOST WORK ON LASER-TARGET AND LASER-SURFACE INTERACTIONS HAS CONCENTRATED ON THE DEVELOPMENT OF DIAGNOSTICS AND PROBES FOR MEASURING PHYSICAL PROPERTIES OF THE PLASMA PRODUCED FROM PELLETS, THIN FILM TARGETS, AND BULK MATERIALS. LITTLE WORK HAS BEEN DONE TO ANALYZE THE MATERIAL BLOWOFF. WE SHALL STUDY THIS IN FURTHER DETAIL IN ORDER TO HELP DETERMINE THE "MECHANISMS BY WHICH THE DIRECTED ENERGY EFFECTS ACTUALLY INTERACT WITH TARGET MATERIALS." DURING PHASE I WE WILL DETERMINE THE REQUIREMENTS AND SPECIFICATIONS OF THE LASER PROBE. STATE OF THE ART TECHNIQUES IN PICOSECOND RANGING AND GATING WILL BE REVIEWED AND A SYSTEM WILL BE DESIGNED. THE PROBING TECHNIQUE WILL ALLOW THE STUDY AND COMPARISON OF THE CHARACTERISTICS OF THE BLOWOFF FROM VARIOUS MATERIALS WITH DIFFERENT ABLATING LASERS OR OTHER SOURCES OF DIRECTED ENERGY.

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| PHYSICAL DYNAMICS, INC.<br>300 120TH AVENUE NE, BLDG. 7, SUITE 220<br>BELLEVUE, WA 98005<br>R. DAVID LUCAS<br>TITLE:<br>PROCESSING AND DISPLAY OF LARGE-SCALE INOSPHERIC IMAGES<br>TOPIC: 205 OFFICE: AFGL/XOP | AF | \$ 50,132 |
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A COMPREHENSIVE APPROACH TO THE DIGITIZATION, PROCESSING, AND DISPLAY

FISCAL YEAR 1984

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OF AFGL ALL-SKY IMAGES IS PROPOSED. WE FIRST PLAN TO EVALUATE AND COMPARE TWO METHODS OF PRODUCING DIGITAL REPRESENTATIONS OF THE IMAGES: VIDEO FRAME-GRABBING AND DIGITAL SCANNING. ACCURACY, RESOLUTION, NOISE LEVELS, COST AND COVENIENCE WILL BE CONSIDERED. AS PART OF THIS EFFORT, WE WILL BUILD UP A SMALL LIBRARY OF DIGITIZED ALL-SKY IMAGES. WE WILL ALSO DEVELOP SOFTWARE TO PERFORM A SEQUENCE OF TRANSFORMATIONS WHICH MAP THE DIGITAL IMAGES FROM CAMERA COORDINATES TO GEOGRAPHIC OR GEOMAGNETIC COORDINATES AND FINALLY TO A DISPLAY SURFACE. NUMEROUS DETAILS SUCH AS REGISTRATION,, CALIBRATION, AND RESAMPLING WILL BE ATTENDED TO. DISPLAY FORMATS WHICH MAXIMIZE THE VISUALIZATION OF USEFUL INFORMATION WILL BE DESIGNED AND SOFTWARE TO GENERATE THE DISPLAYS WILL BE PRODUCED. THE PRIMARY DISPLAY FORMAT WILL BE A COMPOSITE VIEW OF ALL-SKY IMAGES SUPERIMPOSED ON GEOGRAPHIC OR GEOMAGNETIC COORDINATES WITH COASTLINES SHOWN. THREE DIMENSIONAL VIEWS AND ANIMATION WILL ALSO BE CONSIDERED. WE WILL LOOK AT WAYS THAT DATA OBTAINED FROM OTHER SENSORS, SUCH AS THOSE ABOARD THE HILAT SATELLITE, CAN BE CORRELATED AND DISPLAYED WITH THE ALL-SKY IMAGES. ATTENTION WILL ALSO BE PAID TO THE DATA MANAGEMENT PROBLEMS THAT WOULD ARISE FROM ANY ATTEMPT TO PROCESS LARGE NUMBERS OF ALL-SKY IMAGES.

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| PHYSICAL DYNAMICS, INC. - N.W. OFFICE<br>300 120TH AVE NE, BLDG 7, SUITE 220<br>BELLEVUE, WA 98005<br>DONALD P. DELISI | AF | \$ 74,786 |
| TITLE:<br>EXPERIMENTAL GENERATION OF STRATIFIED SHEAR FLOW BY WAVE MOMENTUM TRANSPORT                                  |    |           |
| TOPIC: 157                      OFFICE: AFOSR/XOT  |    |           |

THIS PROPOSAL IS A JOINT EXPERIMENTAL, THEORETICAL, AND NUMERICAL STUDY OF GRAVITY WAVE - CRITICAL LAYER INTERACTIONS. THESE INTERACTIONS ARE IMPORTANT IN UNDERSTANDING ATMOSPHERIC DYNAMICS BECAUSE OF STRESS DIVERGENCE AND MIXING THAT OCCUR AS A GRAVITY WAVE APPROACHES ITS CRITICAL LEVEL. THE OBJECTIVES OF PHASE I ARE TO GENERATE STEADY-STATE, STRATIFIED SHEAR FLOWS IN THE LABROATORY BY THE WAVE MOMENTUM TRANSPORT TECHNIQUE, AND TO MEASURE AND CHARACTRIZE THE RESULTING FLOWS. WE WILL GENERATE THESE SHEAR FLOWS BY ALLOWING A GRAVITY WAVE TO PROPAGATE INTO A STRATIFIED FLUID, THEREBY TRANSPORTING MOMENTUM FROM THE BOUNDARY AT WHICH THE WAVE IS FORCED TO THE INTERIOR FLUID WHERE THE

FISCAL YEAR 1984

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WAVE IS DISSIPATED. THIS TECHNIQUE IS MOTIVATED BY THE GRAVITY WAVE EXPERIMENT OF PLUMB AND MCEWAN (1978). IN PHASE 2, WE WILL PROPAGATE ADDITIONAL GRAVITY WAVES INTO THE STRATIFIED SHEAR FLOW TO STUDY CRITICAL LAYER INTERACTIONS.

THE MAJORITY OF THE PHASE I EFFORT IS TO CONSTRUCT AN EXPERIMENTAL FACILITY TO DETERMINE THE CHARACTERISTICS OF THE SHEAR FLOWS GENERATED BY THE WAVE MOMENTUM TRANSPORT TECHNIQUE. WE WILL USE THEORETICAL PREDICTIONS TO HELP US DESIGN THIS FACILITY. EXPERIMENTS WILL BE PERFORMED. AND THE MEASURED RESULTS WILL BE COMPARED TO BOTH THEORETICAL AND NUMERICAL PREDICTIONS.

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| PHYSICAL SCIENCES INC<br>RESEACH PARK PO BOX 3100<br>ANDOVER, MA 01810<br>WILLIAM J MARINELLI<br>TITLE:<br>LASER DIAGNOSTICS FOR MEASURING VIBRATIONAL STATES OF O <sub>2</sub> (A1 DELTA [G])<br>TOPIC: 219A      OFFICE: AFWL/PRP | AF | \$ 49,996 |
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IN ORDER TO UNDERSTAND THE MECHANISM OF THE CHEMICAL OXYGEN-IODINE LASER (COIL) THE ROLE OF VIBRATIONALLY EXCITED O ( g) IN PROMOTING I DISSOCIATION MUST BE ASSESSED. THERE IS CURRENTLY NO LASER-BASED TECHNIQUE CAPABLE OF MEASURING O ( g)(v) IN THE 10 MOLECULE cm<sup>3</sup> CONCENTRATION RANGE EXPECTED IN A COIL CHEMICAL ENVIRONMENT. WE PROPOSED TO USE MULTIPHOTON IONIZATION SPECTROSCOPY (MPI) TO DETECT O ( g)(v) IN THIS SYSTEM. USING AN MPI TECHNIQUE PREVIOUSLY DEVELOPED BY THE PRINCIPAL INVESTIGATOR AND COWORKERS AT CORNELL UNIVERSITY TO OBSERVE VIBRATIONALLY RELAXED O ( g), WE WILL DEMONSTRATE THE ABILITY TO DETECT O<sub>2</sub>( g)(v) USING THE PULSED PHOTOLYSIS OF O<sub>2</sub> AT 266 nm TO CREATE A DISTRIBUTION OF O ( g) VIBRATIONAL STATES. PHOTOLYSIS OF I( P / ) PRECURSORS IN EXCESS O WILL BE USED TO CREATE O ( g) VIA ENERGY TRANSFER IN ORDER TO ASSESS ANY INTERFERENCES FOR THE MPI DETECTION OF O ( g) WHICH MAY BE CHARACTERISTIC OF COIL SYSTEMS. DETECTION SENSITIVITIES OR LIMITS WILL BE REPORTED FOR EACH VIBRATIONAL LEVEL AND SPECTRAL SIMULATION WILL BE DONE TO IDENTIFY THE O RYDBERG STATES THAT ARE INTERMEDIATES IN THE MPI PROCESS.

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| PHYSICAL SCIENCES INC.<br>RESEARCH PARK, P.O. BOX 3100<br>ANDOVER, MA 01810<br>DR. MICHAEL L. FINSON<br>TITLE:<br>NONEQUILIBRIUM BOUNDARY LAYER COMPUTER CODE FOR REENTRY VEHICLES<br>TOPIC: 253      OFFICE: BMO/PMX | AF | \$ 48,649 |
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A COMPUTER CODE WILL BE DEVELOPED TO PROVIDE TWO-DIMENSIONAL

FISCAL YEAR 1984

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NONEQUILIBRIUM SOLUTIONS FOR REENTRY VEHICLE BOUNDARY LAYERS, WITH EMPHASIS ON PREDICTION OF THE ELECTRON DENSITY. A BLOCK IMPLICIT TECHNIQUE WILL BE IMPLEMENTED FOR RELIABLE, STABLE SOLUTION OF THE CHEMICAL KINETIC RATE EQUATIONS AT ALL REENTRY ALTITUDES. THE CODE WILL BE CAPABLE OF HANDLING A WIDE VARIETY OF CHEMICAL SYSTEMS (AIR, HYDROCARBONS, ALKALI CONTAMINANTS, AND ANY OTHERS OF FUTURE INTEREST), AND WILL CONTAIN AN OPTION FOR LAMINAR OR TURBULENT BOUNDARY LAYER FLOW. THE CODE WILL BE DESIGNED TO PERMIT EASY OPERATION BY POTENTIAL USERS.

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| PHYSICAL SCIENCES INC. | AF | \$ 49,098 |
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RESEARCH PARK, BOX 3100  
ANDOVER, MA 01810

ALAN GELB

TITLE:

PROTECTION OF THERMAL SHIELDS FROM LASER IRRADIATION BY HIGHLY REFLECTING LIQUID FILMS

TOPIC: 256 OFFICE: BMO/PMX

THE CONCEPT OF THIN LIQUID FILM MEDIATED PROTECTION FROM LASER IRRADIATION WILL BE APPLIED TO HEAT SHIELD MATERIALS. THE CONCEPT EMPLOYS A THIN METAL FILM WHICH BECOMES LIQUID DURING IRRADIATION. THE FILM IS DESIGNED TO BE HIGHLY REFLECTING TO LASER IRRADIATION WITHOUT INTERFERING WITH THE VAPORIZATION THERMODYNAMICS OF THE HEAT SHIELD. THIS CONCEPT PROVIDES LASER HARDENING IN AN EXO ENVIRONMENT. AT ENDO ALTITUDES, THE THIN FILM WILL NOT INTERFERE WITH THE HEAT SHIELD FUNCTION. A COMBINED THEORETICAL-EXPERIMENTAL PROGRAM IS PROPOSED.

THE THEORETICAL EFFORT WILL DETERMINE THE RANGES OF LASER PARAMETERS FOR WHICH HIGH REFLECTIVITY WILL BE MAINTAINED AND IDENTIFY CANDIDATE COATING MATERIALS. CANDIDATE MATERIALS WILL BE SCREENED FOR HIGH REFLECTIVITY, AND FOR STABLE LIQUID PHASE OVER REQUIRED TEMPERATURE RANGES. METAL ALLOYS WILL BE GIVEN PARTICULAR ATTENTION AS CANDIDATE MATERIALS. CONSIDERATION WILL BE GIVEN TO NUCLEAR HARDENING POTENTIAL.

THE EXPERIMENTAL PORTION OF THIS PROGRAM WILL TEST CHOSEN CANDIDATE MATERIALS FOR HIGH REFLECTIVITY AND FILM STABILITY UNDER SIMULATED LASER INTERACTION. MEASUREMENTS WILL BE PERFORMED BY-BEAM HEATING. FILM STABILITY, HEAT OF VAPORIZATION AND OPTICAL REFLECTIVITY WILL BE DETERMINED IN ORDER TO DETERMINE Q\*.

FISCAL YEAR 1984

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| PHYSICAL SCIENCES INC.<br>RESEARCH PARK, P.O. BOX 3100<br>ANDOVER, MA 01810<br>DR. MERLIN G. MILLER<br>TITLE:<br>ASSESSMENT OF A LAYERED LASER DEFENSE SYSTEM<br>TOPIC: 280            OFFICE: BMO/PMX | AF           | \$ 48,189                  |

THE PROPOSED STUDY WILL INVESTIGATE THE UTILITY OF A LAYERED LASER DEFENSE SYSTEM (LLDS) DESIGNED TO ELIMINATE U.S. BOOSTERS AND/OR REENTRY VEHICLE SYSTEMS. THE PRINCIPAL OBJECTIVE IS TO IDENTIFY AND EVALUATE ACTIVE COUNTERMEASURES DESIGNED TO DEFEAT ONE OR MORE LAYERS OF THE LLDS. TASKS TO BE ACCOMPLISHED INCLUDE: (1) THREAT DEFINITION; (2) MISSILE BASELINE VULNERABILITY ASSESSMENT; (3) BASELINE SYSTEM PERFORMANCE MODELING; (4) COUNTERMEASURE DEFINITION; (5) COUNTERMEASURE EVALUATION; AND (6) TECHNOLOGY DEVELOPMENT REQUIREMENTS SPECIFICATION. THE ANTICIPATED RESULTS OF THIS STUDY WILL INCLUDE: (1) AN ASSESSEMENT OF THE SERIOUSNESS OF THE DEFINED THREAT; (2) THE IDENTIFICATION OF APPROPRIATE COUNTERMEASURES TO DEFEAT THE THREAT; AD (3) A SPECIFICATION OF THE TECHNOLOGY DEVELOPMENT REQUIRED TO RESOLVE CRITICAL DEPLOYMENT ISSUES.

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| PLANNING SYSTEMS INCORPORATED<br>7900 WESTPARK DRIVE, SUITE 600<br>MCLEAN, VA 22102<br>DR. BURLIE A. BRUNSON<br>TITLE:<br>ACOUSTIC SEA BOTTOM CLASSIFICATION: A REQUIREMENT ANALYSIS<br>TOPIC: 101            OFFICE: NCSC | NAVY | \$ 47,697 |
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THERE IS CONSIDERABLE EVIDENCE THAT MINES BURY IN MANY AREAS WHERE BOTH NAVY AND COMMERCIAL SHIPS MUST OPERATE. IF THESE MINES ARE LEFT UNCOUNTERED, THEY POSE A SIGNIFICANT THREAT TO TRANSITING TRAFFIC. FORTUNATELY, NOT ALL SEA BOTTOMS ARE CONDUCIVE TO MINE BURIAL, AND THE BURIED MINE COUNTERMEASURES PROBLEM CAN BE REDUCED BY IDENTIFYING AND APPLYING BURIED MINE COUNTERMEASURES ONLY IN THE AREAS WHERE THE PROBABILITY OF BURIAL IS HIGH. TO DO THIS IN AN EFFICIENT MANNER REQUIRES THE DEVELOPMENT OF A RAPID WIDE-AREA BOTTOM CLASSIFICATION SYSTEM. UNDER THIS EFFORT, PSI WILL DETERMINE THE REQUIRE-

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>----- | AWARDED<br>AMOUNT<br>----- |
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MENTS FOR CLASSIFYING THE SEA BOTTOM WITH RESPECT TO MINE BURIAL POTENTIAL. THE ANALYSIS WILL BE CONDUCTED USING EXISTING ACOUSTIC DATA AND STATE-OF-THE-ART GEOACOUSTIC AND MINE BURIAL MODELS. CRITICAL SEAFLOOR PARAMETERS WHICH AFFECT MINE BURIAL WILL BE DETERMINED TOGETHER WITH WAVE PENETRATION AND SIGNAL PROCESSING REQUIREMENTS FOR OBTAINING THEM FROM ACOUSTIC REFLECTIVITY MEASUREMENTS. TECHNICAL SPECIFICATIONS WILL BE PREPARED FOR A PROTOTYPE RAPID SEA BOTTOM CLASSIFICATION SYSTEM INCLUDING PRELIMINARY ACOUSTIC, GEOTECHNICAL AND SIGNAL PROCESSING AND SAMPLING REQUIREMENTS.

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| PM LABS OF NEVADA, INC.,<br>822-F HAMPSHIRE RD<br>WESTLAKE, CA 91361<br>PAUL H. DUTCH, PHD | ARMY | \$108,778 |
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TITLE:  
 DESTRUCTION OF TOXIC CHEMICAL AGENTS IN NATURAL WATER BY USE OF ENZYMES  
 TOPIC: 26 OFFICE: FRDME-PM

HYDROLYZING AND OXIDATIVE ENZYME SYSTEMS WILL BE EVALUATED AND TESTED ON WATER SAMPLES SPIKED WITH ORGANOPHOSPHOROUS TOXIC CHEMICAL AGENTS CONTAINING P-F AND P-CN LINKAGES IN AN ATTEMPT TO DETOXYFY AND MAKE THE WATER DRINKABLE AGAIN. IF COMMERCIALY AVAILABLE ENZYMES ARE NOT EFFECTIVE, THEN PEROXIDASE TYPE OF ENZYMES WILL BE SYNTHESIZED USING ORGANOPHOSPHOROUS COMPOUNDS AS SUBSTRATES AND THEIR OPTIMUM DETOXIFICATION EFFECT WILL BE DETERMINED EXPERIMENTALLY. SUCH FACTORS SUCH AS THE MAXIMUM RATE OF TOXIC CHEMICAL DESTRUCTION AS A FUNCTION OF TEMPERATURE, PH PRESENCE OF COENZYMES, TRACE METALS AND FINALLY THE CONCENTRATION OF THE ENZYMES AS VARIABLE WILL BE TESTED. THE MOST PROMISING SYSTEM WILL BE REPORTED IN THE FINAL REPORT AFTER COMPLETION OF PHASE I PROGRAM. THE SUCCESSFUL COMPLETION OF PHASE I IS HIGHLY PROBABLE.

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| PRIME DEVICES INC<br>4211 N. ORANGE BLOSSOM TRAIL<br>ORLANDO, FL 32804<br>RICHARD J. WANGLER | ARMY | \$ 68,630 |
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TITLE:  
 OPTICAL FIBER DATA TRANSFER SYSTEM (SLIP RING REPLACEMENT)  
 TOPIC: 9 OFFICE: DRDAV-PD

THE PROPOSED OPTICAL DATA TRANSFER DEVICE WOULD BE USED TO TRANSFER

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>---- | AWARDED<br>AMOUNT<br>----- |
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DATA BETWEEN A FIXED AND ROTATING SYSTEM. IT HAS THE POTENTIAL OF BEING INEXPENSIVE, RELIABLE AND HAVING HIGH DATA RATE CAPABILITY. THE DEVICE IS BASED ON USING A "LOSSY" OPTICAL FIBER AS A 360 DEGREE DETECTOR WHICH INTERCEPTS ENERGY FROM AN OPTICAL SOURCE SUCH AS A LASER DIODE OR LIGHT EMITTING DIODE (LED). WITH THE HIGH DATA CAPABILITY OF THE OPTICAL LINK, SEVERAL LOW DATA RATE INFORMATION CHANNELS COULD BE TIME DIVISION MULTIPLEX (TDM) INTO A SINGLE CHANNEL TO BE SENT OVER THE NON-CONTACTING OPTICAL LINK, THUS FURTHER REDUCING COST AND COMPLEXITY. A DETAILED ANALYSIS WOULD BE DONE ON HELICOPTER SYSTEM REQUIREMENTS ALONG WITH OTHER POTENTIAL SYSTEM REQUIREMENTS IN ORDER TO DEFINE THE CONFIGURATION OF THE OPTICAL TRANSFER DEVICE. SINCE THE OPTICAL DATA TRANSFER DEVICE IS BASED ON PROVEN EXPERIMENTAL DATA, MOST OF THE PROPOSED EFFORT WOULD BE ADAPTING THIS TECHNIQUE TO A SLIP RING APPLICATION. THE PROPOSED GOAL WOULD BE TO HAVE A WORKING BREADBOARD SYSTEM ALONG WITH MEASURED PERFORMANCE WHICH WOULD INDICATE THAT PHASE II DEVELOPMENT WOULD BE WARRANTED.

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| PROCESSING RESEARCH INC.<br>6231 LEESBURG PIKE, SUITE 510<br>FALLS CHURCH, VA 22044<br>DR. RICHARD A. MUELLER<br>TITLE:<br>TARGET RECOGNITION AND HOMING<br>TOPIC: 35 OFFICE: JCMPO | NAVY | \$ 94,582 |
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AN INVESTIGATION WILL BE PERFORMED TO EVALUATE THE EFFECTIVENESS OF ESM CONCEPTS FOR ENHANCED CRUISE MISSILE SYSTEMS. THE OBJECTIVE IS TO EVALUATE THE PERFORMANCE OF VARIOUS RECEIVER AND RECOGNITION TECHNIQUES USING EMITTER SIGNAL CHARACTERISTICS, INCLUDING INTRAPULSE AND INTERPULSE. CHARACTERISTICS INCLUDE RF, FREQUENCY MODULATION ON PULSE, PHASE MODULATION ON PULSE, UNINTENTIONAL MODULATION ON PULSE, PULSEWIDTH, PULSE RISE TIME AND PULSE TRAIN FEATURES OF PRI & RF.

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| Q-DOT, INC.<br>1069 ELKTON DRIVE<br>COLORADO SPRINGS, CA 80907<br>DR. PETER C. T. ROBERTS<br>TITLE:<br>GALLIUM ARSENIDE MEMORY APPLICATION STUDY Q-DOT RESEARCH<br>TOPIC: 30 OFFICE: AVPO | AF | \$ 49,991 |
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TO SUCCESSFULLY EMPLOY THE INTRINSICALLY SHORT ACCESS TIME (I.E.,

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>---- | AWARDED<br>AMOUNT<br>----- |
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LESS THAN 1NS) OF GaAs DIGITAL MEMORY CHIPS, UNIQUE SIGNAL PROCESSING ARCHITECTURES WILL BE REQUIRED WHICH MAY INFLUENCE CONVENTIONAL FUNCTION PARTITIONING AMONG INTEGRATED CIRCUITS. TO DETERMINE THE OPTIMAL ARCHITECTURE OF BOTH PROCESSOR AND IC'S, A CANDIDATE PROCESSOR OF IMPORTANCE TO THE AIR FORCE WILL BE SELECTED. ITS ARCHITECTURE WILL BE ANALYZED TO UNCOVER OPPORTUNITIES FOR IMPROVEMENT. THE ARCHITECTURE WILL BE OPTIMIZED FOR GaAs MEMORY. RESULTING STRUCTURES WILL BE SIMULATED AT BOTH THE CIRCUIT AND SYSTEM LEVELS. BENEFITS OF INTEGRATED LOGIC-MEMORY WILL BE COMPARED TO CONVENTIONAL IMPLEMENTATIONS. A COMPREHENSIVE FINAL REPORT WILL DOCUMENT THE RESULTS.

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| QUAL-X, INC.<br>3039 HOME ROAD, P.O. BOX 236<br>POWELL, OH 43065<br>A. F. MAHON<br>TITLE:<br>EVALUATION OF LOW CYCLE FATIGUE AND COATINGS WITH THE KET GAS PENETRANT INSPECTION PROCESS<br>TOPIC: 126                      OFFICE: NASC | NAVY | \$ 49,180 |
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THE GAS PENETRANT PROCESS IS FUNDAMENTALLY ASSOCIATED WITH THE POTENTIAL ABILITY TO DETERMINE SURFACE ANOMALIES BY THE VARIATIONS IN GAS ABSORPTION AT THESE ANOMALIES. THIS PROGRAM IS FOCUSED ON TWO TURBINE ENGINE AREAS, LOW CYCLE FATIGUE AND TURBINE BLADE COATINGS, BOTH OF WHICH ARE INTIMATELY RELATED TO SURFACE BEHAVIOR THERMODYNAMICS. THE LOW CYCLE FATIGUE EFFORT IS DIRECTED TO DEVELOPING A SURFACE CONDITIONING MODEL THAT WILL ASSURE RELIABLE LCF CRACK DETECTION AT A SURFACE. THE COATINGS EFFORT IS DIRECTED TO DERIVING A WHOLE FIELD TURBINE BLADE COATING INSPECTION PROCESS.

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| QUANTUM COMPOSITES, INC.<br>4702 JAMES SAVAGE ROAD<br>MIDLAND, MI 48640<br>WILLIAM I. CHILDS<br>TITLE:<br>DEVELOPMENT OF HIGH PERFORMANCE EPOXY MOLDING COMPOUNDS FOR FABRICATING LIGHT WEIGHT MUNITION DISPENSER STRUCTURES<br>TOPIC: 226                      OFFICE: DLXB | AF | \$ 48,826 |
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THE USE OF A HIGH PERFORMANCE EPOXY SHEET MOLDING COMPOUND TO FABRI-

FISCAL YEAR 1984

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CATE MUNITION DISPENSERS WILL BE STUDIED. THE STRUCTURE WOULD BE FABRICATED USING COMPRESSION OR TRANSFER MOLDING. A MOLD WILL BE MADE FOR A CRITICAL SECTION OF THE CHOSEN DISPENSERS, AND A NUMBER OF MATERIALS TESTED FOR PERFORMANCE. THE USE OF CONTINUOUS GLASS FIBER EPOXY SMC WILL BE EVALUATED IN SELECTED AREAS REQUIRING DIRECTIONAL STRENGTH PROPERTIES.

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| QUESTRON CORPORATION<br>3366 N. TORREY PINES COURT<br>LA JOLLA, CA 92037<br>BRUCE LAWTON<br>TITLE:<br>U.S. ICBM DIRECTED ENERGY WEAPON VULNERABILITY STUDY<br>TOPIC: 282            OFFICE: BMO/PMX | AF | \$ 52,235 |
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RECENT INITIATIVES, SUCH AS THE WORK OF THE DEFENSIVE TECHNOLOGIES STUDY TEAM ("FLETCHER SUMMER STUDY") HAVE EMPHASIZED BALLISTIC MISSILE DEFENSE EMPLOYING DIRECTED ENERGY WEAPON (DEW). POSSIBLE DEPLOYMENT OF SUCH WEAPONS BY ADVERSARIES OF THE U. S. MAKES MANDATORY THE UNDERSTANDING OF VULNERABILITIES OF U. S. BALLISTIC MISSILES OF THE SPECTRUM OF POSSIBLE THREATS. THIS STUDY IS THE FIRST PHASE IN EVALUATING ALL CLASSES OF VULNERABILITIES (ELECTRONICS, STRUCTURAL FAILURE, PROPELLANT IGNITION, ETC.) TO THE RANGE OF DEW THREATS (CONVENTIONAL AND X-RAY LASERS AND PARTICLE BEAMS). THE EFFORT CONSISTS OF CATEGORIZING CLASSES OF MISSILE COMPONENTS (MISSILE SYSTEM), SUBSYSTEMS, AND PIECEPARTS); IDENTIFYING THE VARIOUS DEW THREATS, RANGE OF THREAT LEVELS AND THREAT LOCATION VS. LIKELY MISSILE MISSION "SCENARIOS"; ESTABLISHING VULNERABILITY LEVELS FOR THE VARIOUS COMPONENTS; AND THREAT LEVELS TO INDUCE FAILURE IN THE SENSITIVE COMPONENTS.

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| R-K RESEARCH AND SYSTEM DESIGN<br>3947 RIDGEMONT DRIVE<br>MALIBU, CA 90265<br>DIANE M. RAMSEY-KLEE, PHD<br>TITLE:<br>DEVELOPMENT OF A PLAN TO EVALUATE THE NAVY OCCUPATIONAL HEALTH INFORMATION MONITORING SYSTEM (NOHIMS)<br>TOPIC: 13            OFFICE: NMC-NCR | NAVY | \$ 43,966 |
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THE PHASE I WORK PLAN BEGINS WITH A REVIEW OF THE LITERATURE

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>---- | AWARDED<br>AMOUNT<br>----- |
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RELEVANT TO OCCUPATIONAL HEALTH INFORMATION SYSTEMS AND EVALUATION METHODOLOGY. AN ANNOTATED BIBLIOGRAPHY OF THIS LITERATURE REVIEW WILL BE INCLUDED IN THE PHASE I FINAL REPORT. NINE AREAS OF SYSTEM FUNCTIONING AS FOLLOWS ARE INCLUDED FOR CONSIDERATION IN DESIGNING THE EVALUATION STRATEGY: RESPONSIVENESS OF NOHIMS TO NAVY NEEDS AND REQUIREMENTS, SUITABILITY OF THE NOHIMS DESIGN, EFFICIENCY OF NOHIMS PERFORMANCE, ENHANCEMENT OF MEDICAL MONITORING AND CARE, USE OF THE NOHIMS DATABASE FOR LEGAL EVIDENCE, USABILITY OF NOHIMS, COST ANALYSIS OF NOHIMS, TRANSFERABILITY OF NOHIMS, AND NOHIMS AS AN AID TO RESEARCH. A VARIETY OF EVALUATION TECHNIQUES AND METHODS WILL BE INCORPORATED INTO THE EVALUATION PLAN DEPENDING ON THEIR APPROPRIATENESS TO THE DATA TO BE COLLECTED. OBJECTIVE MEASURES ARE PREFERRED BUT MAY NOT BE POSSIBLE TO APPLY. SUBJECTIVE MEASURES TO BE CONSIDERED ARE THE USE OF INTERVIEW GUIDES, RATING SCALES, STRUCTURED QUESTIONNAIRES, AND/OR HISTORICAL CHRONICLES. THE DETAILED EVALUATION PLAN WITH ITS ACCOMPANYING DATA COLLECTION INSTRUMENTS WILL SERVE AS A STEP-BY-STEP GUIDE FOR CONDUCTING THE ACTUAL EVALUATION IN PHASE II.

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| R. A. INDUSTRIES<br>7426 WESTLAWN AVE.<br>LOS ANGELES, CA 90045<br>E.A. STRATE<br>TITLE:<br>ELECTRICAL CONE CONNECTOR<br>TOPIC:       6       OFFICE: ASD/AFEA | AF | \$ 14,265 |
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A NEED EXISTS TO IMPROVE THE CURRENT FAILURE RATE IN COMPLEX ELECTRICAL SYSTEMS REQUIRING PLUG-IN/PLUG-OUT ELECTRICAL CONNECTORS. THIS RESEARCH PROPOSES TO DEVELOP A NEW CONE WHICH IS KEYED TO THE FEMALE CONE FOR CONTACT ALIGNMENT. AFTER THE CONTACTS ARE MOLDED INTO THE PLUG, THE CONTACTS ARE PRECISION GROUND TO ZERO TOLERANCE RELATIVE TO ANGLE AND DIAMETER AS ON TAPER ROLLER BEARINGS.

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| RADCON RADAR CONTROL SYSTEMS<br>P.O. BOX 1921<br>MONTEREY, CA 93942<br>W. V. MOFFAT<br>TITLE:<br>STATISTICAL ESTIMATE JAMMER POWER MANAGEMENT (U)<br>TOPIC:       16       OFFICE: ERADCOM | ARMY | \$ 84,022 |
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THE PROBLEM IS TO MAKE ACCURATE RF AND TIME OF ARRIVAL PREDICTIONS

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>----- | AWARDED<br>AMOUNT<br>----- |
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OF MODERN FIRE CONTROL RADAR PULSE SIGNALS. THE PROBLEM OF EFFECTIVE PREDICTION OF RF AND PRI AGILE RADAR SIGNALS IS CURRENTLY UNSOLVED. THE TECHNICAL APPROACH IS TO UTILIZE SPECTRAL MEASUREMENT OF THE INTENTIONAL MODULATION ON PULSE (IMOP) AND THE UNINTENTIONAL MODULATION ON PULSE (UMOP) FOR EMITTER CORRELATION SORTING AND STATISTICAL LEAST SQUARE PREDICTIONS, AS APPLIED BY KALMAN FILTERING, FOR JAMMER RF AND TIME POWER MANAGEMENT. SPECTRAL MEASUREMENTS AND CORRELATION SORTING WILL BE ACCOMPLISHED WITH SURFACE ACOUSTIC WAVE ANALOG DEVICES. STATISTICAL ESTIMATE PROCESSING WILL BE ACCOMPLISHED DIGITALLY THROUGH A PARALLEL, MULTIPROCESSING NETWORK, FEATURING HIGH SPEED INDEPENDENT AND PARALLEL MEMORY ACCESS. A SIX CALENDAR MONTH, ONE MAN-YEAR TECHNICAL EFFORT PROVIDES A FEASIBILITY ANALYSIS AND A DOCUMENTED PHASE II PROOF OF FEASIBILITY TEST PLAN.

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| RADIATION MONITORING DEVICES, INC<br>44 HUNT STREET<br>WATERTOWN, MA 02172<br>GERALD ENTINE, PHD<br>TITLE:<br>PERSONAL DIGITAL NEUTRON DOSIMETER<br>TOPIC: 28            OFFICE: NESC | NAVY | \$ 49,896 |
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OVER A HUNDRED THOUSAND NAVY PERSONNEL AS WELL AS A LARGE NUMBER OF MILITARY AND CIVILIAN WORKERS ARE NOW REQUIRED TO WEAR NUCLEAR RADIATION DOSIMETERS. ALTHOUGH MUCH OF THE POTENTIAL EXPOSURE IS FROM NEUTRONS, PRESENTLY NO SMALL ELECTRONIC NEUTRON DOSIMETER EXISTS AND ONLY PASSIVE DEVICES ARE AVAILABLE. THIS LEADS NOT ONLY TO EXCESS SHIELDING REQUIREMENTS AND INEFFICIENT USE OF PERSONNEL, BUT ALSO TO AN INCREASED CHANCE OF INADVERTANT NEUTRON EXPOSURE.

WE PROPOSE TO DEVELOP A SMALL, ROBUST, AND SENSITIVE DIGITAL PERSONAL DOSIMETER WHICH WILL ACTIVELY MEASURE NEUTRON EXPOSURE OVER A WIDE RANGE OF NEUTRON ENERGIES. THIS DEVICE WILL PROVIDE AN AUDIBLE WARNING AT HIGH EXPOSURE RATE, AND ALSO A RAPID ELECTRONIC READOUT FOR ANALYSIS OF INTEGRATED DOSE BY THE BASE COMPUTER.

THE SENSING ELEMENT WILL USE THE DETECTION OF SOFT ERRORS IN A SEMICONDUCTOR MEMORY CHIP, A CONCEPT INVENTED BY THE NAVY AND WHICH

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>----- | AWARDED<br>AMOUNT<br>----- |
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IS VERY COMPATIBLE WITH MODERN HYBRID CIRCUITRY. DURING PHASE I, WE WILL INVESTIGATE THE SELECTION OF A MEMORY DEVICE FOR THE SENSOR, CONDUCT RESEARCH ON TECHNIQUES TO MAKE THE SENSOR SENSITIVE TO A WIDE RANGE OF NEUTRON ENERGIES, AND COMPLETE THE CONCEPTUAL DESIGN OF THE FINAL DOSIMETER. THE RESULTING DEVICE SHOULD HAVE WIDE APPLICABILITY, GOOD USER ACCEPTANCE, AND BE A MAJOR ADVANCE IN THE STATE-OF-THE-ART OF PERSONNEL DOSIMETRY.

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| REED INSTRUMENTS, INC.<br>685A MYRTLE AVE., P.O. BOX 540<br>BOONTON, NJ 07005<br>THOMAS J. REED<br>TITLE:<br>WIRELESS 12-LEAD CARDIAC MONITORING SYSTEM FOR PULMONARY STRESS TESTING<br>TOPIC:     96           OFFICE: SGRD-RMA | ARMY | \$ 48,067 |
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A SYSTEM IS SHOWN WHICH CAN ACQUIRE ELECTROCARDIOGRAPHIC INFORMATION, CONVERT IT TO 12-LEAD FORMAT, DIGITIZE IT, TRANSMIT IT OVER THE AIR, RECEIVE IT AND RECONSTRUCT THE 12 SEPARATE CHANNELS FOR PRESENTATION TO A STRIP CHART TYPE RECORDER. IN ADDITION, MASS STORAGE OF THE RECEIVED DATA IS CONSIDERED. THE FEATURE OF THE SYSTEM IS THAT IT'S FREQUENCY RESPONSE IS GREATER THAN 100HZ IN EACH CHANNEL AND THAT THE PATIENT IS DISCONNECTED FROM THE RECORDING DEVICES WHICH SHOULD SERVE TO REDUCE LEAD INDUCED ARTIFACTS AND INCREASE HIS FREEDOM OF MOVEMENT.

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| RESOURCE EXPANDERS CORPORATION<br>5133 WHITECAP STREET<br>OXNARD, CA 93030<br>JOHN J. SOCHOR<br>TITLE:<br>FEASIBILITY DEMONSTRATION OF A NAVAIR-ORIENTED ADVANCED TECHNOLOGY R&D ASSESSMENT AND PLANNING METHODOLOGY<br>TOPIC:     140           OFFICE: NASC | NAVY | \$ 49,612 |
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CONTINUING EXPANSION OF TECHNICAL OPTIONS, INCREASING THREAT PERCEPTIONS, AND LIMITED BUDGET RESOURCES REQUIRE EARLY NAVAIR RECOGNITION OF ADVANCED TECHNOLOGY VIABILITY, POTENTIAL RESOURCE REQUIREMENTS/AFFORDABILITY PROJECTIONS, AND PRIORITIZED ABILITY

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>----- | AWARDED<br>AMOUNT<br>----- |
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TO CONTRIBUTE TO NAVAL AVIATION FUTURE CAPABILITY. THIS METHODOLOGY FRAMEWORK IS DESIGNED TO EMPHASIZE PROJECTION OF ADVANCED TECHNOLOGY CANDIDATES POTENTIAL CONTRIBUTIONS TO FUTURE CV BATTLE GROUPS WITHIN QUANTIFIED CONTEXTS OF FORCE MULTIPLIERS, COST-BENEFITS, AND INTRODUCTION OPPORTUNITY WINDOWS. AVIONICS, SURVEILLANCE, WEAPONS, AND AIRCRAFT ARENAS - IN THE FULLY IMPLEMENTED METHODOLOGY - WOULD BE ANALYZED SEPARATELY AND THEN COMBINED INTO AN OVERALL NAVAIR TECHNOLOGY VALUE-FRAMEWORK MATRIX. THIS PHASE I WILL PROVIDE FEASIBILITY DEMONSTRATION WITH GOALS OF INITIATING METHODOLOGY DATA BANK ESTABLISHMENT AND OF CALCULATING QUANTIFIED FORCE MULTIPLIER/COST-BENEFITS FOR A NOMINAL STRAWMAN AVIONICS TECHNOLOGY CANDIDATE. A COMBINED OVERVIEW WILL BE DEVELOPED OF BUDGET ECONOMICS, NAVY CAPITAL INVESTMENTS, AND PROJECTED TECHNOLOGY-CANDIDATE CAPABILITY BENEFITS TO CV BATTLE GROUP AIR WING OPERATIONS IN AN EXTENDED PLANNING CONTEXT. THE INTER-DISCIPLINARY METHODOLOGY CAN BECOME A SIGNIFICANT MANAGEMENT R&D ADVANCED TECHNOLOGY ASSESSMENT AND PLANNING TOOL - AND ALSO PROVIDE IMPROVED NAVAIR GUIDANCE TO INDUSTRY IRAD.

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| RF PRODUCTS, INC.<br>DAVIS AND COPEWOOD STREETS<br>CAMDEN, NJ 08103<br>TIMOTHY R. RILEY<br>TITLE:<br>ADVANCED DEVELOPMENT OF A FREQUENCY-HOPPING MULTICOUPLER<br>TOPIC: 20 OFFICE: NESC | NAVY | \$ 47,137 |
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RF PRODUCTS PROPOSES TO INVESTIGATE THE DESIGN OF A FREQUENCY-HOPPING MULTICOUPLER. USING AN IN-HOUSE-DEVELOPED HIGH-POWER FREQUENCY-HOPPING PROTOTYPE FILTER, WE WILL CONSIDER TWO APPROACHES TO DEFINING THE FILTER/COMBINING NETWORK INTERFACE, SELECT THE MORE ADVANTAGEOUS, CREATE A FOUR-FILTER BRASSBOARD COMBINER WITH TWO OPERATING CHANNELS AND TWO CHANNELS CONNECTED TO UNUSED-PORT TERMINATORS, AND DEMONSTRATE HIGH-POWER CAPABILITY TO PROBE THE FEASIBILITY OF THE MULTICOUPLER CONCEPT. THIS WILL POSITION RF PRODUCTS FOR PHASE II AND SUBSEQUENT EFFORTS THAT WILL RESULT IN THE DESIGN AND PRODUCTION OF A 225-400 MHZ FREQUENCY-HOPPING MULTICOUPLER THAT WILL ELIMINATE THE RADIO JAMMING PROBLEMS ASSOCIATED WITH FREQUENCY MANAGEMENT AND ANTENNA PROLIFERATION IN THE HAVE QUICK ANTI-JAMMING COMMUNICATIONS SYSTEMS.

FISCAL YEAR 1984

| SUBMITTED BY<br>-----  | DEPT<br>----- | AWARDED<br>AMOUNT<br>----- |
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| RHODES ENGINEERING, INC.<br>P.O. BOX 1145<br>NEWPORT, RI 02840<br>EDWARD KOCH, JR.<br>TITLE:<br>SUBMARINE DEPTH EXCURSION RECORDING SYSTEM DEVELOPMENT<br>TOPIC: 58 OFFICE: NAVSEA | NAVY          | \$ 49,884                  |

THE PROBLEM ADDRESSED BY THIS PROPOSAL IS THE LACK OF SUBMARINE HULL DEPTH EXCURSION HISTORY NEEDED TO PRODUCE A REALISTIC CYCLIC LOAD SPECTRUM WHICH IS THE BASIS FOR PROJECTION OF FATIGUE LIFE OF HULL STRUCTURES AND HULL STRUCTURE SURVEILLANCE DECISIONS. THE OBJECTIVE OF THE PROPOSED EFFORT IS THE DEVELOPMENT AND FEASIBILITY DEMONSTRATION OF A SELF-CONTAINED AND AUTOMATED DEPTH EXCURSION RECORDING SYSTEM WHICH WILL PROVIDE THE REQUIRED DEPTH HISTORY. THE TASKS TO BE ACCOMPLISHED BREAKDOWN INTO TWO LOGICAL DIVISIONS OF EFFORT: (1) RECORD SYSTEM DEVELOPMENT; (2) EXTERNAL INTERFACE DEVELOPMENT. EXISTING OFF-THE-SHELF MICROPROCESSOR BASED DIGITAL HARDWARE BOARDS CAN READILY BE FASHIONED INTO A COMPACT, SINGLE UNIT DEVICE WHICH WILL RECORD THE DEPTH HISTORY DATA REQUIRED. TASKS TO BE ACCOMPLISHED INCLUDE SPECIFIC HARDWARE CONFIGURATION, SOFTWARE DEVELOPMENT AND PACKAGING. THE OTHER EFFORT TO BE UNDERTAKEN IS THE SHIP SYSTEM TO DEPTH RECORDER INTERFACE DEVELOPMENT. THE DEPTH PARAMETER WHICH MUST BE LOGGED IS AVAILABLE AS EITHER A SYNCHRO SIGNAL OR IN DIGITAL FORMAT. IN ORDER TO ACQUIRE THE PARAMETER, RHODES ENGINEERING, INCORPORATED HAS CHOSEN TO DEVELOP AN INTERFACE FOR THE SYNCHRO SIGNAL WHICH IS COMPATIBLE WITH THE ELECTRICAL AND PACKAGING CHARACTERISTICS OF THE BASIC RECORDER COMPONENTS PROPOSED TO BE USED.

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| ROBERT V. MEYER INC<br>LAKE SHORE DR PO BOX 889<br>CENTER HARBOR, NH 03226<br>ROBERT V. MEYER<br>TITLE:<br>INDIVIDUAL BLAST OVERPRESSURE DOSIMETER<br>TOPIC: 78 OFFICE: SGRD-RMA | ARMY | \$ 41,203 |
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PRESSURE PULSES WILL EXTRUDE LEAD DIAPHRAGMS INTO CAVITIES. THE

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>----- | AWARDED<br>AMOUNT<br>----- |
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SHAPE AND DESIGN OF THE CAVITY WILL PERMIT THE PRESSURE TO BE IDENTIFIED WHICH EXTRUDED THE DIAPHRAGM INTO THE CAVITY.

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| ROBOT DEFENSE SYSTEM, INC.<br>3860 REVERE STREET - SUITE A<br>DENVER, CO 80239<br>EDWARD N. CARABETTA<br>TITLE:<br>ROBOTIC VEHICLES FOR FRONT-LINE SOLDIER SUPPORT<br>TOPIC: 12 OFFICE: DARPA | DARPA | \$ 50,000 |
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THE ROBOT DEFENSE SYSTEMS (RDS) PROWLER IS AN ALL-TERRAIN PLATFORM WITH SOME AUTONOMOUS AND EXCELLENT REMOTE CONTROL CAPABILITIES. A PROTOTYPE EXISTS AND ADVANCED MODELS ARE SCHEDULED FOR MID-SUMMER 1984 DELIVERY. RDS PROPOSES THAT PROWLER BE THE PLATFORM FOR ALL THREE WEAPON SYSTEMS. FOR ANTI-TANK CAPABILITY, RDS IS CONSIDERING TOW, DRAGON, AND MAMBA. THE 7.62MM GATTLING MINIGUN IS THE PROPOSED MACHINE GUN SYSTEM. ALSO, A CUSTOM GRENADE LAUNCHING SYSTEM CAN BE BUILT USING SEVERAL M203 OR MX148 GRENADE LAUNCHERS ARRANGED CIRCULARLY.

PROWLER CAN GO TO A POSITION SPECIFIED IN ITS MAP SPACE, NAVIGATE A PREPLANNED COURSE, OR BE DRIVEN REMOTELY. VISION SYSTEMS (PRESENTLY ACOUSTICAL, NEXT PULSED LASER SCAN, AND EVENTUALLY VIDEO AND CHARGE-COUPLED DEVICE SCENE ANALYSIS) HELP DETECT AND AVOID OBSTACLES OR IDENTIFY AND VIEW TARGETS. REMOTE OPERATIONS WILL CONTROL WEAPONS. INERTIAL GUIDANCE, ATTITUDE, AND MOTION SENSORS CAN BE COMBINED WITH MOTION, DECISION, AND CONTROL LOGIC OF INCREASING SOPHISTICATED. RDS SEES A CONNECTION BETWEEN WORK WE ARE DOING AND DARPA'S "STRATEGIC COMPUTING" RESEARCH. WE FEEL THAT WITH DARPA'S SUPPORT, NECESSARY DEVELOPMENTS CAN BE ACHIEVED TO MAKE THE PROWLER A MAJOR WEAPON SYSTEM

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| RTS LAB INC<br>2603 N W 74TH PLACE<br>GAINESVILLE, FL 32606<br>RICHARD T SCHNEIDER PHD<br>TITLE:<br>MULTIAPERTURE OPTICAL SYSTEM RESEARCH<br>TOPIC: 1 OFFICE: ONR | NAVY | \$ 49,927 |
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THE GOAL OF THIS RESEARCH EFFORT IS TO BUILD AND DEMONSTRATE A

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>---- | AWARDED<br>AMOUNT<br>----- |
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FUNCTIONING MULTIAPERTURE OPTICAL (MAO) SYSTEM OPERATING IN THE IR AND MEASURE THE MINIMUM REQUIRED SNR FOR DETECTION OF AN UNRESOLVED POINT TARGET. ALSO A MATHEMATICAL MODEL WILL BE DEVELOPED TO SIMULATE THE PERFORMANCE OF A MAO SYSTEM BASED ON REALISTIC DETECTOR DATA FOR VARIOUS GEOMETRICAL DESIGNS OF THE MAO SYSTEM (PHASE I). INNOVATIVE CONCEPTS FOR IR PHOTOMULTIPLICATION AND ACTIVE MODE (LIDAR) OPERATIONS WILL BE INTEGRATED INTO INEXPENSIVE AND VERSATILE MAO SYSTEMS WITH A WIDE VARIETY OF APPLICATIONS AND FLEXIBILITY (PHASE II).

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| S. LEVY INCORPORATED           | AF | \$ 37,592 |
| 1999 S. BASCOM AVE., SUITE 725 |    |           |
| CAMPBELL, CA 95008             |    |           |
| DAVOOD ABDOLLAHIAN             |    |           |

TITLE:  
APPLICATION OF TWO-PHASE FLOW AND HEAT TRANSFER CORRELATIONS TO ZERO GRAVITY CONDITIONS  
TOPIC: 43 OFFICE: AFWAL/XRPF

THE PROPOSED RESEARCH PROGRAM IS FOR DEVELOPMENT OF MODELS FOR TWO-PHASE FRICTION MULTIPLIER, VOID FRACTION-QUALITY RELATION, AND FORCED CONVECTIVE NUCLEATE BOILING HEAT TRANSFER COEFFICIENT UNDER ZERO GRAVITY CONDITIONS. DUE TO HIGH HEAT TRANSFER COEFFICIENT, A TWO-PHASE GAS-LIQUID MEDIUM IS EXPECTED TO BE USED IN THE FUTURE COOLING SYSTEMS FOR SPACECRAFT EQUIPMENT. DESIGN OF THESE COOLING SYSTEMS REQUIRE A KNOWLEDGE OF TWO-PHASE FLOW AND HEAT TRANSFER UNDER REDUCED AND ZERO GRAVITIES. THE OBJECTIVE OF THE PROPOSED PROGRAM IS TO EXTEND THE WELL ESTABLISHED TWO-PHASE FLOW MODELS DEVELOPED AT EARTH GRAVITY TO ZERO GRAVITY CONDITIONS. THIS IS ACHIEVED BY USING THE REDUCED GRAVITY POOL BOILING AND BUBBLE DYNAMIC STUDIES TO ESTABLISH THE EXPECTED VOID DISTRIBUTION IN TWO-PHASE FLOW MODELS IN WHICH THE GRAVITY COMPONENT HAS BEEN NEGLECTED OR CAN BE EASILY SEPARATED WILL BE USED TO FORMULATE THE MODELS FOR THE ABOVE THREE MAJOR ENGINEERING PARAMETERS.

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| SABBAGH ASSOCIATES, INC. | NAVY | \$ 50,000 |
| 2634 ROUND HILL LANE     |      |           |
| BLOOMINGTON, IN 47401    |      |           |
| HAROLD A. SABBAGH        |      |           |

TITLE:  
AN EDDY-CURRENT MODEL FOR THREE-DIMENSIONAL NONDESTRUCTIVE EVALUATION OF ADVANCED COMPOSITES  
TOPIC: 87 OFFICE: NSWC

THE PROPOSED RESEARCH PROBLEM IS TO DEVELOP A MODEL AND AN INVERSION

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>---- | AWARDED<br>AMOUNT<br>----- |
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ALGORITHM THAT IS SUITABLE FOR THE THREE-DIMENSIONAL QUANTITATIVE NON-DESTRUCTIVE EVALUATION (NDE) OF ADVANCED COMPOSITE MATERIALS BY USING EDDY-CURRENTS. THE APPROACH THAT WE PROPOSE IS BASED ON, AND EXTENDS, WORK THAT HAS ALREADY BEEN PERFORMED BY ANALYTICS, INC. FOR EDDY-CURRENT NDE OF CONVENTIONAL METALS. THE TECHNICAL OBJECTIVES ARE TO DETERMINE THE FEASIBILITY OF USING MULTIFREQUENCIES FOR THIS JOB, TO DETERMINE IN LOCALIZED REGIONS THE FIBER-RESIN RATIO IN GRAPHICS EPOXY AND TO DETERMINE MORE PRECISELY THE TYPES ANOMALIES, WHETHER FLAWS, DELAMINATIONS, BROKEN FIBERS, ETC., THAT CAN BE RECONSTRUCTED BY OUR INVERSION METHOD. THESE OBJECTIVES CAN BE MET BY; (1) APPLYING RIGOROUS ELECTROMAGNETIC THEORY TO DETERMINE A GREEN'S FUNCTION FOR A STRATIFIED HALF-SPACE OF ANISOTROPIC COMPOSITE MATERIALS, (2) DETERMINING THE INTEGRAL RELATIONS FOR THE DIRECT AND INVERSE PROBLEMS, USING THE GREEN'S FUNCTION JUST DERIVED, (3) DETERMINING SUITABLE NUMERICAL ALGORITHMS FOR SOLVING THE INVERSE PROBLEM, AND (4) WRITING A COMPUTER PROGRAM TO EXECUTE THE MODEL.

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| SAN DIEGO MACHINE INTELLIGENCE, LTD.<br>2720 FELTON ST.<br>SAN DIEGO, CA 92104<br>HENRY BALLARD<br>TITLE:<br>RAPID AND ACCURATE PERSONNEL IDENTIFICATION<br>TOPIC: 248      OFFICE: BMO/PMX | AF | \$ 48,256 |
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THE PROPOSAL ADDRESSES THE FEASIBILITY OF USING A CCD CAMERA INTERFACED TO A COMPUTER TO PHOTOGRAPH AND ANALYZE, IN REAL TIME BY A PATTERN RECOGNITION SYSTEM, THE DIGITIZED RETINAL PATTERNS OF HUMANS FOR THE PURPOSE OF IDENTIFICATION. THE FUNDAMENTAL ISSUES TO BE CONSIDERED IN THE PHASE I RESEARCH PLAN ARE: (A) THE ESTABLISHMENT OF A RETINAL DATA BASE MODEL TO DETERMINE THE LEGITIMATE, INFORMATION CARRYING FEATURES OF HUMAN VASCULATURE PATTERN TO BE USED BY THE FEATURE EXTRACTION MODULE OF THE PATTERN RECOGNITION SYSTEM; (B) THE DESIGN OF THE MOST APPROPRIATE RETINAL PATTERN CLASSIFICATION (IDENTIFICATION) ALGORITHM BASED UPON THE INFORMATION GATHERED IN THE RETINAL DATA BASE MODEL; (C) THE BENCHMARKING AND FEASIBILITY STUDY OF DETERMINING WHICH CCD CAMERA IS MOST SUITABLE IN DIGITIZING IMAGES OF HUMAN RETINAS.

FISCAL YEAR 1984

| SUBMITTED BY<br>-----   | DEPT<br>---- | AWARDED<br>AMOUNT<br>----- |
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| SBR TECHNOLOGIES, INC.<br>P.O. BOX 697<br>NIAGARA FALLS, NY 14303<br>PETER F. CASELLA<br>TITLE:<br>WASTEWATER TREATMENT AND PURIFICATION IN A "BUTTONED-UP" MANNED<br>DEEP BASE USING THE SEQUENCING BATCH REACTOR: AN INNOVATIVE BIOLOGI<br>TOPIC: 247 OFFICE: BMO/PMX | AF           | \$ 50,000                  |

THIS PROJECT IS DESIGNED TO TEST THE FEASIBILITY OF USING AN INNOVATIVE BIOLOGICAL WASTEWATER TREATMENT TECHNOLOGY, THE SEQUENCING BATCH REACTOR (SBR), FOR TREATMENT AND PURIFICATION OF DOMESTIC, INDUSTRIAL AND MEDICAL WASTES IN A "BUTTONED-UP" MANNED DEEP BASE. THIS PROPOSED RESEARCH WILL CONSIST OF AN EXPERIMENTAL PROGRAM TO TREAT DOMESTIC INDUSTRIAL AND MEDICAL WASTE INDIVIDUALLY AND COLLECTIELY. SINCE THE DEEP BASE IS A COMPLETELY SELF-CONTAINED ENVIRONMENT, SPECIAL DESIGN CONSIDERATION WILL BE GIVEN TO CONSERVING AND RECYCLING THE AIR AND WATER USED IN THIS TECHNOLOGY. THE PURIFIED WATER WILL BE EXAMINED FOR ANY POST-TREATMENT NECESSARY TO ENSURE ITS POTABLE USE.

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| SCIENCE AND ENGINEERING ASSOCIATES, INC.<br>2500 LOUISIANA NE SUITE 610<br>ALBUQUERQUE, NM 87110<br>DR. RAY O. RANTANEN<br>TITLE:<br>INNOVATIVE SMALL ICBM CONCEPTS IN A NUCLEAR WAR SCENARIO<br>TOPIC: 281 OFFICE: BMO/PMX | AF | \$ 67,500 |
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| SCIENTIFIC MEASUREMENT SYSTEMS, INC.<br>2201 DONLEY DRIVE<br>AUSTIN, TX 78758<br>S. R. GAUTAM<br>TITLE:<br>APPLICATION OF COMPUTERIZED TOMOGRAPHY FOR HIGH RESOLUTION TESTING<br>OF COMPOSITE ROCKET MOTOR COMPONENTS<br>TOPIC: 91 OFFICE: NSW | NAVY | \$ 49,950 |
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A METHOD BASED ON THE PROCESSES OF COMPUTERIZED TOMOGRAPHY IS

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>---- | AWARDED<br>AMOUNT<br>----- |
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PROPOSED FOR NONDESTRUCTIVE QUANTITATIVE ASSESSMENT OF DAMAGE FEATURES IN FIBER/RESIN COMPOSITE COMPONENTS OF ROCKET MOTORS. AN IN-DEPTH STUDY WILL BE UNDERTAKEN TO ESTABLISH THE FEASIBILITY OF THE APPROACH. AN EXTENSIVE DATA BASE WILL BE GENERATED FROM COMPREHENSIVE TOMOGRAPHIC EXAMINATIONS OF A CONTROLLED REPRESENTATIVE OBJECT. THE INFORMATION ACQUIRED WILL BE USED FOR STUDYING THE DEPENDENCE OF RESOLUTION ON THE TOMOGRAPHIC PARAMETERS. A DESIGN GUIDELINE WILL BE DEVELOPED FOR AN OPTIMAL PERFORMANCE FIELD TOMOGRAPH, ALONG WITH COST AND SCHEDULE PROJECTIONS.

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| SCIENTIFIC MEASUREMENT SYSTEMS, INC.<br>2201 DONLEY DRIVE<br>AUSTIN, TX 78758<br>S. R. GAUTAM<br>TITLE:<br>APPLICATION OF COMPUTERIZED TOMOGRAPHY FOR FIBER-TO-RESIN RATIO MEASUREMENT<br>TOPIC: 87 | NAVY | \$ 50,000 |
| OFFICE: NSWC  |      |           |

A METHOD BASED ON THE PROCESSES OF COMPUTERIZED TOMOGRAPHY (CT) IS PROPOSED FOR NONDESTRUCTIVE, QUANTITATIVE MEASUREMENTS OF FIBER AND RESIN CONTENTS OF TWO-PHASE COMPOSITE SYSTEMS. RESEARCH IS PROPOSED FOR ESTABLISHING THE METHODOLOGY FOR USING CT TECHNIQUES IN ASSESSING KEVLAR-EPOXY OR GRAPHITE-EPOXY TYPE COMPOSITE MATRICES USED IN FABRICATING ROCKET MOTOR CASES. THROUGH A COMPREHENSIVE CT EXAMINATION OF A SET OF SAMPLES, AN EXTENSIVE DATA BASE WILL BE OBTAINED AND ANALYZED FOR DETERMINING THE DEPENDENCE OF DENSITOMETRIC RESOLUTION ON THE TOMOGRAPHIC PROCESS PARAMETERS. COLLECTIVE INFORMATION OBTAINED WILL BE USED FOR DERIVING DESIGN GUIDELINES FOR AN OPTIMAL PERFORMANCE TOMOGRAPH FOR FIELD APPLICATIONS.

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| SCIENTIFIC RESEARCH ASSOCIATES INC<br>P O BOX 498<br>GLASTONBURY, CT 06033<br>BERNARD C WEINBERG<br>TITLE:<br>ANALYSIS OF UNSTEADY SHOCK WAVE INTERACTIONS<br>TOPIC: 1 | DNA | \$ 48,330 |
| OFFICE: OAAM   |     |           |

A PROPOSAL IS PRESENTED HEREIN TO INITIATE AN ANALYTIC STUDY OF THE

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>----- | AWARDED<br>AMOUNT<br>----- |
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FLOW FIELD RESULTING FROM THE INTERACTION OF AN UNSTEADY SHOCK WAVE WITH THE GROUND AND ABOVE GROUND STRUCTURES. THE LONG TERM GOAL OF THIS ANALYSIS WILL BE TWOFOLD, (1) PREDICT THE PRESSURE PULSE ON STRUCTURES AND (2) PREDICT THE FLOW FIELD DUE TO THE PROPAGATION OF A SHOCK WAVE ALONG THE GROUND AND THE RESULTANT DUST ENTRAINMENT THE OCCURS. ALTHOUGH THE ULTIMATE AIM OF THE PROGRAM IS TO FULFILL THE TWO GOALS MENTIONED ABOVE, THE PRESENT PROPOSAL FOCUSES ON DEMONSTRATING THE CAPABILITY TO ACCURATELY PREDICT PRESSURE DISTRIBUTIONS BY CONSIDERING THE SHOCK DIFFRACTION PROBLEM, I.E. THE INTERACTION OF A MOVING SHOCK WAVE WITH A WEDGE. AN IMPORTANT FEATURE OF THE ANALYSIS IS THE USE OF NAVIER-STOKES CODE WHICH PROPERLY ACCOUNTS FOR VISCOUS EFFECTS THAT INFLUENCE THE PHYSICAL PROCESSES OCCURING NEAR THE SURFACE.

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| SCIENTIFIC RESEARCH ASSOCIATES INC<br>PO BOX 498<br>GLASTONBURY, CT 06033<br>HENRY MCDONALD<br>TITLE:<br>NUMERICAL INVESTIGATION OF UNSTEADY THREE-DIMENSIONAL TURBULENT STRUCTDURES IN BOUNDARY LAYER FLOWS OVER AN AIRFOIL<br>TOPIC: 144            OFFICE: AFOSR/XOT | AF | \$ 68,301 |
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A PROPOSAL IS PRESENTED HEREIN TO NUMERICALLY INVESTIGATÈ THE UNSTEADY DYNAMICS OF HAIRPIN VORTICS SUBMERGED IN VARIOUS BACKGROUND FLOWS. THE COMPUTER CODE TO BE USED WAS DEVELOPED FOR CALCULATING UNSTEADY THREE-DIMENSIONAL TURBULENT BOUNDARY LAYER FLOWS ON WINGS AND IS CAPABLE OF TREATING NEGATIVE CROSS FLOW AND STREAMWISE REVERSE FLOW. UNDER PHASE I OF THE CURRENT PROPOSAL, THE BACKGROUND FLOW WOULD BE THE MEAN TURBULENT FLOW FIELD OVER A NEWMAN AIRFOIL AND TWO SETS OF PROBLEMS WOULD BE CONSIDERED. THE FIRST ONE WOULD BE THE STUDY OF THE BEHAVIOR OF ISOLATED HAIRPIN VORTEX OF DIFFERENT LENGTH SCALE IN THE GIVEN BACKGROUND FIELD. THE SECOND SET WOULD BE THE INVESTIGATION OF THE EFFECTS OF UNSTEADY VORTEX GENERATION ON THE TURBULENCE CHARACTERISTICS OF THE NEWMAN AIRFOIL FLOW.

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| SCIENTIFIC RESEARCH ASSOCIATES, INC.<br>P. O. BOX 498<br>GLASTONBURY, CT 06033<br>RICHARD BUGGELN<br>TITLE:<br>ADVANCED LABYRINTH SEALS<br>TOPIC: 114            OFFICE: AFWAL | AF | \$ 68,227 |
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A PROPOSAL IS PRESENTED HEREIN TO EXTEND A RECENTLY DEVELOPED

FISCAL YEAR 1984

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| <p>LABYRINTH SEAL ANALYSIS TO ENABLE IT TO BE APPLIED TO MORE ADVANCED SEALS WHICH HAVE RECENTLY BEEN PROPOSED FOR USE IN ADVANCED HIGH PERFORMANCE AXIAL TURBOMACHINERY. UNDER PHASE I OF THIS EFFORT, THE NECESSARY INITIAL COORDINATE SYSTEM DEVELOPMENT WILL BE UNDERTAKEN TO ENABLE THE CURVED SEAL LIPS CHARACTERISTICS OF THESE ADVANCED DESIGNS TO BE DESCRIBED AND SAMPLE CALCULATIONS WOULD BE PERFORMED. THE PREDICTIONS WILL BE COMPARED, WHERE POSSIBLE, TO DATA. FURTHER PHASE II EFFORTS COULD EXTEND THE GEOMETRIC RANGE OF SEALS WHICH COULD BE CONSIDERED, IMPROVE THE COMPUTER CODE EFFICIENCY AND USABILITY AND EXAMINE THE POSSIBLE USE OF CONSTRAINED OPTIMIZATION TOGETHER WITH ARTIFICIAL INTELLIGENCE TO CONSTRUCT A ROUTINE OPTIMIZED SEAL DESIGN PROCEDURE.</p> |               |                            |

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| <p>SCIENTIFIC RESEARCH ASSOCIATES, INC.<br/>P. O. BOX 498, 100 SYCAMORE STREET<br/>GLASTONBURY, CT 06033<br/>HENRY MCDONALD<br/>TITLE:<br/>DISC PUMPING ANALYSIS<br/>TOPIC: 114            OFFICE: AFWAL</p> | <p>AF</p> | <p>\$ 68,227</p> |
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IN MODERN HIGH PERFORMANCE GAS TURBINES OF INTEREST TO THE AIR FORCE IT HAS BEEN FOUND BENEFICIAL TO ACHIEVE HIGH OPERATING TEMPERATURES AT THE EXPENSE OF REQUIRING ACTIVE COOLING OF MANY OF THE COMPONENTS. THIS COOLING AIR IS OFTEN DRAWN FROM THE COMPRESSOR AND FED INTO THE TURBINE ALONG A PATH THROUGH THE INTERIOR OF THE ENGINE OUT OF THE MAIN GAS PATH THROUGH THE COMBUSTOR. EFFICIENCY DEMANDS THAT THE COOLING AIR MASS FLOW AND RESULTING LOSSES, BOTH DIRECT AND INDUCED, BE MINIMIZED. HERE THE PROBLEM OF SUPPLYING THIS COOLING AIR TO THE TURBINE DISCS AD ENDWAL IS ADDRESSED TOGETHER WITH THE COMPANION PROBLEM OF PREVENTING HOT GAS INJECTION INTO DISC CAVITIES, WHILE AT THE SAME TIME DISCHARGING THE COOLING FLOW BACK INTO THE MAIN GAS PATH WITH MINIMAL ADVERSE CONSEQUENCE. AN ANALYTICAL APPROACH IS ADOPTED TO ELUCIDATE THE COMPLEX FLUID MECHANIC PROCESSES OCCURING IN THESE DEVICES, SINCE AT PRESENT THE FLUID MECHANIC PROCESSES ARE POORLY UNDERSTOOD AND POSE A FORMIDABLE EXPERIMENTAL PROBLEM. SINCE THE FLUID MECHANIC PROCESSES ARE SO COMPLEX, THE PROPOSED APPROACH IS BASED ON NUMERICAL SOLUTIONS TO THE COMPRESSIBLE ENSEMBLE AVERAGED NAVIER-STOKES EQUATION. THE GOAL OF THE OVERALL EFFORT IS TO DEVELOP BOTH AN UNDERSTANDING AND A PREDICTIVE

FISCAL YEAR 1984

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CAPACITY WHICH WOULD ULTIMATELY IMPACT THE DESIGN PROCESS.

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| SCIENTIFIC SERVICE INC<br>517 E. BAYSHORE<br>REDWOOD CITY, CA 94063<br>JAMES V. ZACCOR<br>TITLE:<br>DEVELOPMENT OF AN INDUSTRIAL BLAST OVERPRESSURE DOSIMETER<br>TOPIC: 78            OFFICE: SGRD-RMA | ARMY | \$ 45,026 |
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THE OBJECTIVE OF THIS PROGRAM IS TO ASSESS THE FEASIBILITY OF DEVELOPING AN INDIVIDUAL BLAST OVERPRESSURE DOSIMETER THAT WILL MEASURE A 10 TO 150 PSI BLAST WAVE. FROM A MEDICAL STANDPOINT, THERE ARE A NUMBER OF REASONS WHY THE DEVELOPMENT OF A PERSONAL BLAST DOSIMETER IS SIGNIFICANT: APPROPRIATE MEDICAL TREATMENT MAY BE OVERPRESSURE AND IMPULSE SENSITIVE; INJURIES PRODUCED BY BLAST ARE DIFFICULT TO DIAGNOSE, AND MANY OF THE SYMPTOMS DO NOT MANIFEST THEMSELVES UNTIL SOME HOURS AFTER THE EVENT; AND IN THE EVENT OF MANY INDIVIDUALS BEING SUBJECTED TO A BLAST INCIDENT IT WOULD BE EXTREMELY VALUABLE TO HAVE A METHODOLOGY THAT WOULD ENABLE TRIAGE TO BE PERFORMED EFFECTIVELY AND EFFICIENTLY. UNDER THIS PROGRAM A NUMBER OF CONCEPTUAL APPROACHES FOR A BLAST DOSIMETER WILL BE EVALUATED, ANALYTICALLY AND EXPERIMENTALLY TO DETERMINE THE MOST PROMISING APPROACH TO BE DEVELOPED DURING PHASE 2 OF THE PROGRAM. A TENTATIVE LIST OF REQUIREMENTS FOR THIS DOSIMETER INCLUDE LOW COST, LONG SHELF AND USE LIFE, SMALL SIZE, WIDE TEMPERATURE OPERATING RANGE, NON-DIRECTIONAL, VISIBLE READOUT, NOT GIVE FALSE READINGS, ABILITY TO MAKE MEASUREMENTS THROUGHOUT THE RANGE OF INTEREST, HANDLE MULTI-EVENTS, AND IF POSSIBLE GIVE A MEASURE OF BLAST DURATION.

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| SCIENTIFIC SYSTEMS, INC.<br>54 RINDGE AVENUE EXTENSION<br>CAMBRIDGE, MA 02140<br>DR. JOHN BAILLIEUL<br>TITLE:<br>COMPUTER-AIDED DESIGN OF ROBUST DECENTRALIZED CONTROLLERS<br>TOPIC: 56            OFFICE: AFWAL/XRPF | AF | \$ 59,932 |
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RECENT RESEARCH IN LINEAR MULTIVARIABLE CONTROL THEORY BASED ON THE

FISCAL YEAR 1984

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STABLE FACTORIZATION APPROACH NOW MAKES IT POSSIBLE TO DEVELOP A SYSTEMATIC APPROACH TO THE DESIGN OF ROBUST DECENTRALIZED CONTROL SYSTEMS. ESPECIALLY, CURRENTLY AVAILABLE RESULTS INCLUDE, (1) CONDITIONS TO DETERMINE WHEN THERE EXISTS A STABILIZING CONTROLLER THAT IS ROBUST AGAINST A SPECIFIED AMOUNT OF UNCERTAINTY, AND (2) A PARAMETRIZATION OF ALL DECENTRALIZED STABILIZING CONTROLLERS FOR A TWO-CHANNEL SYSTEM. IN PHASE I OF THE PROPOSED RESEARCH, WE WILL EXPLOIT THESE RESULTS TO MAKE A START ON THE DESIGN OF ROBUST DECENTRALIZED CONTROLLERS BY TACKLING THE FOLLOWING PROBLEMS:

- 1) NUMERICAL COMPUTATION OF OPTIMALLY ROBUST CONTROLLERS
  - 2) DECENTRALIZED STABILIZATION OF AN N-CHANNEL SYSTEM
  - 3) ROBUST DECENTRALIZED CONTROL OF A TWO-CHANNEL SYSTEM
  - 4) OPTIMAL DECENTRALIZED FILTERING FOR A TWO-CHANNEL SYSTEM
- THE RESOLUTION OF THESE PROBLEMS WILL PROVIDE A FIRM FOUNDATION FOR PHASE II, AT THE END OF WHICH WE WILL BE IN A POSITION TO MARKET A COMMERCIAL CAD SOFTWARE PACKAGE.

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| SCIENTIFIC SYSTEMS, INC.<br>54 RINDGE AVENUE EXTENSION<br>CAMBRIDGE, MA 02140<br>JUDITH M. GILES | NAVY | \$ 48,409 |
| TITLE:<br>PLANNING FOR IV&V OF THE SOFTWARE DEVELOPMENT OF THE TCO SYSTEM                        |      |           |
| TOPIC: 48                      OFFICE: MARINE CORPS  |      |           |

THIS RESEARCH IS AIMED AT ESTABLISHING A PLAN FOR PERFORMING IV&V OF THE SOFTWARE DEVELOPMENT OF THE TCO SYSTEM. THE APPROACH WILL BE TAILORED TO ACHIEVE THE GOALS AND OBJECTIVES ESTABLISHED FOR THE IV&V EFFORT, BUT WILL ALSO EXPLOIT THE GENERIC ASPECTS OF IV&V IN A MANNER THAT ALLOWS FOR THE PLAN TO SERVE AS A PROTOTYPE FOR FUTURE IV&V PLANNING EFFORTS. THE SPECIFIC TASKS TO BE ACCOMPLISHED INCLUDE: FAMILIARIZATION WITH THE TCO SYSTEM PROGRAM; DEFINITION OF IV&V TASKS AND TECHNICAL APPROACH; SELECTION OF AUTOMATED SOFTWARE TOOLS; DEFINITION OF THE INTERFACE BETWEEN THE DEVELOPMENT CONTRACTOR AND THE IV&V TEAM; DEFINITION OF AND DISCUSSION OF ISSUES RELATING TO THE IV&V ORGANIZATION AND MANAGEMENT; AND GENERATION OF A FINAL REPORT.

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| SEITEC, INC.<br>P.O. BOX 81264<br>CLEVELAND, OH 44181<br>GEORGE R. SEIKEL         | AF | \$ 49,496 |
| TITLE:<br>POTENTIAL OF COMPLETELY MAGNETICALLY CONTAINED ELECTROTHERMAL THRUSTERS |    |           |
| TOPIC: 151                      OFFICE: AFOSR/XOT                                 |    |           |

RESEARCH ON A NOVEL ELECTROTHERMAL THRUSTER CONCEPT IS PROPOSED. THIS

FISCAL YEAR 1984

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PROPOSED CONCEPT PROVIDES FOR STABLE, TOTAL MAGNETIC CONTAINMENT AND EXPANSION OF THE IONIZED PROPELLANT. IT AVOIDS THE SPECIFIC IMPULSE LIMITATIONS DUE TO HEAT TRANSFER OF CONVENTIONAL PHYSICAL NOZZLE ELECTROTHERMAL THRUSTERS. IT OFFERS SIGNIFICANT IMPROVEMENTS IN OPERATING LIFE AND EFFICIENCY OVER PRIOR PARTIALLY MAGNETIC CONTAINED EXTERNAL MAGNETIC FIELD MPD THRUSTERS WHICH A DECADE AGO DEMONSTRATED EFFICIENCIES OF 35% AT SPECIFIC IMPULSES OF 2000-3000 SEC. AND OPERATING LIVES OF 500-1000 HOURS. RESEARCH ON THOSE THRUSTERS WAS TERMINATED IN THE EARLY 1970'S BECAUSE OF A DECLINE IN INTEREST IN HIGH POWER ELECTRIC PROPULSION. RECENT REVIEWED INTEREST IN EARTH-ORBIT ELECTRIC PROPULSION FOR ORBIT RAISING, MANEUVERING, AND/OR DRAG CANCELLATION HAS STIMULATED A RENEWED INTEREST IN HIGH-PERFORMANCE 2000-3000 SECOND SPECIFIC IMPULSE THRUSTERS. THE PROPOSED THRUSTERS CONCEPT, WHICH INNOVATIVELY BUILDS ON THE BEST OF THE PAST TECHNOLOGY, COULD BE THE PRIME CANDIDATE TO MEET SUCH MISSION REQUIREMENTS. IN PHASE I ALTERNATE APPROACHES FOR HEATING A COMPLETELY MAGNETICALLY CONTAINED ELECTROTHERMAL THRUSTER WILL BE EVALUATED, A CONCEPTUAL DESIGN OF THE MOST PROMISING TYPE THRUSTER WILL BE DEVELOPED ALONG WITH PERFORMANCE ESTIMATES, AND IT'S POTENTIAL WILL BE COMPARED WITH ALTERNATIVE THRUSTERS.

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| SENSOR ELECTRONICS, INC.<br>105 FAIRWAY TERRACE<br>MT. LAUREL, NJ 08054<br>EDWIN LANGBERG, PH.D.<br>TITLE:<br>NOISE SUPPRESSING TALK-THROUGH EARPLUGS<br>TOPIC: 100      OFFICE: SGRD-RMA | ARMY | \$ 48,852 |
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A NOVEL NOISE SUPPRESSING TALK-THROUGH EARPLUG IS PROPOSED. IT USES ACTIVE LOW-FREQUENCY NOISE SUPPRESSION TO ACHIEVE HIGH ATTENUATION ALONG WITH BROADBAND LIMITING CHARACTERISTICS. A NEW METHOD OF TIGHT BUT COMFORTABLE EARPLUG FIT IS DESCRIBED. A NOVEL MICROPHONE/LOUDSPEAKER CONFIGURATION IS OUTLINED.

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| SENSOR ELECTRONICS, INC.<br>105 FAIRWAY TERRACE<br>MT. LAUREL, NJ 08054<br>EDWIN LANGBERG, PH.D.<br>TITLE:<br>WIRELESS MULTI-CHANNEL BIO-MEDICAL TELEMETRY<br>TOPIC: 96      OFFICE: SGRD-RMA | ARMY | \$ 47,704 |
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A MULTI-CHANNEL SHORT RANGE BIO-MEDICAL TELEMETRY SYSTEM IS DESCRIBED

FISCAL YEAR 1984

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WHICH USES INFRA-RED TRANSMISSION AND A VERY EFFICIENT AND INEXPENSIVE MODULATION AND DEMODULATION SYSTEM, WELL SUITED FOR COMPUTER DATA PROCESSING. THE SYSTEM OVERCOMES THE LIMITED FREQUENCY ALLOCATION AND INTERFERENCE PROBLEMS OF RADIO-BASED TELEMETRY. IT HAS SIGNIFICANT ADVANTAGES IN CARDIOPULMONARY STRESS TESTING AND SIMILAR PATIENT MONITORING APPLICATIONS.

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| SIGNATRON, INC.<br>12 HARTWELL AVENUE<br>LEXINGTON, MA 02173<br>JAMES M. KATES<br>TITLE:<br>NARROWBAND SECURE DIGITIZED VOICE<br>TOPIC: 269            OFFICE: ESD/PKR | AF | \$ 52,003 |
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SECURE VOICE COMMUNICATIONS OVER NARROW (10 - 12.5 kHz) CHANNELS IS BECOMING INCREASINGLY IMPORTANT. SPEECH COMPRESSION FOR USE OVER SUCH NARROW CHANNELS MUST OPERATE AT 9.6 kbps. EXISTING SPEECH-COMPRESSION APPROACHES AT 9.6 kbps SUFFER FROM PROBLEMS SUCH AS SENSITIVITY TO INPUT NOISE, SENSITIVITY TO CHANNEL ERRORS, INADEQUATE SPEECH QUALITY, OR SEVERE COMPUTATIONAL REQUIREMENTS. IN THIS PROPOSAL WE DISCUSS AN INNOVATIVE APPROACH TO SPEECH COMPRESSION AT 9.6 kbps THAT PROMISES TO OVERCOME MANY OF THESE PROBLEMS, RESULTING IN A PRACTICAL AND EFFECTIVE SYSTEM.

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| SILICON DESIGNS<br>13547 SE 27TH PLACE<br>BELLEVUE, WA 98005<br>JOHN C. COLE<br>TITLE:<br>DEVELOPMENT OF A SAFE SEPARATION SENSOR ACCELEROMETER<br>TOPIC: 132            OFFICE: NASC | NAVY | \$ 48,949 |
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MAJOR ADVANCES IN MICROELECTRONIC AND MICROMECHANICAL COMPONENTS HAVE BEEN MADE IN RECENT YEARS. THE OFFEROR HAS DEVELOPED A PRELIMINARY DESIGN FOR A VERY LOW-COST ACCELEROMETER THAT COMBINES THE SENSOR, SENSE AMPLIFIER AND A/D CONVERTER ON A SINGLE CHIP. ANALYSES INDICATE THAT THE DESIGN OFFERS A SIGNIFICANT IMPROVEMENT

FISCAL YEAR 1984

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IN TEMPERATURE STABILITY OVER CONVENTIONAL APPROACHES. THE OFFEROR PROPOSES TO INVESTIGATE THE PROBLEMS ASSOCIATED WITH APPLYING THIS DESIGN AS A SAFE SEPARATION SENSOR. ADVERSE EFFECTS OF VIBRATION WILL BE EXAMINED ON SIMILAR MICROMECHANICAL COMPONENTS. A SCALED BREADBOARD OF THE SENSORS AND ELECTRONICS WILL BE FABRICATED AND TESTED. DAMPING METHODS COMPATIBLE WITH MICROELECTRONIC AND MICROMECHANICAL COMPONENTS WILL BE INVESTIGATED. MODIFICATIONS TO AN EXISTING FABRICATION PROCESS WILL BE EXAMINED WITH THE OBJECTIVE OF IMPROVING ASSEMBLY YIELD. FINALLY, A COST MODEL WILL BE DEVELOPED TO EVALUATE COMMERCIAL FEASIBILITY.

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| SKELETAL ASSESSMENT SERVICES CORPORATION<br>P.O. BOX 478, KINGS YARD<br>YELLOW SPRINGS, OH 45387<br>CHARLES COLBERT, PH.D.<br>TITLE:<br>FEASIBILITY DEMONSTRATION: PERSONNEL IDENTIFICATION DEVICE FOR<br>ENTRY ACCESS CONTROL (PIDEAC)<br>TOPIC: 248                      OFFICE: BMO/PMX | AF | \$ 73,186 |
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WE PROPOSE TO DEMONSTRATE FEASIBILITY OF ACHIEVING PERSONNEL ENTRY ACCESS CONTROL BY IDENTIFYING A PROFILE PATTERN GENERATED FROM TV IMAGES OF TEN FINGERS, EACH SCANNED TRANSVERSELY IN ABOUT 80 SLICES FROM TIP TO KNUCKLE. THE 80 WIDTHS DESCRIBING THE SHAPE OF EACH FINGER ARE AUTOMATICALLY MEASURED, FORMING 10 INDIVIDUAL "WIDTH PROFILES." IN 1980-81, USING X-RAY IMAGES OF FINGER BONES, WE DEVELOPED THE BASIC PROFILE MATCHING PRINCIPLES UNDER A NATIONAL ACADEMY OF SCIENCES/AIR FORCE RESEARCH PROJECT. WE IDENTIFIED THE CORRECT PERSON TO APPLY THIS METHOD TO FLESH-COVERED FINGERS IMAGED BY A TV CAMERA, AND TO DEMONSTRATE AN ERROR RATE SO LOW AS TO PRECLUDE ADMISSION OF AN UNAUTHORIZED PERSON PRESENTING A FAKED OR STOLEN I.D. CARD. CONTINUAL UPDATING IS ACCOMPLISHED BY REPLACING THE PREVIOUSLY STORED PROFILE WITH THE MOST RECENTLY ACCEPTED PROFILE. THERE IS NO NEED TO STORE ACTUAL IMAGES, ONLY TEN STRINGS OF 10-BIT NUMBERS, WHICH COULD BE MAGNETICALLY RECORDED ON THE BEARER'S I.D. CARD. MATCH COMPUTATION TIME WITH A HARD-WIRED MICROCHIP PROGRAM SHOULD BE A MATTER OF SECONDS.

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| SPACE TECH CORPORATION<br>2324 MANCHESTER COURT<br>FORT COLLINS, CO 80526<br>MICHAEL ANDREWS<br>TITLE:<br>STUDY OF RETARGETABLE HORIZONTAL MICROCODE GENERATION SYSTEMS<br>TOPIC: 278                      OFFICE: ESD/PKR | AF | \$ 41,959 |
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THE MAJOR PROBLEM WITH USING MACHINE-INDEPENDENT MICROPROGRAMMING

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>---- | AWARDED<br>AMOUNT<br>----- |
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LANGUAGE IS EFFECTIVE MACHINE TARGETING. A MICROCODE COMPILER IS DESIRABLE WHICH EASILY DIRECTS THE CODE GENERATOR OF A HIGH-LEVEL LANGUAGE TRANSLATOR IS DISTINCT MICROPROGRAMMABLE MACHINES. IT IS PROPOSED TO STUDY THE PARTITIONING OF THE MICROCODE GENERATION PORTION OF THE TRANSLATOR INTO TWO SEPARATE BUT RELATED COMPONENTS: A MACHINE-INDEPENDENT MICROCODE GENERATION ALGORITHM THAT USES PRE-COMPUTED, MACHINE-DEPENDENT TEMPLATES TO MAP INTERMEDIATE LANGUAGE CONSTRUCTS TO MICRO-OPERATIONS, AND A MICROCODE ALGORITHM THAT AUTOMATICALLY COMPUTES THE MACHINE-DEPENDENT TEMPLATES DIRECTLY FROM A MICRO MACHINE DESCRIPTION. THE PROPOSED RESEARCH SEEK TO DEMONSTRATE THE FEASIBILITY OF USING MACHINE-INDEPENDENT MICROCODE GENERATION METHODS IN A RETARGETABLE MICROCODE COMPILER FOR HIGHLY HORIZONTAL ARCHITECTURES, PARTICULARLY VLSI AND VHSIC SIGNAL PROCESSING MICROARCHITECTURES DESCRIBED IN THE VHSIC-VHDL.

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| SPARTA INC<br>7926 JONES BRANCH DRIVE<br>MCLEAN, LA 22102<br>DOUGLAS L HOGAN<br>TITLE:<br>AN ARTIFICIAL INTELLIGENCE TECHNIQUE FOR C3I<br>SPEECH UNDERSTANDING<br>TOPIC: 126            OFFICE: AMD/RDO | AF | \$ 48,385 |
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THE PROJECT WILL FIRST INVESTIGATE MEANS BY WHICH CONTENT-ADDRESSABLE MEMORY TECHNIQUES COULD BE EMPLOYED IN C3I SPEECH RECOGNITION. IN THE SECOND PHASE, A HARDWARE/SOFTWARE IMPLEMENTATION OF SELECTED TECHNIQUES WILL BE CONSTRUCTED. THE SPECTRAL AND TEMPORAL CHARACTERISTICS OF SPEECH ARE REGISTERED AS ELEMENTS IN "FEATURE VECTOR SPACES." THE RESEARCH IN PHASE I WILL FOCUS ON UNDERSTANDING HOW THESE SPACES ARE POPULATED BY ACTUAL TEST AND REFERENCE PATTERNS. THIS DEEPER UNDERSTANDING WILL BE USED AS GUIDANCE FOR (1) DEVELOPING ALGORITHMS THAT CAN EASILY BE IMPLEMENTED WITH PARALLEL PROCESSING AND (2) DEVELOP SPEECH SIGNAL TRANSFORMATIONS THAT UNIQUELY IDENTIFY WORDS, PHRASES, ETC. VIA A CONTENT-ADDRESSABLE MEMORY. IN PHASE II A HARDWARE/SOFTWARE IMPLEMENTATION WILL BE CONSTRUCTED TO EVALUATE TECHNIQUES IDENTIFIED IN PHASE I.

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| SPARTA INC.<br>23293 SO. POINTE DRIVE, SUITE 250<br>LAGUNA HILLS, CA 92653<br>JOHN GLATZ<br>TITLE:<br>EVALUATION OF SILICON CARBIDE/ALUMINUM (SiC/Al) MATERIAL FABRICATED<br>BY PRECISION CASTING<br>TOPIC: 69            OFFICE: NSWC | NAVY | \$ 49,857 |
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FISCAL YEAR 1984

| SUBMITTED BY<br>-----   | DEPT<br>---- | AWARDED<br>AMOUNT<br>----- |
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| SPARTA SYSTEMS, INC.<br>23293 SOUTH POINTE DRIVE<br>LAGUNA HILLS, CA 92653<br>B. W. KNUDSON<br>TITLE:<br>SMALL ICBM DISPERSED BASING CONCEPT STUDY<br>TOPIC: 281            OFFICE: BMO/PMX | AF           | \$ 49,000                  |

A BASING MODE IS PROPOSED FOR THE SMALL ICBM (SICBM) TO BE RESPONSIVE TO THE NEED FOR A DEPLOYMENT CONCEPT TO ENHANCE ITS SURVIVABILITY AND UTILITY. THE BASING CONCEPT USES STRATEGIC WARNING TO DISPERSE THE SICBM TO A REMOTE LOCATION. HOWEVER, AS COMPARED TO OTHER DISPERSAL BASING SYSTEMS, THIS CONCEPT HAS (1) A PUBLICLY AND POLITICALLY ACCEPTABLE PEACE TIME BASING LOCATION, (2) SURVIVABILITY TO SURPRISE SLBM ATTACK WITHOUT DISPERSAL, (3) MINIMAL DISPERSAL WARNING TIME OF FEW MINUTES INSTEAD OF, IN SOME CONCEPTS, HOURS, AND (4) MINIMAL RELIANCE ON SURVIVABLE SATELLITE WARNING. THIS STUDY ADDRESSES THE DESIGN AND OPERATIONAL ASPECTS OF THIS BASING OPTION AND COMPARES THE RESULTS WITH ROAD-MOBILE, SCURRY-ON-WARNING CONCEPTS.

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| SPARTA SYSTEMS, INC.<br>23293 SO. POINTE DRIVE, SUITE 250<br>LAGUNA HILLS, CA 92653<br>DR. J. E. LOWDER<br>TITLE:<br>U.S. ICBM DIRECTED ENERGY WEAPON VULNERABILITY STUDY<br>TOPIC: 282            OFFICE: BMO/PMX | AF | \$ 69,000 |
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THE POTENTIAL FUTURE DEVELOPMENT OF AN EFFECTIVE DIRECTED ENERGY WEAPON SYSTEM BY THE SOVIET UNION REQUIRES THAT THE VULNERABILITY OF U.S. ICBMS BE INVESTIGATED. THE ANALYTICAL STUDY PROPOSED HERE WILL REVIEW AND IDENTIFY CRITICAL COMPONENTS WITH POTENTIAL VULNERABILITIES TO DIRECTED ENERGY WEAPONS CONSISTING OF CONTINUOUS WAVE AND REP-PULSED LASERS, GIANT PULSE AND X-RAY LASERS AND NEUTRAL PARTICAL BEAMS. THE MISSILE COMPONENTS WILL BE RATED IN TERMS OF VULNERABILITY TO VARIOUS TYPES OF DIRECTED ENERGY BEAMS AND THE IMPACT ON MISSION PERFORMANCE. FIRST-ORDER DESIGN HARDENING TRADE-OFF ANALYSES WILL BE PERFORMED TO IDENTIFY PROMISING CONCEPTS.

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>----- | AWARDED<br>AMOUNT<br>----- |
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SPECIFIC RECOMMENDATIONS FOR FURTHER INVESTIGATIONS NEEDED TO ADDRESS UNANSWERED ISSUES WILL BE MADE.

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| SPARTA, INC.<br>7926 JONES BRANCH DRIVE<br>MCLEAN, VA 22102<br>DR. CHARLES A. ELDRIDGE<br>TITLE:<br>AN EXPERT SYSTEM FOR PLANNING OPTIMAL MESSAGE ROUTES<br>TOPIC: 35            OFFICE: DRSMI-ICDN | ARMY | \$ 47,361 |
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THIS PROJECT WILL FIRST SPECIFY AND THEN IMPLEMENT AN EXPERT SYSTEM TO AID IN THE PLANNING OF OPTIMAL MESSAGE ROUTES IN A LARGE (400 NODE), DYNAMIC TACTICAL NETWORK. WHEREAS CONVENTIONAL NETWORK OPTIMAL ROUTES ARE BASED UPON DELAY MINIMIZATIONS, THE APPROACH HERE WILL BE TO MAXIMIZE THE PROBABILITY OF SUCCESSFUL DELIVERY. THIS OPTIMIZATION WILL REQUIRE ASSESSMENT OF THE RELIABILITY OF EACH LINK AND NODE IN ADDITION TO THEIR TRAFFIC HANDLING CAPABILITIES AND REQUIREMENTS. THE OPTIMIZATION ACTIVITY IS WELL SUITED FOR THE EXPERT SYSTEM APPROACH AND VICE-VERSA BECAUSE OF THE STRUCTURE OF THE PROBLEM AND THE RESULTING FLEXIBILITY. THE EXPERT SYSTEM WILL BE SPECIFIED IN PHASE I; IN PHASE II, AN ACTUAL EXPERT SYSTEM WILL BE IMPLEMENTED.

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| SPARTA, INC.<br>23293 SOUTH POINTE DRIVE, SUITE 250<br>LAGUNA HILLS, CA 92653<br>JOHN J. GLATZ<br>TITLE:<br>DEVELOPMENT OF HIGH TEMPERATURE METAL MATRIX MATERIAL<br>TOPIC: 52            OFFICE: AFWAL/XRPF | AF | \$ 48,622 |
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SPARTA SYSTEMS, INC, PROPOSES A PROGRAM TO DEVELOP AND EVALUATE A METAL MATRIX COMPOSITE (MMC) SUPERALLOY WITH MATERIAL PROPERTIES IN THE 200 DEGREE (F) TEMPERATURE RANGE WHICH ARE SUPERIOR TO EXISTING METALS. THE OBJECTIVES OF THIS STUDY ARE TO DEVELOP THE MATERIAL AND TO EVALUATE THE POTENTIAL ADVANTAGES, DISADVANTAGES AND SYSTEMS IMPLICATIONS OF MANUFACTURING REENTRY VEHICLE AIRFRAME COM-

FISCAL YEAR 1984

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PONENTS FROM THIS MMC MATERIAL. THE RESULTS OF THIS MATERIAL DEVELOPMENT STUDY WILL BE COMPARED WITH EXISTING HIGH TEMPERATURE STEELS. THE STUDY APPROACH IS AS FOLLOWS: (1) INITIALLY IDENTIFY TYPICAL GENERIC COMPONENTS ON A REENTRY VEHICLE (RV) AIRFRAME STRUCTURE THAT FUNCTIONS IN THE 1500 TO 2000 DEGREE (F) TEMPERATURE RANGE AND ESTABLISH A SET OF FEASIBLE MATERIAL PROPERTIES GOALS; (2) PERFORM PARAMETRIC PREDICTIONS OF MATERIAL PROPERTIES USING SEVERAL ANALYTICAL FORMULATIONS AND VARIOUS CONSTITUENTS AND THEIR PROPORTIONS WITHIN THE LIMITS OF MANUFACTURING CAPABILITY; (3) FABRICATE A BILLET(S) OF THE MATERIAL(S) USING A POWDER METALLURGY PROCESS WITH PARTICULATE REINFORCEMENT DEVELOPED BY TRW; (4) EVALUATE THE RESULTING MATERIAL AND COMPARE THE RESULTS TO OTHER EXISTING HIGH TEMPERATURE SUPERALLOYS WITH REGARD TO MATERIAL PROPERTIES, MANUFACTURING COST, POTENTIAL GROWTH AND LIMITATIONS, ETC.; AND (5) DOCUMENT THE RESULTS IN A FINAL REPORT.

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| SPARTA, INC.<br>555 SPARKMAN DR., SUITE 410<br>HUNTSVILLE, AL 35805<br>DR. ROBERT REYNOLDS<br>TITLE:<br>LASER DEFENSE STUDY - THE EFFECT OF ACTIVE U.S. COUNTERMEASURES ON<br>LAYERED LASER DEFENSE SYSTEMS (LLDS)<br>TOPIC: 280            OFFICE: BMO/PMX | AF | \$ 49,000 |
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THE CONCEPT OF EMPLOYING DIRECTED ENERGY WEAPONS OPERATING AT NEAR THE SPEED OF LIGHT OF DESTROY BALLISTIC MISSILES OFFERS PROMISE OF THE ULTIMATE SOLUTION FOR PROTECTION AGAINST BALLISTIC MISSILE ATTACKS. ALTHOUGH THE METHOD OF KILL OF DIRECTED ENERGY WEAPONS IS BOTH NOVEL, FAST AND LONG RANGE, THE FUNCTIONING AND CAPABILITY OF A LAYERED DEFENSE SYSTEM (LLDS) IS DEPENDENT ON SENSORS, BATTLE MANAGEMENT, COMMUNICATIONS AND TIMELINES AS WELL AS THE LASER DEVICES THEMSELVES AND THEIR METHOD OF KILL. MOST OF THESE FUNCTIONS WILL REQUIRE TECHNOLOGICAL BREAKTHROUGHS TO BECOME FEASIBLE. CONCEPTUALLY, IT SHOULD BE POSSIBLE TO CREATE ACTIVE COUNTERMEASURES TO AN LLDS WHICH WILL DEGRADE ONE OR MORE FUNCTIONS CRUCIAL TO THE PERFORMANCE OF THE SYSTEM. WE PROPOSE TO DEVELOP A METHODOLOGY FOR CREATING AND EVALUATING THE EFFECT OF ACTIVE U.S. COUNTERMEASURES ON AN LLDS, AND TO APPLY THAT METHOD IN A SYSTEM STUDY TO EVALUATE TWO POTENTIAL ACTIVE U.S. COUNTERMEASURES. THE METHOD INCLUDES A MEANS OF DETERMINING, THROUGH SIMULATION, THE MOST LIKELY LLDS WHICH MAY BE

FISCAL YEAR 1984

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DEPLOYED, AND THE EVALUATION OF THE PAYOFF OF CANDIDATE ACTIVE COUNTERMEASURES TO THE LLDS THUS ALLOWING U.S. BALLISTIC MISSILES TO ACHIEVE THEIR OBJECTIVES.

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| SPARTA, INC.<br>555 SPARKMAN DR., SUITE 410<br>HUNTSVILLE, AL 35805<br>DR. ROBERT C. HARPER<br>TITLE:<br>PROTON RADIATION EFFECTS ON FREQUENCY CONTROLLED CRYSTALS<br>TOPIC: 66            OFFICE: NSWC | NAVY | \$ 47,754 |
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A LARGE PERCENTAGE OF THE ELECTRONIC INSTRUMENTS IN USE TODAY HAVE AN OSCILLATOR OR WAVEFORM GENERATOR OF SOME SORT. AN OSCILLATOR MAY BE USED SIMPLY AS A SOURCE OR REGULARLY SPACED PULSES, A CLOCK, OR AS THE LOCAL OSCILLATOR IN A RECEIVER. NO MATTER HOW THE OSCILLATOR IS USED IT MUST MAINTAIN ITS FREQUENCY OF OSCILLATION TO A SPECIFIC DEGREE OF ACCURACY. IN A GROWING NUMBER OF APPLICATIONS THESE OSCILLATORS ARE REQUIRED TO OPERATE IN THE PRESENCE OF PROTON RADIATION. THE SOURCE OF THIS RADIATION CAN BE FROM SOLAR FLARES, COSMIC RAYS OR CHARGED PARTICLE DIRECTED ENERGY WEAPONS. THE RELATIONSHIP BETWEEN THE DOSE AND FREQUENCY SHIFT OF THESE OSCILLATORS IS IMPORTANT TO QUANTIFY THE DEGRADATION OR FAILURES OF INSTRUMENTS WITH CRYSTAL OSCILLATORS WHEN EXPOSED TO CHARGED PARTICLE BEAMS.

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| SPECTRA RESEARCH SYSTEMS<br>1811 QUAIL STREET<br>NEWPORTBEACH, CA 92660<br>LOUIS MOLE<br>TITLE:<br>DISTRIBUTED RF SENSOR SYSTEMS FOR BATTLE GROUP DEFENSE<br>TOPIC: 7            OFFICE: DARPA | DARPA | \$ 49,226 |
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NAVAL CARRIER BATTLE GROUP MISSION REQUIREMENTS FREQUENTLY RESULTS IN THEIR FORWARD DEPLOYMENT UNDER POTENTIALLY HOSTILE CIRCUMSTANCES THAT EXPOSES THEM TO THE CRUISE MISSILE THREAT FROM BOTH AIR AND SUBMARINE

FISCAL YEAR 1984

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LAUNCHED WEAPONS. DEVELOPMENT OF A RADAR BUOY CAPABILITY, "SONOBUOY LIKE" PACKAGED AND DEPLOYABLE THAT INTEGRATES WITH A SHIPBOARD BASED DATA PROCESSING/COMMAND AND CONTROL SYSTEM, WILL PROVIDE THE POTENTIAL FOR PERIMETER DEFENSE SURVEILLANCE AGAINST CRUISE MISSILES THAT MAY APPEAR AT AN AZIMUTH. THIS STUDY WILL EXAMINE SIX DIFFERENT RADAR BUOY CONFIGURATION AND PROCESSING CONCEPTS TO IDENTIFY THE OPTIMUM CANDIDATE SYSTEM FOR SUBSEQUENT PHASE II PROTOTYPE EVALUATION. THE ANALYSIS WILL INCLUDE A CONCEPTUAL RADAR SYSTEM FORMULATION AND DESIGN WITH THEORETICAL/ANALYTICAL FEASIBILITY ESTIMATES PLUS IDENTIFICATION OF CRITICAL EXPERIMENTS/TECHNOLOGY DEVELOPMENT REQUIRED FOR CONCEPT VALIDATION. INCLUDED IN THIS RADAR BUOY/SHIPBASED PROCESSOR CONCEPT DEVELOPMENT WILL BE AN EVALUATION OF POTENTIAL RADAR BUOY/SHIPBASED SYSTEM CONFIGURATION CONCEPTS, IDENTIFICATION/RESOLUTION OF KEY TECHNICAL ISSUES, AND SPECIFICATION OF AN ENGINEERING TEST MODEL AND "PROOF OF CONCEPT" EXPERIMENT PLAN. THE PROPOSED PHASE I TECHNICAL ANALYSIS SHALL PROVIDE THE BASIS FOR SUBSEQUENT PROGRAM PHASES INVOLVING SYSTEM PROTOTYPE FABRICATION AND FIELD TEST EVALUATION.

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| SPECTRA RESEARCH SYSTEMS                        | AF                 | \$ 49,839 |
| 555 SPARKMAN DRIVE; SUITE 1406                  |                    |           |
| HUNTSVILLE, AL 35805                            |                    |           |
| DR. D. DAVID MARSHALL                           |                    |           |
| TITLE:  |                    |           |
| DEVELOPMENT OF A SPACECRAFT MATERIALS DATA BASE |                    |           |
| TOPIC: 85                                       | OFFICE: AFWAL/XRPM |           |

THE OBJECTIVE OF THIS RESEARCH IS TO DETERMINE THE FEASIBILITY OF ESTABLISHING AN AUTOMATED DATA BASE AND RETRIEVAL SYSTEM WHICH CONTAINS A BROAD CROSS SECTION OF INFORMATION ON SPACECRAFT MATERIALS. SUCH A DATA BASE DOES NOT CURRENTLY EXIST. THE DATA BASE FILE STRUCTURE WILL INCLUDE OUTGASSING AND CONDENSATION DATA AND MATERIALS PHYSICAL AND MECHANICAL PROPERTIES. THE SYSTEM IS FOCUSED TOWARD SERVING A BOARD SEGMENT OF THE AEROSPACE COMMUNITY AND WILL BE DESIGNED TO PERMIT EXPANSION OVER TIME AS ADDITIONAL TEST DATA BECOMES AVAILABLE. VARIOUS FILE STRUCTURES AND QUERY PROCEDURES WILL BE ASSESSED TO IDENTIFY FLEXIBLE APPROACHES TO PROVIDE ACCESS TO MATERIALS PROPERTIES, TEST DATA, AND SYSTEM APPLICATIONS. THE DATA BASE DESIGN WILL PERMIT REMOTE TERMINAL AND CENTRAL SITE DATA INTERROGATION AND MULTIPLE OUTPUT OPTIONS.

FISCAL YEAR 1984

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| SPECTRA RESEARCH SYSTEMS<br>1811 QUAIL STREET<br>NEWPORT BEACH, CA 92660<br>DR. LOUIS MOLE<br>TITLE:<br>METEOROLOGICAL CONSIDERATIONS FOR RV FLIGHT TESTING<br>TOPIC: 252            OFFICE: BMO/PMX | AF | \$ 49,177 |
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THE OBJECTIVE OF THIS RESEARCH IS TO EVALUATE REQUIREMENTS FOR A REMOTE WEATHER SAMPLING SYSTEM FOR USE ON REMOTELY PILOTED VEHICLES (RPV). THE WEATHER SAMPLING SYSTEM IS TO MEASURE CLOUD STATISTICS, PARTICLE SIZE/WATER CONTENT INFORMATION, DENSITY AND, IF POSSIBLE, WIND INFORMATION. THE RESEARCH SUPPORTED UNDER THIS PROGRAM WILL PERFORM ANALYSES AND DEVELOP AN INSTRUMENTATION HARDWARE AND SOFTWARE DESIGN TO MEASURE THE FREESTREAM PARTICULAR WATER CONTENT FROM AN RPV. THE INSTRUMENT MUST PROVIDE A REALTIME READOUT FOR TELEMETERING TO GROUND DATA CLOUDS WITH EQUIVALENT WATER CONTENT RANGE OF 10-3 GRAM/M3 TO 1 GRAM/M3. SRS' APPROACH TO WEATHER PARTICLE SAMPLING IS THE USE OF ITS PARTICLE MEASUREMENT RADAR (PMR) CONCEPT. THE PMR CONCEPT FOR WEATHER SAMPLING EMPLOYS A MINIATURE, BISTATIC, CONTINUOUS WAVE (CW) RADAR WHICH RELIES ON RESOLUTION AFFORDED BY THE INTERSECTION ANTENNA BEAMS TO DETECT INDIVIDUAL WEATHER PARTICLES IN THE FREESTREAM. THE USE OF MULTIPLE RECEIVE BEAMS IN A NEAR ORTHOGONAL PLANE PROVIDES WIND INFORMATION. PARTICLE SIZE IS MEASURED AS A FUNCTION OF SCATTERED SIGNAL STRENGTH. THE STATISTICS OF THE WEATHER PARTICLES ARE DETERMINED BY AVERAGING A LARGE NUMBER OF MEASUREMENTS PROVIDED BY PMR. THE FEASIBILITY OF PMR IS BASED ON THE AVAILABILITY OF SOLID STATE RF DEVICES IN THE FREQUENCY RANGE OF 100 GHZ, LIGHT WEIGHT PRINTED CIRCUIT ANTENNA ARRAYS, AND SINGLE CHIP SIGNAL AND DATA PROCESSORS. THE USE OF THESE ADVANCED COMPONENTS WILL RESULT IN A HIGH QUALITY WEATHER SAMPLING SYSTEM THAT WEIGHTS ONLY A FEW POUNDS AND CONSUMES LOW POWER.

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| SPECTRA RESEARCH SYSTEMS<br>555 SPARKMAN DRIVE SUITE 1406<br>HUNTSVILLE, AL 35805<br>JOHN D. HYDE<br>TITLE:<br>APPLICATION OF INFRARED RADIOMETRY TO LOCATE UNBONDED ZONES IN LARGE BONDED STRUCTURES<br>TOPIC: 86            OFFICE: NSWC | NAVY | \$ 49,979 |
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FOR NONDESTRUCTIVE EVALUATION TO REMAIN A VERSATILE TOOL, NOT

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>----- | AWARDED<br>AMOUNT<br>----- |
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LIMITED BY COMPLEX GEOMETRIES OR MATERIAL TYPES, INDUSTRY MUST REFINE THE EXISTING NONDESTRUCTIVE EVALUATION TECHNIQUES OR DEVELOP NEWER ONES. BECAUSE OF THE RECENT ADVANCES IN HIGHER SENSITIVITY INFRARED DETECTORS, THE AVAILABILITY OF A WIDER SPECTRUM OF OPTICAL MATERIALS, IMPROVEMENTS INFILTRATING AND DATA PROCESSING TECHNIQUES, AND THE DEVELOPMENT OF LOWER NOISE AMPLIFIERS AND ELECTRONICS, INFRARED RADIOMETRY MAY BE AN ALTERNATE TECHNIQUE TO EVALUATE BONDING INTEGRITY. SINCE THE ANALYSIS IS BASED UPON THE THERMAL GRADIENTS ESTABLISHED AT A MATERIAL INHOMOGENEITY, THE THERMAL GRADIENTS MAY BE EASILY RESOLVED IN THE INFRARED REGION OF THE ELECTROMAGNETIC SPECTRUM THROUGH A VISUAL INSPECTION OF ISOTHERMS. THIS PROPOSED EFFORT WILL DEFINE A MINIMUM VOID SIZE AND MAXIMUM VOID DEPTH WHICH WILL PRODUCE A DETECTABLE AND CONTRASTING THERMAL SIGNATURE; WILL PARAMETRICALLY EVALUATE ISOTHERM FORMATION TO IDENTIFY AND DEFINE OPERATIONAL PARAMETERS FOR PHYSICAL TESTING; WILL STUDY ISOTHERM DISTORTION AS A FUNCTION OF VOID SIZE, SHAPE, AND DEPTH; AND FINALLY, WILL CHARACTERIZE APPLICABLE INFRARED DETECTORS FOR PHASE II TESTING. THESE TOPICS WILL BE REVIEWED TO ESTABLISH THE FEASIBILITY OF APPLYING INFRARED RADIOMETRY TO CHARACTERISTIC BOUNDING INTEGRITY.

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| SPECTRA RESEARCH SYSTEMS<br>1811 QUAIL ST.<br>NEWPORT BEACH, CA 92660<br>DR. LOUIS MOLE<br>TITLE:<br>FEASIBILITY ANALYSIS OF EMBEDDED TRAINING IN OPERATIONAL AIRCRAFT<br>TOPIC: 111            OFFICE: NTEC | NAVY | \$ 49,675 |
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FORWARD BASING AND MISSION REQUIREMENTS, FREQUENTLY RESULT IN FLEET AIRCRAFT OPERATIONS IN GEOGRAPHICAL LOCATIONS THAT DO NOT PERMIT MILITARY PERSONNEL READY ACCESS TO THE APPROPRIATE AIRCRAFT SIMULATORS NECESSARY TO REMAIN IN THE HIGHEST STATE OF TACTICAL PROFICIENCY. THIS PHASE I PROJECT WILL EXAMINE THE FEASIBILITY OF UTILIZATION OF THE OPERATIONAL AIRCRAFT'S AVIONICS AND WEAPONS SYSTEMS AS A TRAINING SIMULATOR WHILE PARKED ON THE FLIGHT LINE THEREBY ENABLING NAVY PERSONNEL TO MAINTAIN OPTIMUM PROFICIENCY. THE KEY REQUIREMENT TO ACHIEVING THIS OBJECTIVE IS THE DEVELOPMENT OF A SOFTWARE RESIDENT SYSTEM OF INTERCHANGEABLE TRAINING PACKAGES THAT CAN PROVIDE A COST EFFECTIVE BUT REALISTIC AND VIABLE MENU OF TRAINING SCENARIOS SUITABLE FOR THIS APPLICATION. THE PRIMARY OBJECTIVE IS

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>---- | AWARDED<br>AMOUNT<br>----- |
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TO DETERMINE THE BASIC FEASIBILITY OF THIS CONCEPT AND TO IDENTIFY THE OPTIMUM APPROACH FOR A PHASE II PROOF OF CONCEPT DEMONSTRATION. SUCCESSFUL DEVELOPMENT OF SUCH AN OPERATIONAL AIRCRAFT SIMULATION CAPABILITY REQUIRES THE DEFINITION OF AIRCRAFT SIMULATOR TRAINING REQUIREMENTS, EXAMINATION OF EMBEDDED SOFTWARE AVIONICS CONCEPTS, AND ASSEMBLY OF A COST/BENEFIT FEASIBILITY MATRIX ALONG WITH A PHASE II TEST PLAN FOR CANDIDATE CONCEPT OPERATIONAL DEMONSTRATION AND EVALUATION.

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| SPECTRAL SCIENCES INC<br>111 SOUTH BEDFORD ST<br>BURLINGTON, MA 01803<br>DR LAWRENCE S BERNSTEIN<br>TITLE:<br>HHC INFRARED VAPOR/AEROSOL MONITOR<br>TOPIC: 190            OFFICE: AFSTC | AF | \$ 62,950 |
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BECAUSE OF POTENTIAL ENVIRONMENTAL EFFECTS FROM THE LARGE QUANTITIES OF HCL RELEASED INTO THE ATMOSPHERE FROM SPACE SHUTTLE LAUNCHES, IT IS IMPORTANT TO MONITOR THE TRANSPORT OF HCL IN BOTH VAPOR AND AEROSOL FORM INTO THE SURROUNDING AREAS. THE MAJOR OBJECTIVES OF PHASE I ARE TO EXPERIMENTALLY DEMONSTRATE A NOVEL INFRARED LIGHT SOURCE AND TO DESIGN AN HCL VAPOR/AEROSOL MONITOR, BASED ON THE NEW INFRARED LAMP, WHICH WOULD BE BUILT AND TESTED IN PHASE II. THIS LIGHT SOURCE CAN SIGNIFICANTLY INCREASE THE SENSITIVITY OF HCL ABSORPTION MEASUREMENTS OVER THE USE OF MORE CONVENTIONAL INFRARED SOURCE TECHNOLOGY. THIS ALLOWS FOR A SHORTER, MORE COMPACT ABSORPTION CELL. IT IS ESTIMATED THAT THIS DEVICE CAN MEASURE HCL CONCENTRATIONS OF 0.1PPM (AND PERHAPS SMALLER) AND CAN ALSO BE USED TO DETERMINE THE PARTITIONING OF HCL IN BOTH VAPOR AND AEROSOL FORMS.

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| SPECTRAL SCIENCES, INC.<br>111 SOUTH BEDFORD STREET<br>BURLINGTON, MA 01803<br>DR. STEVEN ADLER-GOLDEN<br>TITLE:<br>SPARK DISCHARGE CHEMICAL AGENT MONITOR FOR DEEP BASING<br>TOPIC: 245            OFFICE: BMO/PMX | AF | \$ 65,851 |
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A SPARK DISCHARGE DEVICE IS PROPOSED FOR A FAST SENSOR FOR TRACE

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>----- | AWARDED<br>AMOUNT<br>----- |
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CONCENTRATIONS OF CHEMICAL AGENTS IN DEEP BASING APPLICATIONS. THE TECHNIQUE WOULD EMPLOY ATOMIC EMISSION DETECTION OF ARSENIC (AS), PHOSPHORUS (P), CHLORINE (CL), AND FLUORINE (F), WHICH ARE MAJOR COMPONENTS OF THESE AGENTS. THE SPARK METHOD IS WELL-ESTABLISHED, HAVING BEEN EMPLOYED BY SEVERAL WORKERS TO DETECT THESE SPECIES, AND ALSO BY OURSELVES FOR THE MEASUREMENT OF TRACE WATER VAPOR. DETECTABILITY OF THIS TECHNIQUE IS AT THE PPM TO SUB-PPM LEVEL, WITH A TIME RESPONSE OF A SECOND OR LESS. IN ADDITION, THE DEVICE WOULD BE RUGGED AND MODERATE IN COST, AND IT COULD ALSO BE READILY DESIGNED TO MEASURE ADDITIONAL ATOMIC SPECIES WHICH INDICATE THE PRESENCE OF OTHER AGENTS OR CONTAMINANTS. THE PHASE I OBJECTIVE IS THE PROOF OF PRINCIPAL EXPERIMENT TO DEMONSTRATE TRACE CHEMICAL AGENT DETECTION IN AIR USING NON-TOXIC SIMULANTS. IN PHASE II, A FLEXIBLE BRASSBOARD APPARATUS WOULD BE BUILT, MEASUREMENTS WOULD BE MADE WITH CHEMICAL AGENT SIMULANTS, AND A PROTOTYPE DEVICE WILL BE DESIGNED.

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| SPECTRON DEVELOPMENT LABORATORIES, INC.<br>3303 HARBOR BLVD., SUITE G-3<br>COSTA MESA, CA 92626<br>DR. JAMES TROLINGER<br>TITLE:<br>A PROPOSAL TO DEVELOP A PULSED LASER HOLOCAMERA FOR REENTRY AND IMPACT TEST DIAGNOSTICS<br>TOPIC: 252            OFFICE: BMO/PMX | AF | \$ 48,450 |
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THE IMPACT OF ATMOSPHERIC PARTICLES ON A NOSETIP MATERIAL DURING REENTRY RESULTS IN THE GENERATION OF DEBRIS PARTICLES WHICH ARE EJECTED FROM THE CRATER FORMED. THESE DEBRIS PARTICLES HAVE THE POTENTIAL FOR SIGNIFICANTLY ERODING ANY DOWNSTREAM PROTRUDING SURFACES SUCH AS A FLARE. CONSEQUENTLY, THE CHARACTERISTICS OF THIS EJECTED DEBRIS SUCH AS ITS VELOCITY, TRAJECTORY, AND SIZE DISTRIBUTION ARE NEEDED FOR REENTRY VEHICLE OR MISSILE DESIGN. ATTEMPTS TO-DATE TO OBTAIN THIS DATA HAVE NOT BEEN SUCCESSFUL BECAUSE OF THE INADEQUACY OF THE AVAILABLE INSTRUMENTATION. A MEASUREMENT TECHNIQUE NOT UTILIED HERETOFORE FOR THIS DATA AND WHICH IS RECOMMENDED BECAUSE OF ITS ABILITY TO FREEZE HIGH SPEED MOTIONS AND ITS GOOD DEPTH OF FIELD CHARACTERISTICS IS PULSED LASER HOLOGRAPHY. IN PHASE I OF THE PROPOSED STUDY, AN EXISTING HOLOCAMERA WILL BE MODIFIED AND MADE AVAILABLE FOR DEBRIS CHARACTERIZATION IMPACT TESTS. THE PROPOSED EFFORT WILL INCLUDE RECONSTRUCTION OF HOLOGRAMS AND OBTAINING DEBRIS CHARACTERIZATION DATA FROM THEM. PHASE I WILL

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>----- | AWARDED<br>AMOUNT<br>----- |
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PROVIDE VERIFICATION OF THE MEASUREMENT TECHNIQUE FOR THIS APPLICATION AND DATA WHICH WILL ENABLE UPGRADING THE MEASUREMENT CAPABILITIES IN FUTURE EFFORTS.

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| SPECTRON DEVELOPMENT LABORATORIES, INC.<br>3303 HARBOR BLVD., SUITE G-3<br>COSTA MESA, CA 92626<br>DENNIS R. KRAUSE<br>TITLE:<br>FAST RESPONSE MULTI-COLOR PYROMETER<br>TOPIC: 260            OFFICE: BMO/PMX | AF | \$ 48,450 |
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THE MEASUREMENT OF THE SURFACE TEMPERATURE OF MATERIALS AND SYSTEMS DURING SIMULATED REENTRY CONDITION TESTING IN HYPERVELOCITY RANGE AND TRACK TEST FACILITIES IS NECESSARY FOR THE DEVELOPMENT OF THESE MATERIALS AND SYSTEMS. TEMPERATURE MEASURING INSTRUMENTATION IS NOT CURRENTLY AVAILABLE TO ADEQUATELY MEET THIS NEED. IT IS PROPOSED THAT A FAST-RESPONSE, MULTI-COLOR PYROMETER BE DEVELOPED WHICH WOULD MEASURE TEMPERATURES ABOVE 1200 AND HAVE A RESPONSE TIME OF 50 NANoseconds OR LESS. THE OBJECTIVE OF PHASE I OF THIS EFFORT WILL BE TO VERIFY THE FEASIBILITY OF DEVELOPING THIS INSTRUMENT AND IN DETERMINING ITS PERFORMANCE LIMITATIONS. DATA WHICH WILL PERMIT AN OPTIMIZED SELECTION OF COMPONENTS AND SYSTEM DESIGN WILL BE OBTAINED.

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| SPECTRON DEVELOPMENT LABORATORIES, INC.<br>3303 HARBOR BLVD., G-3<br>COSTA MESA, CA 92626<br>DR. JAMES D. TROLINGER<br>TITLE:<br>PARTICLE SIZING LASER VELOCIMETER FOR ROCKET PLUME DIAGNOSTICS<br>TOPIC: 283            OFFICE: BMO/PMX | AF | \$ 48,450 |
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A PARTICLE SIZING TECHNIQUE THAT OPERATES IN CONJUNCTION WITH LASER VELOCIMETRY IS PROPOSED. THE TECHNIQUE USES A NON-INTRUSIVE SINGLE PARTICLE COUNTER BASED ON A PULSE HEIGHT ANALYZER. PARTICLE SIZE IS MEASURED FROM THE PULSE HEIGHT AND VELOCITY FROM DOPPLER FREQUENCY. THE TECHNIQUE HAS BEEN USED SUCCESSFULLY

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>----- | AWARDED<br>AMOUNT<br>----- |
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TO MEASURE SPRAY DROPLETS BETWEEN 5 AND 300 UM. THE PROPOSED WORK WILL DEVELOP THE TECHNIQUE FOR PARTICLE MEASUREMENTS IN ROCKET PLUMES WHERE THE PARTICLE VELOCITIES ARE HIGH AND THE ENVIRONMENT NOISY. THE METHOD HAS KEY ADVANTAGES FOR THIS APPLICATION COMPARED TO OTHER METHODS, INCLUDING THE LASER DOPPLER VELOCIMETRY (LDV) VISIBILITY APPROACH.

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| SPECTRON DEVELOPMENT LABORATORIES, INC.<br>3303 HARBOR BLVD., SUITE G-3<br>COSTA MESA, CA 92626<br>DR CECIL F. HESS<br>TITLE:<br>PARTICLE SIZER FOR LASER VELOCIMETERS<br>TOPIC: 135            OFFICE: AEDC/DOT | AF | \$ 48,217 |
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A PARTICLE SIZING TECHNIQUE THAT OPERATES IN CONJUNCTION WITH LASER VELOCIMETRY IS PROPOSED. THE TECHNIQUE USES A NON-INTRUSIVE SINGLE PARTICLE COUNTER BASED ON A PULSE HEIGHT ANALYZER. IT IS EXPECTED THAT A SIZE RANGE OF 0.1 UM TO 10 UM WILL BE ATTAINABLE. LOWER SIZE LIMITS WOULD REQUIRE ENSEMBLE MEASUREMENTS WHICH CANNOT BE READILY USED WITH LASER VELOCIMETRY, SINCE THE SIZE OF EACH PARTICLE IS NECESSARY. THE TECHNIQUE HAS BEEN SUCCESSFULLY USED TO MEASURE SPRAY DROPLETS BETWEEN 5 AND 300 UM. IT IS EXPECTED THAT WITH PROPER DEVELOPMENT THE DYNAMIC SIZE RANGE WILL BE EXTENDED TO 0.1 UM, INCLUDING IRREGULARLY SHAPED PARTICLES AS FOUND IN LASER VELOCIMETRY.

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| SPIRE CORPORATION<br>PATRIOTS PARK<br>BEDFORD, MA 01730<br>ROBERT G. WOLFSON<br>TITLE:<br>NOVEL ELECTROMAGNETIC MATERIALS<br>TOPIC: 166            OFFICE: AFOSR/XOT | AF | \$ 49,894 |
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GaAs, WHICH HAS BEEN USED FOR MONOLITHIC SURFACE ACOUSITC WAVE (SAW) DEVICES, IS ALSO THE MICROELECTRONIC MATERIAL OF CHOICE FOR HIGH SPEED, HIGH-FREQUENCY APPLICATIONS, AD ITS COMBINATION OF PIEZO-

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>----- | AWARDED<br>AMOUNT<br>----- |
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ELECTRIC AND SEMICONDUCTING PROPERTIES OFFERS THE OPPORTUNITY TO INTEGRATE SAW AND ELECTRONIC DEVICES IN THE SAME CHIP. SPIRE PROPOSES TO IMPLEMENT THIS INTEGRATION BY THE EPITAXIAL DEPOSITION OF THIN-FILM GaAs ON SAPPHIRE SUBSTRATES, WHICH WOULD PROVIDE BOTH ACOUSTIC COUPLING AND DIELECTRIC ISOLATION WITH MINIMAL PARASTIC CAPACITANCE. SPECIFICALLY, THE PHASE I FEASIBILITY RESEARCH IS INTENDED TO DEMONSTRATE THAT HIGH-QUALITY (100) GaAs/(0112) SAPPHIRE EPITAXY CAN BE ACHIEVED; THIS ORIENTATION, WHICH IS PREFERRED BOTH FOR SAW PROPAGATION AND FOR MICROELECTRONIC COMPONENT FABRICATION, HAS NOT YET BEEN OBTAINED IN LARGE-AREA GaAs LAYERS ON SAPPHIRE. METALORGANIC CHEMICAL VAPOR DEPOSITION (MO-CVD) WILL BE USED, SINCE THE ABSENCE OF CHLORIDE AND THE LOWER DEPOSITION TEMPERATURES PERMITTED BY THE REACTIONS SHOULD ENHANCE THE PROBABILITY OF SUCCESS. THE DEPOSITION TEMPERATURES, THE REACTANT RATIO, AND THE DEPOSITION RATE WILL BE EXERCISED OVER RANGES CENTERED UPON THE VALUES USED FOR (111) GaAs(0001) SAPPHIRE EXPITAXY. THE GaAs LAYER WILL BE CHARACTERIZED AND THE DEPOSITION PROCESS WILL BE OPTIMIZED.

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| SPIRE CORPORATION<br>PATRIOTS PARK<br>BEDFORD, MA 01730<br>ANTON C. GREENWALD<br>TITLE:<br>PARTICLE-BEAMS, PULSED-POWER, AND SPACE PRIME-POWER PHYSICS<br>TOPIC: 184            OFFICE: AFOSR/XOT | AF | \$ 50,000 |
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ELECTRODE EROSION LIMITS THE LIFETIME OF PULSED SPARK GAPS TO APPROXIMATELY 10 AND 10 PULSES WITH THE PRESENT STATE OF THE TECHNOLOGY. SPIRE CORPORATION PROPOSES TO MAKE NEW TYPES OF REFRACTORY MATERIALS FOR ELECTRODE COATINGS BY ION IMPLANTATION, WITH THE OBJECTIVE OF EXTENDING THE LIFETIME TO BETWEEN 10 AND 10 PULSES. TO OUR KNOWLEDGE, ION IMPLANTATION HAS NEVER BEEN TESTED FOR THIS APPLICATION. IT IS BELIEVED THAT TUNGSTEN ELECTRODES WITH THIN LAYERS OF WB OR WC, FORMED BY CASCADE ION IMPLANTATION, WILL HAVE IMPROVED WEAR CHARACTERISTICS. THE RATE OF ELECTRODE EROSION IS A NEAR SURFACE MATERIALS PROBLEM WITH REFRACTORY METALS SUCH AS TUNGSTEN OR TUNGSTEN-ALLOYS EXHIBITING THE GREATEST LIFETIMES. TUNGSTEN-BORIDE AND TUNGSTEN-CARBIDE HAVE HIGH MELTING POINTS AND ARE VERY HARD MATERIALS. THEY MAY BE MORE SUITABLE FOR THIS APPLICATION BUT CANNOT BE MACHINED TO

FISCAL YEAR 1984

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THE REQUIRED SHAPES, HENCE THE IMPLANTATION APPROACH TO FABRICATION. IN PHASE I WE WILL SHOW THE FEASIBILITY OF FORMING TUNGSTEN-BORON AND TUNGSTEN-CARBON ALLOYS BY ION IMPLANATION AND DETERMINE IF THESE SURFACE COATINGS MEASURABLY DECREASE THE RATE OF EROSION OF PURE TUNGSTEN ELECTRODES.

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| SPRINGBORN LAB<br>10 SPRINGBORN CEN<br>ENFIELD, CT 06082<br>DR BERNARD BAUM<br>TITLE:<br>PROTECTIVE COATINGS FOR UNDERWATER APPLICATIONS<br>TOPIC: 63            OFFICE: CERL-PP | ARMY | \$ 49,988 |
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THE GOAL OF THIS PROJECT IS THE DEVELOPMENT OF A NEW PAINT WHICH IS EASILY APPLIED TO UNDERWATER STRUCTURES, AND OFFERS LONG TERM CORROSION PROTECTION. THE PROPOSED PROGRAM OF PHASE I WILL WILL IDENTIFY POLYMERS WHICH WILL BE EVALUATED FOR APPLICATION AS AN UNDERWATER CORROSION PROTECTIVE COATING. THE POLYMERIC MATERIALS IDENTIFIED WILL INCLUDE SUCH TRADITIONAL UNDERWATER PROTECTIVE COATING MATERIALS AS EPOXY RESINS, AND NON-TRADITIONAL COATINGS APPLIED UNDERWATER SUCH AS PHENOXIES, POLYESTERS, AND NYLONS. THESE COATINGS WILL BE APPLIED TO STEEL SURFACES IMMERSSED IN BOTH FRESH AND SALT WATER TANKS. DURING AND AFTER APPLICATION, THE POLYMERIC MATERIALS WILL BE EVALUATED FOR THEIR KEY PROPERTIES NECESSARY FOR AN EASILY APPLIED PROTECTIVE COATING. THE BEST CANDIDATES WILL BE BLENDED WITH CORROSION INHIBITIVE PIGMENTS. THESE COATING BLENDS WILL BE RE-EVALUATED FOR THEIR EASE OF APPLICATION AND FOR LONG TERM CORROSION PROTECTIVE PROPERTIES. SAMPLES OF THE BEST COATING MATERIALS WILL BE PREPARED FOR CERL-PP INDEPENDENT EVALUATION.

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| SPRINGBORN LABORATORIES, INC.<br>10 SPRINGBORN CENTER<br>ENFIELD, CT 06082<br>ROY A. WHITE<br>TITLE:<br>DEVELOPMENT OF NOVEL NON-MOCA CURATIVE SYSTEMS FOR URETHANE ELASTOMERS<br>TOPIC: 74            OFFICE: NSWC | NAVY | \$ 49,860 |
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METHYLENE BIS O-CHLORO ANILINE HAS LONG BEEN RECOGNIZED AS A

FISCAL YEAR 1984

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SUPERIOR URETHANE CURATIVE BUT TOXICITY CONCERNS HAVE LIMITED ITS USE. ALTERNATIVE COMPOUNDS ARE AVAILABLE, BUT THEY CANNOT MATCH THE HANDLING AND ULTIMATE PHYSICAL PROPERTIES OF MOCA CURED ELASTOMERS.

AN INVESTIGATIONS OF NOVEL POLYAMINE AND POLYOL COMPOUNDS SHOULD YIELD NEW AND USEFUL URETHANE CURATIVES. THE PROGRAM WOULD INVOLVE SCREENING MODIFIED POLYAMINE AND POLYOL COMPOUNDS AS CURATIVES FOR TDI TERMINATED URETHANE PREPOLYMERS.

AMINE CURATIVES WILL BE MODIFIED BY TWO MEANS: CHEMICAL AND PHYSICAL METHODS. CHEMICAL MODIFICATIONS WILL BE MOLECULAR STRUCTURE CHANGES DESIGNED TO IMPROVE ULTIMATE PHYSICAL PROPERTIES, IMPROVE CURATIVE-PREPOLYMER COMPATIBILITY, LOWER THE CURATIVE MELTING POINT, OR MODIFY ITS REACTIVITY. PHYSICAL MODIFICATIONS WILL INVOLVE BLENDING CURATIVES TO ACHIEVE THE SAME OBJECTIVES.

POLYOL CURATIVES WILL BE EVALUATED UNMODIFIED, BUT IN COMBINATION WITH CATALYSTS AND/OR DIPHENYL METHANE DIISOCYANATE TO IMPROVE PHYSICAL PROPERTIES AND PROCESSING CHARACTERISTICS. CURATIVE SYSTEMS WILL BE EVALUATED BY DETERMINING POT LIFE, DEMOLD TIME, AND PHYSICAL PROPERTIES OF CURED ELASTOMERS. THE CURATIVES WILL BE COMPARED TO MOCA CONTROLS. THE GOAL OF THIS EFFORT IS TO DEMONSTRATE THAT NOVEL, NON-TOXIC CURATIVES CAN REPLACE MOCA, WHILE STILL PROVIDING MOCA'S DESIRABLE PROCESSING AND HANDLING PROPERTIES.

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| SPRINGBORN LABORATORIES, INC.<br>10 SPRINGBORN CENTER<br>ENFIELD, CT 06082<br>BERNARD BAUM, PH.D.<br>TITLE:<br>EVALUATION OF BARRIER MATERIALS TO STOP THE MIGRATION OF ORGANIC LIQUIDS, MOISTURE AND CORROSIVE CHEMICALS IN SOLID ROCKET MOTORS<br>TOPIC: 201            OFFICE: AF/TSTR | AF | \$ 41,485 |
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THE PRESENT ROCKET MOTOR LINER SYSTEMS, USUALLY MADE FROM THE SAME POLYMERIC MATERIALS, USED AS THE BINDER IN THE SOLID PROPELLANTS ARE PERMEABLE TO MOISTURE VAPOR AND TO THE RESIDUAL ORGANIC LIQUIDS AND CORROSIVE CHEMICAL FROM THE SOLID PROPELLANT. THE PROPOSED PROGRAM WILL TRY TO DECREASE THIS PERMEABILITY BY INVESTIGATING COMPOSITES OF KNOWN BARRIER FILM BETWEEN THE LINER MATERIALS. WE ALSO INTEND TO EXAMINE THE FEASIBILITY OF INNOVATIVE BARRIER COATINGS AS IS, AND

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>----- | AWARDED<br>AMOUNT<br>----- |
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WITH THE ADDITION OF BARRIER FILLERS. IN A STEPWISE SCREENING AND EVALUATION, CANDIDATES COATINGS AND COMPOSITES WILL FIRST BE TESTED FOR PARMABILITY TO THE ORGANIC LIQUIDS IN QUESTION, AS WELL AS THE MOISTURE VAPOR TRANSMISSION. THE MOST PROMISING MATERIALS WILL THEN UNDERGO BONDING TESTS TO THE VARIOUS SUBSTRATE THEY COME IN CONTACT WITH. IN THE CASE OF FILMS, SEALING AND INSTALLING TECHNIQUES WILL ALSO BE INVESTIGATED. THE BEST SYSTEMS AS DETERMINED BY OUR STUDIES WILL BE SUBMITTED TO THE AIR FORCE FOR INDEPENDENT EVALUATION.

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| STANFORD TELECOMMUNICATIONS, INC.<br>6888 ELM STREET<br>MCLEAN, VA 22101<br>BRYANT ELROD | NAVY | \$ 49,542 |
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TITLE:  
 APPLICATION OF DIFFERENTIAL GPS TO EXPEDITIONARY AIR FIELD NAVIGATION AND SURVEILLANCE REQUIREMENTS  
 TOPIC: 23 OFFICE: NESC

A DIFFERENTIAL GPS GROUND STATION ASSOCIATED WITH A DATA LINK IS PROPOSED AS A POTENTIAL SOURCE OF INSTRUMENT METEOROLOGICAL CONDITIONS NAVIGATION DATA FOR AIRCRAFT AND AS A SOURCE OF DEPENDENT SURVEILLANCE DATA IN SUPPORT OF ATC OPERATIONS AT EXPEDITIONARY AIR FIELDS SERVED BY MATCAL. OBTAINABLE AIRBORNE POSITIONAL ACCURACIES IN A SELECTED AVAILABILITY DEGRADATION OF GPS C/S SIGNAL ACCURACY ENVIRONMENT ARE DETERMINED IN RELATION TO MILITARY STANDARD GPS AIRBORNE RECEIVERS. GROUND DIFFERENTIAL GPS STATION RECEIVER, PROCESSOR, CLOCK AND ANTENNA REQUIREMENTS ARE ASSESSED AND GROUND SYSTEM COST IS ESTIMATED. AVAILABLE DATA LINK ALTERNATIVES, I.E., JTIDS AND TADIL-C ARE EVALUATED FOR SUITABILITY TO THE CONCEPT. ADDITIONALLY, THE MERIT OF USING THE JTIDS RELNAV CAPABILITY IN LIEU OF THE PROPOSED DIFFERENTIAL GPS FUNCTION IS EVALUATED.

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| STAR MICROWAVE<br>25701 MT BACHE RD<br>LOS GATOS, CA 95030<br>ROBERT J. ESPINOSA | NAVY | \$ 47,781 |
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TITLE:  
 TECHNOLOGY FOR LOW COST TRAVELING WAVE TUBES FOR EXPENDABLE MICROWAVE COUNTERMEASURES  
 TOPIC: 15 OFFICE: NESC

EXPENDABLE MICROWAVE COUNTERMEASURES (XMCM) SYSTEMS WILL BE REQUIRED

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>---- | AWARDED<br>AMOUNT<br>----- |
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TO PROTECT SHIPS AND OTHER HIGH VALUE EQUIPMENTS AND INSTALLATIONS FROM ACTIVE MISSILES AND ANTI-RADIATION MISSILES (ARM). TRAVELING WAVE TUBES ARE USED AS THE MICROWAVE POWER AMPLIFIER AND ARE THE CRITICAL COMPONENT WHICH DETERMINES SYSTEM OUTPUT POWER, PRIME POWER AND COOLING REQUIREMENTS. SINCE THE MICROWAVE EXPENDABLES WILL BE REQUIRED IN LARGE NUMBERS THE SYSTEM, AND THE TWT IN PARTICULAR, HAVE TO BE PRODUCED AT LOW COST. THE PEAK OUTPUT POWER, BANDWIDTH AND MANY OF THE OTHER PERFORMANCE REQUIREMENTS FOR EXPENDABLE TWTs ARE APPROXIMATELY THE SAME AS THOSE FOR TUBES USED IN SELF PROTECTION ECM SYSTEMS WHICH ARE CURRENTLY PRICED FROM \$10,000 TO \$25,000. THE PROPOSED WORK WILL IDENTIFY THE TECHNOLOGY NEEDED TO ENABLE THE DESIGN AND PRODUCTION OF EXPENDABLE TWTs AT A SMALL FRACTION OF THEIR PRESENT COST. THE TECHNOLOGY SURVEY WILL BE SUMMARIZED IN A MATRIX FORMAT WHICH WILL ALLOW READY COMPARISON OF THE PHASE 2 TWT WITH THE CURRENT BASELINE AND TO DETERMINE DEVELOPMENT RISK AND BENEFIT OF TWTs FOR FUTURE SYSTEM REQUIREMENTS.

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| STERIDOC CORPORATION<br>6800 JERICHO TURNPIKE<br>SYOSSET, NY 11791<br>MICHAEL E. CROSLIN<br>TITLE:<br>IN-FLIGHT BLOOD PRESSURE MONITOR<br>TOPIC: 94            OFFICE: SGRD-RMA | ARMY | \$ 50,000 |
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ARTERIAL BLOOD PRESSURE CANNOT BE MEASURED WITH PRECISION BY MEANS OF SPHYGMOMANOMETERS. THE METHOD IS ATTENDED BY INACCURACIES CAUSED BY VARIATIONS IN HEART RHYTHM, THE PRESENCE OF NORMAL RESPIRATION, AND RESISTANCE OF THE TISSUES OF THE PART. (1) THIS PRELIMINARY DESIGN SPECIFICATION DESCRIBES A CONCEPT FOR THE DESIGN AND FABRICATION OF A SEMI-AUTOMATIC BLOOD PRESSURE DEVICE. THIS DEVICE TRANSLATES BRACHIAL ARTERIAL FLUID MOTION THROUGH A FLUIDIC DETECTOR, WHICH WILL DETERMINE SYSTOLIC, DIASTOLIC PRESSURES. ADDITIONALLY, THIS DEVICE IS INTENDED FOR USE IN EMERGENCY SITUATIONS, I.E. EMERGENCY EQUIPMENT, ARMY FIELD USE, AIR EVACUATION EQUIPMENT AND COMBAT CONDITIONS.

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| SULLIVAN MINING CORPORATION<br>P.O. BOX 4615<br>SAN DIEGO, CA 92104<br>THOMAS MILTON SULLIVAN<br>TITLE:<br>R & D OF A MICROWAVE BASED CBW AGENT DECONTAMINATION SYSTEM USING LOW TOXICITY CHEMICALS<br>TOPIC: 246            OFFICE: BMO/PMX | AF | \$ 35,000 |
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CHEMICAL/BIOLOGICAL CONTAMINATION OF A DEEP BASE PRESENTS A

FISCAL YEAR 1984

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| SUNOL SCIENCES CORPORATION<br>11887 DUBLIN BLVD. SUITE B-135<br>DUBLIN, CA 94568<br>G. D. GUTHRIE<br>TITLE:<br>DEFINITION OF LOW IMPULSE DECOY COATINGS<br>TOPIC: 255            OFFICE: BMO/PMX | AF           | \$ 56,224                  |

THE PHASE I PROGRAM WILL IDENTIFY REENTRY VEHICLE (RV) DECOY COATING CONCEPTS THAT REPLICATE THE METRIC BEHAVIOR OF THE RV COATING CONCEPTS WILL BE DEvised TO MINIMIZE THE IMPULSE LOAD GENERATION IN A NUCLEAR X-RAY ENCOUNTER. MATERIALS WILL BE SELECTED ON THE BASIS OF THEIR POTENTIAL FOR MEETING NON-NUCLEAR PERFORMANCE REQUIREMENTS. IMPULSE WILL BE MINIMIZED THROUGH THE SELECTION OF MATERIALS, OR COMBINATIONS OF MATERIALS, AND BY THE UNIQUE USE OF COATING GEOMETRY. ANALYTICAL EXPRESSION WILL BE DERIVED TO APPROXIMATE MULTI-DIMENSIONAL BLOW-OFF EFFECTS. THE TECHNICAL APPROACH FOR VERIFYING THE RESULTS WILL BE RECOMMENDED FOR A PHASE II PROGRAM.

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| SUNOL SCIENCES CORPORATION<br>11887 DUBLIN BLVD., SUITE B-135<br>DUBLIN, CA 94568<br>DR. MICHAEL O. SCHICK<br>TITLE:<br>ASSESSMENT OF U.S. ICBM VULNERABILITY TO DIRECTED ENERGY WEAPONS<br>TOPIC: 282            OFFICE: BMO/PMX | AF | \$ 48,565 |
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DIRECTED ENERGY WEAPONS POSE A POTENTIAL NEAR-TERM (1985-1990) THREAT TO U. S. ICBM SYSTEMS. A VULNERABILITY ASSESSMENT OF THREE U. S. ICBM SYSTEMS IS PROPOSED. MAJOR EMPHASIS IS PLACED ON THE PEACEKEEPER, WITH LESSER WEIGHT GIVEN TO THE SMALL ICBM AND MINUTEMAN III SYSTEMS. THE PROPOSED METHODOLOGY WOULD INCLUDE RATING OF VULNERABLE COMPONENTS, FIRST-ORDER CALCULATIONS OF VULNERABILITY THREAT LEVELS, ASSESSMENT OF COMPONENT-DEGRADATION ON MISSION IMPACT, AND CONSIDERATION OF FIRST-ORDER DESIGN/HARDNESS TRADES TO REDUCE COMPONENT VULNERABILITY. THE BASELINE DIRECTED ENERGY THREAT CONSIDERED IS A CONTINUOUS-WAVE, HF/DF CHEMICAL LASER, BUT CONSIDERATION WILL ALSO BE GIVEN TO REPETITIVELY PULSED DEVICES AS WELL AS

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>---- | AWARDED<br>AMOUNT<br>----- |
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SIGNIFICANT, POSSIBLY SYSTEMS NEGATING, NON-NUCLEAR THREAT. MICROWAVE INDUCED IONIZATION OF CHEMICAL WARFARE AGENTS WILL ENABLE THE USE OF NON-TOXIC DECONTAMINATING AGENTS. MICROWAVE IONIZATION IS RELATED TO IR SPECTROPHOTOMETRY, A TECHNOLOGY WIDELY USED IN INDUSTRY. IF MICROWAVES ARE PROVEN TO CAUSE THE TRANSITION OF ELECTRONS IN ORGANOPHOSPHOROUS COMPOUNDS, CHEMICAL WARFARE AGENTS CAN BE IONIZED TO INCREASE THE AFFINITIES OF THESE COMPOUNDS FOR MILD DECONTAMINANTS COMPATIBLE WITH STATE OF THE ART ELECTRONICS. IONIZED CHEMICAL WARFARE AGENTS WILL REACT RAPIDLY AND COMPLETELY. LARGE VOLUMES OF CONTAMINATED AIR ENTERING A DEEP BASE THROUGH THE VENTILATING SYSTEM CAN BE PURIFIED WITH MICROWAVES AND MILD DECONTAMINANTS. PURIFIED AIR CAN BE USED TO PRESSURIZE INTERIOR MANNED SPACES IN ORDER TO CONTINUOUSLY FLUSH OUT CONTAMINANTS SEEPING INTO THE BASE THROUGH MINUTE OPENINGS. NEW DECONTAMINANTS AND THE TIMELINESS OF THEIR DEVELOPMENT, HOWEVER, ARE UNCERTAIN. MICROWAVE IONIZATION WILL IMPROVE RESPIRABLE AIR DECONTAMINATION PROCESSES AT MINIMAL COST WITH LITTLE RISK OF IMPLEMENTATION.

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| SUMX CORPORATION                                      | AF              | \$ 49,918 |
| P.O. BOX 14864, 2211 DENTON DRIVE                     |                 |           |
| AUSTIN, TX 78761                                      |                 |           |
| DAVID W. DEBERRY, PH.D.                               |                 |           |
| TITLE:  |                 |           |
| LOW TOXICITY CHEMICAL/BIOLOGICAL AGENT DECONTAMINANTS |                 |           |
| TOPIC: 246  | OFFICE: BMO/PMX |           |

THIS PROPOSAL DESCRIBES A RESEARCH PROGRAM FOR DETERMINING THE FEASIBILITY OF AN INNOVATIVE METHOD FOR REMOVING CW AGENTS FROM CONTAMINATED SURFACES. THE PROPOSED TECHNIQUE IS EXPECTED TO BE APPLICABLE TO A WIDE VARIETY OF CHEMICAL COMPOUNDS AND MAY ALSO DESTROY BIOLOGICAL AGENTS. THE METHOD IS BASED ON THE PHOTO-CHEMICAL GENERATION OF VERY SHORT REACTIVE, SHORT-LIVED OXIDIZING RADICALS FROM CERTAIN PRIMARY OXIDANTS. EVIDENCE IS PRESENTED FOR THE EFFECTIVENESS OF THIS CONCEPT WHEN APPLIED TO DESTRUCTION OF LOW CONCENTRATIONS OF ORGANICS COMPOUNDS IN BULK SOLUTION. THE PROPOSED STUDY WOULD DETERMINE THE APPLICABILITY TO TREATMENT OF CONTAMINATED SURFACES, PROVIDE INSIGHT INTO THE MOST EFFECTIVE DELIVERY MECHANISM, AND START TO EXPLORE OPTIMIZATION OF SYSTEM CHEMISTRY, WHICH IS OFTEN QUITE COMPLEX.

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>----- | AWARDED<br>AMOUNT<br>----- |
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LASERS OPERATING AT SHORTER WAVELENGTHS. THE PROPOSED PHASE I EFFORT WILL RESULT IN A SYSTEM-SPECIFIC, FIRST-ORDER ASSESSMENT OF THE LASER VULNERABILITY OF PEACEKEEPER. IN ADDITION, GUIDANCE WILL BE PROVIDED FOR A PHASE II EFFORT IN TERMS OF IDENTIFYING DATA GAPS AND UNCERTAINTIES IN COMPONENT VULNERABILITY, AND POINTING TO FURTHER INVESTIGATIONS IN THE AREA OF HARDENING REQUIREMENTS.

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| SUSQUEHANNA RESOURCES AND ENVIRONMENT | AF | \$ 56,267 |
| 305 MAIN STREET, SUITE 104            |    |           |
| JOHNSON CITY, NY 13790                |    |           |
| TIMOTHY D. MASTERS                    |    |           |

TITLE:  
ARTIFICIAL INTELLIGENCE (AI) FOR IMAGE EXPLOITATION: DEMONSTRATION OF WHAT HAVE BEEN ACCOMPLISHED, IDENTIFICATION OF PROBLEMS AREAS,  
TOPIC: 241 OFFICE: DORM

WHILE THE POWER OF ARTIFICIAL INTELLIGENCE HAS BEEN ESTABLISHED, IT IS ESSENTIALLY UNTAPPED REGARDING IMAGE EXPLOITATION. OUR PROJECT IS INTENDED TO ADDRESS THIS PRESSING PROBLEM; ITS SIGNIFICANCE CAN BE EVIDENCED FROM TWO CRITERIA: (1) INNOVATIVENESS: OUR METHODS DEPART SIGNIFICANTLY UPON THE CONVENTIONAL IMAGE PROCESSING TECHNIQUES, AND (2) DIRECT CONTRIBUTION TO RADC: THE RESULTS WILL IMPROVE SIGNIFICANTLY THE EXISTING CAPABILITY. TO PROVE THESE TWO POINTS, WE WILL ACCOMPLISH FOUR TASKS:

- (1) TO DEMONSTRATE THAT OUR AI APPROACHES ARE MUCH BETTER THAN THE EXISTING METHODOLOGIES FROM BOTH THEORETICAL AND EXPERIMENTAL CONSIDERATIONS;
- (2) TO IDENTIFY VERY DIFFICULT FEATURE CAPTURING PROBLEMS THAT HAVE TO BE OVERCOME BEFORE CONSIDERING RULE-BASED FEATURE IDENTIFICATION EFFORT;
- (3) TO DEMONSTRATE A COMBINED RADC/SR & E IMAGE EXPLOITATION CAPABILITY AND THUS PROVE THAT A NEARLY OPERATIONAL AI SYSTEM IS ALREADY AVAILABLE; AND
- (4) TO DEVELOP A STRATEGIC PLAN FOR DEVELOPING ADVANCED PROCESSORS FOR SOLVING VERY DIFFICULT PROBLEMS USING THE CONCEPT OF IMAGE HIERARCHY.

THESE WILL BE ACCOMPLISHED BY USING A "FOOTBALL GAME MODEL:" FEATURE EXTRACTION IS ACHIEVED BY SUCCESSIVE FEATURE CAPTURING (EVERY 10 YARDS) UNTIL IDENTIFICATION IS DONE (A TOUCHDOWN); AI PROCESSORS ARE USED TO ACHIEVE AND ASSIST THAT PROCESS, FOR LATTER AS A GUIDANCE SYSTEM.

FISCAL YEAR 1984

| SUBMITTED BY<br>-----  | DEPT<br>---- | AWARDED<br>AMOUNT<br>----- |
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| SYSTEM PLANNING CORP<br>1500 WILSON BLVD<br>ARLINGTON, VA 22209<br>R BARRY THOMAS<br>TITLE:<br>DEVELOP AN ASD LONG-RANGE RESOURCE PLANNING SYSTEM SPC PROPOSAL<br>201-412<br>TOPIC:        21            OFFICE: ASD/XRZ | AF           | \$ 69,438                  |

SPC PROPOSES TO MODIFY ITS COMPUTER-AUTOMATED LONG-RANGE RESOURCE PLANNING SYSTEM (LRRPS) TO VISUALLY DEMONSTRATE FOR THE AIR FORCE THE RELATIONSHIP BETWEEN R&D PROGRAMS IN THE EMERGING, GROWTH, AND MATURE SYSTEMS CATEGORIES; COLLECT A VALID FUNDING DATA BASE; AND PREPARE A DRAFT FUNDING STRATEGY TO BETTER ALLOCATE R&D DOLLARS TO MEET AIR FORCE LONG-RANGE OBJECTIVES. THE PHASE I RESEARCH EFFORT WILL PROVIDE INITIAL ANSWERS TO THE SBIR PROBLEM STATEMENT AND WILL DEMONSTRATE THE USEFULNESS OF USING LRRPS FOR BOTH LONG-RANGE PLANNING AND IN DEVELOPING ANSWERS TO "WHAT IF" QUESTIONS.

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| SYSTEM PLANNING CORP<br>1500 WILSON BLVD<br>ARLINGTON, VA 22209<br>WILLIAM H. THOMS<br>TITLE:<br>SURVIVABLE C3 APPROACHES FOR SPACE SYSTEMS (u) SPC PROPOSAL 197-412<br>TOPIC:        197            OFFICE: AFSTC | AF | \$ 56,501 |
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DEVELOPMENT OF INNOVATIVE APPROACHES TO ENHANCING THE GROUND C3 SEGMENT SURVIVABILITY OF SPACE SYSTEMS REQUIRES A METHOD FOR MODELING THE SURVIVABILITY OF THE GROUND SEGMENTS OF SUCH SYSTEMS IN ORDER TO ALLOW COMPARATIVE EVALUATION OF APPROACHES AND SELECTION OF THE MOST EFFECTIVE ONE FOR DEVELOPMENT. SPC HAS DEVELOPED A COMPUTER MODEL OF THE PHYSICAL SURVIVABILITY OF SUCH SYSTEMS. GIVEN RELEVANT INFORMATION OF THE CONCEPT OF OPERATION, THE PHYSICALLY OBSERVABLE CHARACTERISTICS OF THE GROUND SEGMENTS, AND THE CAPABILITIES OF SOVIET THREAT INTELLIGENCE AND WEAPONS SYSTEMS, THE MODEL SIMULATES THE INTERACTION OF THE GROUND SEGMENTS AND THE THREAT DURING A PROTRACTED NUCLEAR WAR. OUTPUTS INCLUDE THE EXPECTED LIFE-

FISCAL YEAR 1984

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TIME OF THE SYSTEM, ATTRITION RATE OF THE GROUND UNITS, TIME SPENT UNDER SURVEILLANCE, USEFUL OPERATING TIME, AND SEVERAL OTHER MEASURES OF EFFECTIVENESS.

THE MODEL APPLIES GENERICALLY TO ANY SYSTEM OF LAND MOBILE UNITS AND FIXED FACILITIES (e.g., LOGISTICS SUPPORT FACILITIES). UNDER PHASE I, SPC WOULD (1) ADAPT THE CURRENT MODEL TO ALSO SIMULATE SEA-AND AIR-BASED APPROACHES TO PROVIDING THE GROUND C3 SEGMENTS OF SPACE SYSTEMS, (2) PERFORM A PARAMETRIC EVALUATION OF THREE ALTERNATIVE APPROACHES (LAND, SEA, AND AIR BASING), AND (3) IDENTIFY THOSE ASPECTS THAT ARE WORTHY OF DETAILED, SYSTEM SPECIFIC ANALYSIS. THESE ANALYSES WILL BE UNDERTAKEN AS A PART OF PHASE II.

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| SYSTEM PLANNING CORP<br>1500 WILSON BOULEVARD<br>ARLINGTON, VA 22209<br>FREMONT E REICHWEIN<br>TITLE:<br>ASSESSMENT OF CONTRACTOR PERFORMANCE<br>TOPIC: 41 OFFICE: NAVSUPSYSCOM | NAVY | \$ 47,141 |
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THE PURPOSE OF THE PROPOSED PROJECT IS TO DETERMINE NEW TECHNIQUES TO IMPROVE THE CAPABILITIES OF THE GOVERNMENT TO ASSESS THE PERFORMANCE OF DOD CONTRACTORS. THE PROPOSAL DISCUSSES CURRENT INADEQUACIES IN THE MEANS OF ASSESSMENT AVAILABLE. TECHNICAL OBJECTIVES ENVISIONED ARE (1) DEVELOPMENT OF A DATA BASE OF CANDIDATE ASSESSMENT PARAMETERS, (2) EVALUATION OF EACH OF THE PARAMETERS FOR USE AS DECISION FACTORS, AND (3) DEVELOPMENT OF RECOMMENDATIONS AS TO HOW THE GOVERNMENT MAY IMPLEMENT A MONITORING SCHEME TO COLLECT THE PARAMETRIC DATA ON INDIVIDUAL CONTRACTORS. SOURCES OF DATA WILL INCLUDE INTERVIEW OF KNOWLEDGEABLE PERSONS WITH AN OFFICIAL INTEREST IN THE SUBJECT AND A REVIEW OF RESEARCH/ANALYTIC EFFORTS TO DATE. A MEANS FOR EVALUATING THE MERIT OF CANDIDATE PARAMETERS IS PRESENTED. RECOMMENDATIONS WILL CONSIDER THE FEASIBILITY OF IMPLEMENTATION AS A PARAMOUNT CONCERN. A SIGNIFICANT PART OF THE RECOMMENDATIONS WILL BE TO ESTABLISH A POINT OF DEPARTURE FOR AND STRUCTURE OF A PHASE II EFFORT TO INCLUDE MODELING OF THE ASSESSMENT TECHNIQUES DEVELOPED.

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| SYSTEM PLANNING CORPORATION<br>1500 WILSON BOULEVARD<br>ARLINGTON, VA 22209<br>DR. TERENCE THOMPSON<br>TITLE:<br>CONSENSUS THEORY AND EXPERT SYSTEMS<br>TOPIC: 67 OFFICE: ETL-PRO | ARMY | \$ 49,885 |
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THERE ARE FIVE MAJOR THEORIES\* OF RELEVANCE TO DEVELOPMENT OF A

FISCAL YEAR 1984

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"CONSENSUS THEORY" FOR HANDLING EVIDENCE IN EXPERT SYSTEMS. SINCE THEY HAVE EVOLVED FROM VERY DIFFERENT FIELDS, THEY DO NOT HAVE IDENTICAL ASSUMPTIONS NOR DO THEY SHARE A COMMON NOTATION, TERMINOLOGY, OR SEMANTICS. THE PROPOSED EFFORT SEEKS TO ELUCIDATE THE PRACTICAL IMPACT OF THESE THEORETICAL APPROACHES FOR BUILDERS OF EXPERT SYSTEMS IN THE MILITARY DOMAIN AND TO LAY THE GROUNDWORK REQUIRED FOR FORMULATION OF A "CONSENSUS THEORY" BASED ON CURRENT THEORIES AND METHODS. TO THIS END, THE PHASE I EFFORT HAS THREE MAJOR TECHNICAL OBJECTIVES. FIRST, IT WILL DEVELOP A COHERENT AND SYSTEMATIC DESCRIPTION OF EACH THEORY USING A SINGLE, CONSISTENT NOTATION ACROSS ALL FIVE. SECOND, IT WILL FORMULATE A SET OF ILLUSTRATIVE PROBLEMS, SOLVE THEM USING THEORY IN TURN, AND COMPARE THE RESULTS. THIRD, IT WILL ASSESS THE IMPACT OF THESE RESULTS AND IDENTIFY THE MOST IMPORTANT RESEARCH TOPICS FOR THE PHASE II PROJECT.

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| SYSTEMS FOR AUTOMATIC TEST<br>420 PERSIAN DRIVE<br>SUNNYVALE, CA 94089<br>RICHARD IRWIN<br>TITLE:<br>A TECHNICAL FEASIBILITY STUDY APPLICABLE TO GENERAL PURPOSE AUTO-<br>MATIC PULSE MEASUREMENT<br>TOPIC: 244 | AF | \$ 51,832 |
| OFFICE: DORM  |    |           |

PRECISE CHARACTERIZATION OF THE PULSED RF SIGNAL RESPONSE OF A MODULE IS OFTEN NECESSARY TO ENSURE ITS PERFORMANCE IN A SYSTEM. SOME SYSTEMS REQUIRE THAT MANY MODULES OF A TYPE BE ACCURATELY CHARACTERIZED IN GAIN AND PHASE RESPONSE OVER A RANGE OF FREQUENCY AND SIGNAL LEVELS. A APPROACH TO ACCURATELY MEASURING THESE PARAMETERS USING CURRENTLY AVAILABLE INSTRUMENTS UNDER COMPUTER CONTROL IS DESCRIBED. A TECHNICAL FEASIBILITY STUDY IS PROPOSED THAT WILL LEAD TO DEFINITIVE SYSTEM REQUIREMENTS AND SPECIFICATIONS FOR AN AUTOMATIC PULSE MEASUREMENT SYSTEM (APMS). THE PERFORMANCE CHARACTERISTICS OF SELECTED COMMERCIALY AVAILABLE INSTRUMENTATION PRODUCTS ARE USED TO HELP ENSURE THE TECHNICAL FEASIBILITY OF THE PROPOSED SYSTEM WITHIN CURRENT STATE-OF-THE-ART LIMITATIONS.

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| SYSTEMS PLANNING CORPORATION<br>1500 WILSON BLVD<br>ARLINGTON, VA 22209<br>FREMONT E. REICHWEIN<br>TITLE:<br>ASSESSMENT OF CONTRACTOR PERFORMANCE<br>TOPIC: 41 | NAVY | \$ 47,141 |
| OFFICE: NAVSUPSYS  |      |           |

THE PURPOSE OF THE PROPOSED PROJECT IS TO DETERMINE NEW TECHNIQUES

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>---- | AWARDED<br>AMOUNT<br>----- |
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TO IMPROVE THE CAPABILITIES OF THE GOVERNMENT TO ASSESS THE PERFORMANCE OF DOD CONTRACTORS. THE PROPOSAL DISCUSSES CURRENT INADEQUACIES IN THE MEANS OF ASSESSMENT AVAILABLE. TECHNICAL OBJECTIVES ENVISIONED ARE (1) DEVELOPMENT OF A DATA BASE OF CANDIDATE ASSESSMENT PARAMETERS, (2) EVALUATION OF EACH OF THE PARAMETERS FOR USE AS DECISION FACTORS, AND (3) DEVELOPMENT OF RECOMMENDATIONS AS TO HOW THE GOVERNMENT MAY IMPLEMENT A MONITORING SCHEME TO COLLECT THE PARAMETRIC DATA ON INDIVIDUAL CONTRACTORS. SOURCES OF DATA WILL INCLUDE INTERVIEW OF KNOWLEDGEABLE PERSONS WITH AN OFFICIAL INTEREST IN THE SUBJECT AND A REVIEW OF RESEARCH/ANALYTIC EFFORTS TO DATE. A MEANS FOR EVALUATING THE MERIT OF CANDIDATE PARAMETERS IS PRESENTED. RECOMMENDATIONS WILL CONSIDER THE FEASIBILITY OF IMPLEMENTATION AS A PARAMOUNT CONCERN. A SIGNIFICANT PART OF THE RECOMMENDATIONS WILL BE TO ESTABLISH A POINT OF DEPARTURE FOR AND STRUCTURE OF A PHASE II EFFORT TO INCLUDE MODELING OF THE ASSESSMENT TECHNIQUES DEVELOPED.

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| SYSTEX INC.<br>5020 SUNNYSIDE AVE, SUITE 102<br>BELTSVILLE, MD 20705<br>LORENZO F. EXPOSITO<br>TITLE:<br>COMPUTER GRAPHICS CONTROL SYSTEM<br>TOPIC: 105            OFFICE: SGRD-RMA | ARMY | \$ 50,000 |
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COMPUTER SOFTWARE PROGRAMS ARE DEVELOPED FOR CONTROLLING THE DISPLAY FUNCTION OF A COLOR TACHISTOSCOPE TO BE USED ON VISUAL PSYCHOPHYSICS AND VISUAL PHYSIOLOGY RESEARCH. THE SYSTEM IS CONTROLLED BY A PDP-11 MINICOMPUTER INTERFACED TO A GENISCO 3000 DISPLAY SYSTEM. THE SYSTEM ALLOWS THE INDEPENDENT VARIATIONS OF FORM, COLORS AND MOVEMENT.

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| SYSTRAN CORP<br>S4126 LINDEN AVENUE<br>DAYTON, OH 45432<br>JACK SCHIRA<br>TITLE:<br>PROPOSAL TO BASELINE ARTIFICIAL INTELLIGENCE ASSISTANCE FOR AIRCREWS FOR THE YEAR 2000<br>TOPIC: 22            OFFICE: ASD/XRZ | AF | \$ 53,799 |
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AIRCREWS ARE BEING INCREASINGLY SATURATED IN NEWER AIRCRAFT BY

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>----- | AWARDED<br>AMOUNT<br>----- |
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COGNITIVE WORKLOAD. THEY ARE SUBJECTED TO OVERWHELMING VOLUME AND RATE OF DATA ASSOCIATED WITH THEIR IMPROVING WEAPON SYSTEMS AND EXPANDING THREAT ENVIRONMENT. IMPROVED DISPLAYS AND CONTROLS ARE NO LONGER ADEQUATE TO PERMIT AIRCREWS TO ADEQUATELY CONTEND WITH THEIR NEED TO ABSORB THE AVAILABLE DATA AND MAKE PROPER DECISIONS. ARTIFICIAL INTELLIGENCE TECHNOLOGY IS RAPIDLY SHOWING PROMISE OF PROVIDING A SOLUTION. ARTIFICIAL INTELLIGENCE INCLUDES A NUMBER OF EMERGING TECHNOLOGIES. THEIR GENERAL APPLICABILITY TO THE AIRCREW ENVIRONMENT IS NOT DEMONSTRATED. THIS PROJECT WILL DEVELOP AN EVALUATION WHERE ARTIFICIAL INTELLIGENCE CAN REASONABLY BE APPLIED AND RECOMMEND INITIATIVES AND ACTIVITIES TO DEVELOP THE POTENTIAL OF ARTIFICIAL INTELLIGENCE.

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| TAI CORPORATION<br>12010 SOUTH MEMORIAL PKWY<br>HUNTSVILLE, AL 35803<br>LAWRENCE M. PERRY<br>TITLE:<br>A HOLOGRAPHIC OPTICAL SYSTEM WHICH EXHIBITS THE FUNDAMENTAL<br>PROPERTIES OF ARTIFICIAL INTELLIGENCE<br>TOPIC: 10 OFFICE: DRSEL-PDD-PI | ARMY | \$ 49,832 |
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DR. KARL PRIBRAM OF STANFORD UNIVERSITY HAS HYPOTHESIZED A HOLOGRAPHIC MECHANISM FOR THE STORAGE OF MEMORIES IN THE MAMALIAN BRAIN. OPTICAL HOLOGRAPHIC SYSTEMS HAVE EXHIBITED THE ABILITY TO ASSOCIATE COMPLEX PATTERNS, TO CORRELATE COMPLEX PATTERNS, AND, THUS, TO RECOGNIZE AND TRACK COMPLEX VISUAL OBJECTS. THE QUESTION TO BE ANSWERED BY THIS PROPOSED BASIC RESEARCH IS THE FOLLOWING: CAN AN OPTICAL HOLOGRAPHIC SYSTEM EXHIBIT FUNDAMENTAL PRIMITIVES WHICH ARE NECESSARY FOR HIGHER LEVEL COGNITION? THIS PROPOSAL OUTLINES THE POSSIBILITY OF JUST SUCH A DEMONSTRATION. SINCE THIS RESEARCH DEALS WITH FUNDAMENTAL PRINCIPLES OF COGNITION, IT COULD HAVE FAR-REACHING IMPLICATIONS FOR THE FIELDS OF ARTIFICIAL INTELLIGENCE, COGNITIVE PSYCHOLOGY, AND EVEN NEUROPHYSIOLOGY.

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| TECHNOLOGY DEVELOPMENT OF CALIF, INC.<br>624 SIX FLAGS DRIVE, SUITE 130<br>ARLINGTON, TX 76011<br>MR. JOHN L. WENTZ<br>TITLE:<br>INVESTIGATION OF KNOWLEDGE ENGINEERING APPLICATION TO SQAM<br>REQUIREMENTS ANALYSIS MEASURES<br>TOPIC: 3 OFFICE: DRSMC-RAM(D) | ARMY | \$ 65,608 |
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THE GENERATION OF REQUIREMENT ANALYSIS MEASURES CAN BE ACCOMPLISHED

FISCAL YEAR 1984

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BY THE "EXPERT SYSTEM" APPROACH. IF A COMPUTER PROGRAM IS DEVELOPED WHERE THE INPUTS OF AN EXPERIENCED EVALUATION ENGINEER CAN BE STORED A SET OF LOGICAL QUESTIONS DEFINED AND A METHOD FOR ITS PROGRESSION (INFERENCE ENGINE) THEN A POWERFUL STANDARDIZED SOFTWARE QUALITY TOOL WILL BE AVAILABLE. THE NATURAL APPLICATION OF A PRACTICAL AI SYSTEMS WILL RESULT IN THE LOGICAL DEVELOPMENT OF REQUIREMENTS ANALYSIS MEASURES.

THIS STUDY DEMONSTRATES THAT A PRACTICAL "EXPERT SYSTEM" CAN BE APPLIED TO THE SOLUTION OF THE REQUIREMENTS ANALYSIS PROBLEM. A SOFTWARE QUALITY ASSESSMENT AND MEASUREMENT (SQAM) KNOWLEDGE BASE SYSTEM WILL BE DEFINED WHICH WITH "EXPERT" GUIDANCE CAN BE EXPANDED TO PROVIDE A RELATIONAL SET OF REQUIREMENTS. USING A COMMERICALLY AVAILABLE SOFTWARE SYSTEM A DEMONSTRATION KNOWLEDGE BASE WILL BE IMPLEMENTED. THE INFERENCE RULES NECESSARY FOR A REQUIREMENTS ASSESSMENT WILL BE DEVELOPED. A KNOWLEDGE ACQUISITION SYSTEM WILL BE EVALUATED IN ORDER TO PROVIDE THE CAPABILITY TO UPDATE THE KNOWLEDGE BASE.

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| TECHNOLOGY SERVICE CORPORATION<br>2950 31ST STREET<br>SANTA MONICA, CA 90405<br>N. J. WILLIS<br>TITLE:<br>DISTRIBUTED SENSOR SYSTEMS FOR BATTLE GROUP DEFENSE<br>TOPIC:     07           OFFICE: DARPA | DARPA | \$ 50,751 |
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SEA SKIMMING, ANTI-SHIP CRUISE MISSILES POSE AN INCREASING THREAT TO NAVAL FORCES, AS EVIDENCED BY THE FALKLAND WAR CASUALTIES. TSC PROPOSES A NEW CONCEPT FOR OTH DETECTION, WARNING AND TRACKING: A NET OF EXPENDABLE HF (HIGH FREQUENCY: 3-30 MHZ) RADARS OPERATING IN THE GROUND WAVE MODE, INSTALLED IN EITHER SONOBUOY-SIZED BUOYS OR IN SMALL RPV'S, AND LOCATED 30 TO 70 NMI FROM THE TASK FORCE. THE HF SYSTEM USES ITS TRANSMITTER FOR BOTH RADAR DETECTION AND COMMUNICATION BACK TO THE TASK FORCE; NO AIRBORNE RELAY IS REQUIRED. MONOSTATIC AND BISTATIC RADAR CONFIGURATIONS ARE POSSIBLE, USING RANGE AND DOPPLER SIGNAL PROCESSING. A CONSERVATIVE ESTIMATE FOR MONOSTATIC RADAR DETECTION RANGE IS 16 NMI FROM EACH BUOY OR RPV. PHASE I WILL ASSESS THE FEASIBILITY OF USING HF RADAR BUOYS AND RPV'S FOR OTH MISSILE DEFENSE. SPECIFIC TASKS INCLUDE 1) OPTIMIZED MONO-STATIC/BISTATIC RADAR AND COMMUNICATION ARCHITECTURE AND PERFORMANCE

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DEFENSE SMALL BUSINESS INNOVATION RESEARCH PROGRAM  
(SBIIR) ABSTRACTS OF PHASE I AWARDS 1984(U) DEPARTMENT  
OF DEFENSE WASHINGTON DC 16 APR 85

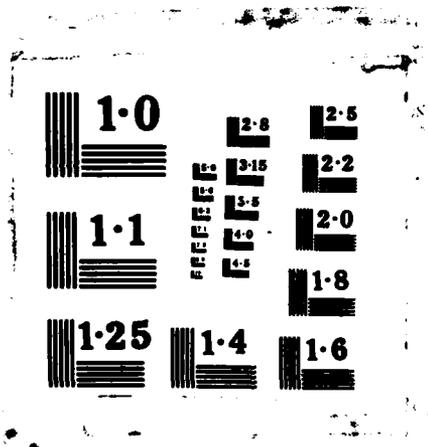
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FISCAL YEAR 1984

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ASSESSMENT; 2) BUOY, RPV AND TARGET LOCATION AND TRACKING TECHNIQUES;  
 3) ASSESSMENT OF SYSTEM COMPLEXITY, SHIPBOARD INTERFACES AND COST;  
 4) ECM VULNERABILITY ANALYSIS; AND 5) IDENTIFICATION OF CRITICAL  
 DEVELOPMENT ISSUES, AND METHODS TO RESOLVE THESE ISSUES THROUGH  
 RESEARCH AND TEST PROGRAMS.

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| TENSION MEMBER TECHNOLOGY                                     | NAVY | \$ 48,742 |
| 15202 PIPELINE LANE   |      |           |
| HUNTINGTON BEACH, CA 92649                                    |      |           |
| PHILIP T. GIBSON  |      |           |
| TITLE:  |      |           |
| DEVELOPMENT OF OPTIMUM ELECTROMECHANICAL MARINE KEVLAR CABLES |      |           |
| TOPIC: 143                      OFFICE: NAVAIR                |      |           |

THIS PROGRAM WILL BEGIN WITH THE EVALUATION OF CANDIDATE SONOBUOY  
 CABLE CONDUCTOR AND STRENGTH MEMBERS MATERIALS AND CONFIGURATIONS  
 USING SEVERAL SPECIAL CABLE DESIGN COMPUTER PROGRAMS PREVIOUSLY  
 DEVELOPED BY THE PROPOSER. THE RESULTS OF THIS STUDY WILL BE  
 COMBINED WITH RECENT SONOBUOY EXPERIENCE TO IDENTIFY A MINIMUM  
 OF SIX CABLE CONSTRUCTIONS WHICH WILL BE PURCHASED AND SUBJECTED  
 TO LABORATORY TESTING. THESE CABLES WILL INCLUDE BOTH SINGLE  
 AND MULTIPLE CONDUCTOR CORES AND VARIOUS STRENGTH MEMBER  
 CONFIGURATIONS INCLUDING PARALLEL, BRAIDED, AND SERVED CONSTRUC-  
 TIONS. SPECIAL ATTENTION WILL BE PAID TO THE DEVELOPMENT OF CABLES  
 HAVING STRETCH COMPATIBLE CORES WHICH WILL SURVIVE PROLONGED  
 CABLE CYCLIC TENSION LOADING. THE OBJECTIVE OF THIS PROGRAM  
 WILL BE TO IDENTIFY IMPROVED CABLE CONFIGURATIONS AND MANUFACTURING  
 TECHNIQUES WHICH WILL PROVIDE RELIABLE SONOBUOY CABLES AT A  
 MINIMUM COST.

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| TEXAS RESEARCH INSTITUTE, INC.                | NAVY | \$ 85,416 |
| 9063 BEE CAVES ROAD                           |      |           |
| AUSTIN, TX 78746                              |      |           |
| SCOTT THORNTON                                |      |           |
| TITLE:  |      |           |
| ADHESIVE SYSTEMS FOR RUBBER-TO-METAL BONDS    |      |           |
| TOPIC: 61                      OFFICE: NAVSEA |      |           |

THIS PROPOSAL RESPONDS TO THE NAVY'S NEED FOR NON-PROPRIETARY

FISCAL YEAR 1984

| SUBMITTED BY<br>-----   | DEPT<br>---- | AWARDED<br>AMOUNT<br>----- |
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| <p>BONDING SYSTEMS FOR NEOPRENE-TO-METAL VULCANIZED BONDS. THE APPROACH OFFERED IS TO BEGIN WITH THE CHEMLOC 205/220 AND OTHER EXISTING PROPRIETARY AND NON-PROPRIETARY FORMULATIONS, TO ESTABLISH THE EFFECTIVENESS OF CERTAIN MODIFICATIONS THEREOF TO IMPROVE CATHODIC DELAMINATION RESISTANCE. THE MODIFICATIONS PROPOSED INCLUDE ADDITIONS OF REACTIVE COUPLING AGENTS SUCH AS ORGANOSILANES AND POTENTIAL OH RESISTIVE ORGANIC ACID GROUPS SUCH AS PHENOLICS AND NAPTHOICS. A THIRD SET OF MODIFICATIONS TO THE SYSTEM AS A WHOLE ARE TREATMENTS OF THE METAL ADHEREND SURFACES TO RENDER THEM NON-CATALYTIC TO THE CATHODIC REACTIONS RESPONSIBLE FOR DELAMINATION. THE MATERIALS TO BE USED IN THIS PROJECT ARE NEOPRENE 5109 OR 5109S, ALUMINUM ALLOY 6061-T6, AISI 1026 CARBON STEEL AND MONEL.</p> |              |                            |

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| <p>THE ABEL CO<br/>ST RD 774 BOX 267<br/>PEMBROKE, VA 24136<br/>KENNETH ABEL<br/>TITLE:<br/>EMERGENCY BREATHING APPARATUS UTILIZING HYDROGEN PEROXIDE<br/>TOPIC: 192 OFFICE: AFSTC</p> | <p>AF</p> | <p>\$ 52,571</p> |
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THIS STUDY WILL EXAMINE THE FEASIBILITY AND PRACTICALITY OF UTILIZING HYDROGEN PEROXIDE OR HYDROGEN PEROXIDE COMPOUNDS/SOLUTIONS AS A LIGHT WEIGHT, COMPACT OXYGEN SOURCE FOR EMERGENCY BREATHING APPLICATIONS.

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| <p>THE ARIZONA CARBON FOIL CO INC<br/>4152 E SIXTH ST<br/>TUCSON, AZ 85711<br/>STANLEY BASHKIN<br/>TITLE:<br/>DEVELOPMENT OF A PROTON BEAM DETECTOR<br/>TOPIC: 217 OFFICE: AFWL/PRP</p> | <p>AF</p> | <p>\$ 51,721</p> |
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TWO DIFFERENT DETECTORS, BOTH USING THIN, CRACKED-ETHYLENE FOILS, WILL BE MADE. ONE DETECTOR CONSISTS OF A LOW-PRESSURE GAS CELL, SEALED AT EITHER END WITH ALUMINIZED ETHYLENE FOILS ABOUT 10 MICROGRAMS PER SQUARE CENTIMETER THICK. LIGHT GENERATED WHEN THE PROTON

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>---- | AWARDED<br>AMOUNT<br>----- |
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BEAM TRAVERSES THE GAS WILL BE VIEWED THROUGH A SIDE WINDOW; THE INTENSITY OF THE LIGHT, AS MEASURED WITH A PHOTOMULTIPLIER OR PHOTO-DIODE AND ASSOCIATED ELECTRONICS, WILL INDICATE THE ION BEAM INTENSITY. FOR THE OTHER DETECTOR, ELECTRONS EJECTED FROM A SINGLE, ALUMINIZED FOIL WILL BE MAGNETICALLY DEFLECTED TO ONE SIDE, WHERE THEY WILL BE DETECTED WITH AN ELECTRON MULTIPLIER; THE ELECTRON CURRENT WILL INDICATE THE BEAM INTENSITY. BOTH DETECTORS DEPEND ON THE FACT THAT THIN ETHYLENE FOILS HAVE EXCEPTIONALLY LONG LIFETIMES UNDER PARTICLE BOMBARDMENT. THESE DETECTORS WILL BE LINEAR, DIRECT READING, EASY TO CALIBRATE, AND WILL NOT INTERFERE WITH THE OTHER USES OF THE TARGET CHAMBER.

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| THE ASSOCIATED CORPORATION<br>19 SPRING STREET<br>NEWPORT, RI 02840<br>DAVID T. BARRY<br>TITLE:<br>TLAM-C TERMINAL HOMING EFFECTIVENESS STUDY<br>TOPIC: 32 OFFICE: JCMPO | NAVY | \$ 82,984 |
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TAC PROPOSES TO CONDUCT A STUDY TO EVALUATE THE COMPARATIVE EFFECTIVENESS OF VARIOUS FORWARD-LOOKING AUTONOMOUS SENSORS AND ALGORITHMS FOR TLAM-C. THE CURRENT TLAM-C USES A TERRAIN MAPPING RADAR ALTIMETER AND CORRELATES THE SENSED AREA AT KEY WAYPOINTS WITH A STORED DIGITAL REPRESENTATION OF THE TERRAIN AREA AT THE WAYPOINTS TO PROVIDE MID-COURSE AND TERMINAL GUIDANCE CORRECTION TO THE INERTIAL NAVIGATION SYSTEM. CRITICAL HIGH VALUE TARGETS FOR THE CONVENTIONAL WARHEAD WEAPON INCLUDE BOTH STATIONARY AND LAND-MOBILE TARGETS. THE EXISTING TERMINAL SYSTEM IS EFFECTIVE AGAINST STATIONARY OR NEAR-STATIONARY TARGETS IN AN AREA BOMBARDMENT SENSE PROVIDED A SUFFICIENTLY UNIQUE (HIGH CORRELATION OF FEATURES) TERMINAL SCENE IS AVAILABLE FOR THEATRE MISSION PLANNING. THE OBJECTIVE OF THIS STUDY WILL BE TO PROVIDE A QUANTITATIVE COMPARATIVE EVALUATION OF TERMINAL HOMING INCORPORATING FORWARD-LOOKING SENSORS IN THE TLAM-C AS A FUNCTION OF THE TYPE SENSOR, REPRESENTATIVE TARGET CHARACTERISTICS AND IMPROVED TERMINAL GUIDANCE ALGORITHMS. THESE WOULD THEN BE TRANSFORMED TO MISSION PLANNING REQUIREMENTS, TARGETING ASSETS NECESSARY AND ACHIEVABLE QUICK RESPONSE TIME IN TARGETING AND RE-TARGETING IN BOTH A TACTICAL JAM-FREE AND COUNTER-MEASURES ENVIRONMENT

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>----- | AWARDED<br>AMOUNT<br>----- |
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IN THE TARGET AREA. THE STUDY IS ENVISIONED AS A SIX MONTH EFFORT CONSISTING OF THREE PHASES - A LITERATURE REVIEW, COORDINATION AND INITIAL ANALYSIS OF THE PROBLEM TO BOUND THE STUDY REQUIREMENTS WITH JCMP (START TO 2 MOS), A SYNTHESIS OF THE EVALUATIVE COMPARISON MODEL (1ST TO 4TH MO) AND THE COMPARATIVE ANALYSIS (2ND TO 6TH MO) CULMINATING IN A FINAL REPORT.

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| THE CUMAGNA CORPORATION<br>26 S. WAKEFIELD ROAD<br>NORRISTOWN, PA 19403<br>ROBERT A. FLORENTINE<br>TITLE:<br>THE INNOVATION EXPANSION OF MAGNAWEAVE FOR SUPERIOR WOVEN REINFORCE-<br>MENTS OF COMPOSITES<br>TOPIC: 7 OFFICE: DRDAV-PD | ARMY | \$ 49,334 |
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MAGNAWEAVE FABRICATES MULTIDimensionALLY REINFORCED PERFORMS FOR COMPOSITES. TO DATE, THE TECHNOLOGY HAS ATTACKED THE PROBLEM OF WEAVING SPECIFIC SHAPES. IT HAS SUCCEEDED. THE PROJECT WILL ADDRESS THE POTENTIAL OF THE BASIC MAGNAWEAVE PROCESS TO BE AMENDED AND EXTENDED TO OPTIMIZE PERFORMANCE IN SUCH AREAS AS FRACTURE TOUGHNESS, INTERLAMINAR SHEAR STRENGTH, AND WEAVE ISOTROPY. DATA FROM EARLIER PROGRAMS SUGGEST SUCH IMPROVEMENTS SHOULD BE POSSIBLE "TRANSVERSE" AND "THIRD DIMENSIONAL" LAYINS SHOULD ENHANCE MAGNAWEAVE CAPABILITIES DRAMATICALLY; THE "NO HOLE" HOLE APPEARS TO BE A BREAKTHROUGH IN ATTACHMENT INTEGRITY. BUILDING ON THE BASIC TECHNOLOGY SHOULD PROVIDE THE DEFENSE COMMUNITY WITH AN EXCEPTIONALLY VERSATILE AND CAPABLE TOOL.

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| THE ELECTROSYNTHESIS COMPANY, INC.<br>P.O. BOX 16<br>E. AMHERST, NY 14051<br>NORMAN L. WEINBERG<br>TITLE:<br>ELECTROCHEMICAL DECONTAMINATION OF AIRBORNE CHEMICAL AND BIOLOGICAL<br>WARFARE AGENTS IN A DEEP BASE<br>TOPIC: 246 OFFICE: BMO/PMX | AF | \$ 50,000 |
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AN ELECTROCHEMICAL APPROACH TO THE DESTRUCTION OF AIRBORNE CHEMICAL

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>----- | AWARDED<br>AMOUNT<br>----- |
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AND BIOLOGICAL WARFARE AGENTS IN A DEEP BASE IS PRESENTED IN THIS PHASE I PROPOSAL. THE PROPOSED ELECTROCHEMICAL FLOW SYSTEM WILL DECONTAMINATE THE AIR STREAM IN THE ANOLYTE AND THE CATHOLYTE SOLUTIONS BY OXIDATION, REDUCTION AND/OR SOLVOLYSIS. THE SCOPE AND LIMITATIONS OF THIS METHOD WILL BE DEMONSTRATED BY CONVERSION OF SEVERAL SIMULATING SUBSTANCES. PHASE II WILL EXTEND THESE STUDIES TO INCLUDE FURTHER REPRESENTATIVES, AS WELL AS BIOLOGICAL WARFARE AGENTS. THIS ELECTROCHEMICAL DECONTAMINATION APPROACH, MAY BE READILY SENSOR-ACTIVATED, AND IS EXPECTED TO ELIMINATE THESE AGENTS RAPIDLY AND COMPLETELY. AN INSTALLATION WILL BE RELATIVELY LOW IN COST AND THE NON-TOXIC CHEMICAL BYPRODUCTS WILL BE EASILY REMOVED.

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| THE ENERGYSTICS CORPORATION<br>1225 JEFF DAVIS HWY, SUITE 1500<br>ARLINGTON, VA 22202<br>ROBERT GEHRKE<br>TITLE:<br>GLOBAL POSITIONING SATELLITE<br>TOPIC: 84 OFFICE: NSWC | NAVY | \$ 49,996 |
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THIS PROPOSAL PRESENTS AN APPROACH FOR ASSESSING THE FEASIBILITY OF MEASURING AIRCRAFT AND/OR SHIP USER VEHICLE HEADING AND ATTITUDE AND DETERMINING WHETHER +/- 1 ACCURACY CAN BE OBTAINED USING THE GLOBAL POSITIONING SYSTEM (GPS). THE TECHNICAL APPROACH PROPOSED WILL EXAMINE THE NAVIGATION SIGNALS AND THE METHODS OF PROCESSING THE INFORMATION, AND WILL PROPOSE METHODS FOR EXTRACTING HEADING AND ATTITUDE DATA FROM THE GPS. ADDITIONAL RADIO AND DATA PROCESSING TECHNIQUES SUCH AS INTERFEROMETRY AND MORE ACCURATE PHASE MEASUREMENTS MAY BE NEEDED TO MEET THE ACCURACY. THE VARIATION IN ACCURACY, AS A FUNCTION OF IMPLEMENTATION, IS AN OUTPUT OF THE STUDY. VEHICLE DYNAMICS AND SATELLITE CONSTELLATION GEOMETRY ARE INDEPENDENT VARIABLES IN THE PROCESS OF DETERMINING HEADING AND ATTITUDE. ADDITIONAL PROCESSING AND DIFFERENT RECEIVER CONFIGURATIONS THAT CURRENTLY ENVISIONED, MAY BE REQUIRED. THE GPS USER EQUIPMENT DOES NOT PROVIDE HEADING AND ATTITUDE IN ITS CURRENT IMPLEMENTATION SO THAT ATTITUDE AND HEADING DETERMINATION MAY REQUIRE ADDITIONAL RECEIVER PROCESSING.

FISCAL YEAR 1984

| SUBMITTED BY<br>-----   | DEPT<br>---- | AWARDED<br>AMOUNT<br>----- |
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| THERMACORE, INC.<br>780 EDEN ROAD<br>LANCASTER, PA 17601<br>G. YALE EASTMAN<br>TITLE:<br>DIRECTED ENERGY THERMAL SHIELDS<br>TOPIC: 51            OFFICE: AFWAL/XRPF | AF           | \$ 53,304                  |

SPACE-BASED DIRECTED ENERGY WEAPONS HAVE THE POTENTIAL FOR ATTACKING SATELLITE COMMUNICATION AND INFORMATION GATHERING SYSTEMS. ACCORDINGLY, THERE IS A STRONG INCENTIVE TO DEVELOP PROTECTIVE SYSTEMS WHICH WILL ALLEVIATE OR NEGATE THE DAMAGING EFFECTS OF THESE WEAPONS AS STRUCTURES.

A POTENTIALLY EFFECTIVE APPROACH, FOR THE PROTECTION OF SATELLITES FROM DIRECTED ENERGY WEAPONS, IS THE UTILIZATION OF HEAT PIPES WITHIN A SHIELD STRUCTURE. HEAT PIPES COULD BE DESIGNED TO ABSORB THE ENERGY BEAM AND TRANSPORT THE GENERATED HEAT FOR DISSIPATION OVER THE ENTIRE SURFACE OF THE STRUCTURE BEING PROTECTED. THE ABSORBED ENERGY WOULD BE DISSIPATED BY A COMBINATION OF HEATING THE SHIELD STRUCTURE AND RADIATION FROM THE SURFACE OF THE SHIELD TO SPACE.

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| THERMACORE, INC.<br>780 EDEN ROAD<br>LANCASTER, PA 17601<br>ROBERT M. SHAUBACK<br>TITLE:<br>ANALYSIS AND PERFORMANCE EVALUATION OF HEAT PIPES WITH MULTIPLE HEAT SOURCES<br>TOPIC: 97            OFFICE: AFWAL | AF | \$ 52,584 |
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ADVANCED SPACECRAFT CURRENTLY BEING DESIGNED HAVE COMPLEX THERMAL MANAGEMENT REQUIREMENTS. THESE REQUIREMENTS MAY BE BEST SATISFIED BY HEAT PIPES CAPABLE OF ACCEPTING HEAT FROM MULTIPLE HEAT SOURCES. THERE IS NO THOROUGH ANALYTICAL OR EXPERIMENTAL BASIS FOR THE DESIGN OF HEAT PIPES OF THIS TYPE. THE PROPOSED PHASE I PROGRAM HAS AS ITS OBJECTIVE THE ANALYTICAL MODELING AND EXPERIMENTAL VERIFICATION OF THE PERFORMANCE OF HEAT PIPES HAVING MULTIPLE, DISTRIBUTED EVAPORATORS.

FISCAL YEAR 1984

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| TITAN SYSTEMS, INC.<br>9191 TOWNE CENTRE DRIVE - SUITE #500<br>SAN DIEGO, CA 92122<br>RAYMOND CURTIS LEE<br>TITLE:<br>DEVELOPMENT OF A SIMULATION MODEL OF ABM COMPONENTS<br>TOPIC: 262            OFFICE: BMO/PMX | AF | \$ 49,924 |
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TITAN SYSTEMS, INC. WILL DEMONSTRATE THE FEASIBILITY OF PRODUCING A SIMULATION MODEL OF ABM COMPONENTS WITH ENOUGH DETAIL TO SATISFY BMO REQUIREMENTS BY DEVELOPING A USEABLE COMPUTER PROGRAM WITH ALL CONVENTIONAL BMD ELEMENTS REPRESENTED. THIS MODEL WILL BE BASED ON THE MULTIPLE ENGAGEMENT MODULE (MEM) PROGRAM, A BALLISTIC MISSILE DEFENSE SIMULATION THAT ALREADY CONTAINS MODELS FOR ICBM AND SLBM RV TRAJECTORIES, RADAR OPERATION AND TARGET TRACKING, BOTH ENDOATMOSPHERIC AND EXOATMOSPHERIC INTERCEPTOR FLYOUT, AND A COMPLETE SET OF NUCLEAR EFFECTS ROUTINES. USING MEM AS A STARTING POINT AND ADDING AN OPTICAL SENSOR MODEL WILL PROVIDE THE CAPABILITY TO ADDRESS ALL ELEMENTS OF AN ADVANCED ABM SYSTEM AT MINIMUM COST, RISK, AND DEVELOPMENT TIME. THE PRINCIPLE INVESTIGATOR DIRECTED THE INITIAL DEVELOPMENT OF MEM AND IS NOW PARTICIPATING IN CONTRACTS FOR THE U.S. BALLISTIC MISSILE DEFENSE COMMAND. BOTH THE PRINCIPLE INVESTIGATOR AND THE ASSISTANT P.I. HAVE EXTENSIVE BACKGROUNDS IN SIMULATION CODE DEVELOPMENT, STRATEGIC MISSILE ANALYSIS, AND BALLISTIC MISSILE DEFENSE TECHNOLOGY.

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| TRACER TECHNOLOGIES<br>2120 W. MISSION ROAD, SUITE M<br>ESCONDIDO, CA 92025<br>WALTER G. ENGLAND, PH.D.<br>TITLE:<br>DEVELOPMENT OF A FUEL SPILL/VAPOR MIGRATION MODELING SYSTEM.<br>TOPIC: 109            OFFICE: AFWAL/XRPP | AF | \$ 45,454 |
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THE SYSTEM OF HANDLING AIRCRAFT FUELS AND/OR MISSILE PROPELLANTS CAN BE SUBJECT TO FAILURE (MAJOR OR MINOR). SUCH SYSTEM FAILURES COULD RESULT IN A FUEL/PROPELLANT SPILL AND SUBSEQUENTLY RESULT IN THE RELEASE OF POTENTIALLY EXPLOSIVE OR TOXIC VAPORS INTO THE ATMOSPHERE. THIS PROPOSAL EXPLORES THE FEASIBILITY AND PRELIMINARY

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>----- | AWARDED<br>AMOUNT<br>----- |
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DEVELOPMENT OF A MODELING SYSTEM WHICH IS ABLE TO MAKE HIGHLY ACCURATE ASSESSMENTS OF IMPACTS TO GROUND SUPPORT PERSONNEL, EQUIPMENT, AND AIRCRAFT RELATIVE TO SPILLS OF FUELS/PROPELLANTS AND OTHER EVENTS THAT COULD RELEASE TOXIC OR EXPLOSIVE VAPORS. THE PROPOSED PROGRAM WILL MODIFY A SERIES OF EXISTING SOURCE CHARACTERIZATION AND VAPOR DISPERSION MODELS, DEVELOPED FOR THE PETROCHEMICAL INDUSTRY, FOR APPLICATION TO PROBLEMS FACED BY THE U.S. AIR FORCE. THE PHASE I EFFORT WILL DEFINE AND PROVIDE MODELS THAT CAN PROPERLY ASSESS IMPACTS RELATIVE TO TYPICAL SPILL/VAPOR MIGRATION SCENARIOS. PHASE II WILL EXPAND THE MODEL SCOPE WHEREBY PROVIDING A COMPREHENSIVE USER FRIENDLY SYSTEM TO ASSESS IMPACTS RELATIVE TO ALL TYPES OF SPILLS. THE PROPOSED MODELING SYSTEM WILL HELP THE AIR FORCE ALIGN REALISTIC GROUND SAFETY CRITERIA WHICH WILL SAVE OPERATIONAL COSTS AND ENABLE AN INCREASE IN COMBAT SORTIE GENERATION RATE.

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| TRC ENVIRONMENTAL CONSULTANTS, INC.<br>800 CONNECTICUT BLVD<br>EAST HARTFORD, CT 06108<br>MARSHALL A ATWATER<br>TITLE:<br>ATMOSPHERIC MODELING OF CHEMICAL, BIOLOGICAL & OBSCURANT CLOUDS<br>OVER AMPHIBIOUS OPERATIONS<br>TOPIC: 50 OFFICE: MARINE CORPS | NAVY | \$ 68,509 |
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THIS PROPOSED STUDY WILL EXAMINE THE FEASIBILITY OF USING A EULERIAN LIMITED AREA MODEL (LAM) TO IMPROVE PREDICTION OF CHEMICAL, BIOLOGICAL, AND OBSCURANT CLOUDS DURING AMPHIBIOUS OPERATIONS. THE LAM HAS BEEN USED TO PREDICT MESOSCALE AND MICROSCALE METEOROLOGICAL PHENOMENA FOR A WIDE VARIETY OF CLIMATIC REGIMES AND HAS BEEN TESTED FOR A NUMBER OF EXTENSIVE METEOROLOGICAL FIELD EXPERIMENTS. THE LAM CAN PREDICT LOCALIZED THREE-DIMENSIONAL CIRCULATION AND ATMOSPHERIC DISPERSION CHARACTERISTICS IN THE VICINITY OF A SHORELINE LAND-SEA INTERFACE. THE STUDY WILL INCLUDE DEFINITION OF THE COMPUTER RESOURCES AND MEASUREMENTS DATA AVAILABLE FOR OPERATING THE MODEL SYSTEM. SPECIFICATIONS FOR A PROTOTYPE MODEL SYSTEM BASED UPON THE LAM WILL BE DEVELOPED. AN INTERACTIVE CLOUD MODEL WILL BE DESIGNED TO SIMULATE THE BEHAVIOR OF CHEMICAL, BIOLOGICAL AND OBSCURANT CLOUDS, UTILIZING THE METEOROLOGICAL CONDITIONS DEVELOPED BY THE LAM. THE LAM WILL BE USED TO SIMULATE A COASTAL LOCATION WITH REPRESENTATIVE METEOROLOGICAL

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>---- | AWARDED<br>AMOUNT<br>----- |
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CONDITIONS TO DETERMINE THE FEASIBILITY FOR SIMPLIFICATIONS. FULL REQUIREMENTS WILL BE SPECIFIED TO ALLOW MODERN SOFTWARE ENGINEERING TO START IMMEDIATELY IN PHASE II.

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| TREC<br>P.O. BOX 4735<br>HUNTSVILLE, AL 35815<br>DR. THOMAS R. EDWARDS<br>TITLE:<br>AUTOMATIC ACQUISITION ALGORITHMS AND PROCESSORS TWO-DIMENSIONAL CONVOLUTE INTEGERS<br>TOPIC: 28 OFFICE: DRSMI-ICDA | ARMY | \$ 49,524 |
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TWO-DIMENSIONAL CONVOLUTE INTEGERS REPRESENTS ADVANCED STATE OF THE ART TECHNOLOGY FOR ADDRESSING PROBLEMS ASSOCIATED WITH TWO-DIMENSIONAL DATA SETS, I.E., IMAGES. CRITICAL PEER REVIEW OF PUBLISHED JOURNAL ARTICLES, TECHNICAL BRIEFS, PATENT APPLICATIONS, AND PRIVATE CORRESPONDENCES (AVAILABLE UPON REQUEST) INDICATE THE VALUE OF THIS NEW AND POWERFUL TECHNOLOGY IN BOTH THE FEDERAL, PUBLIC, AND PRIVATE SECTORS. APPLICATIONS RANGE FROM CORRECT CURL CALCULATIONS OF SOLAR MAGNETIC FIELDS, TO GRADIENT SURFACE IMAGE GENERATION, LOW PASS, HIGH PASS, BAND PASS DIGITAL FILTERS OF TWO-DIMENSIONAL DATA SETS. THE TECHNIQUE RESULTS FROM TWO-DIMENSIONAL REGRESSION THEORY AND HAS EASE OF APPLICATION IN BOTH SOFTWARE AND HARDWARE (REAL-TIME). PROFESSOR WARNER, CHEMISTRY DEPARTMENT EMORY UNIVERSITY, FEELS THE WORK WILL ONE OF THE MOST REFERENCED TO APPEAR IN ANALYTICAL CHEMISTRY AND APPLIES DIRECTLY TO THE EMERGING HYPHENATED INSTRUMENTS FOR CHEMICAL ANALYSIS. THE EVEN DATA MASK ASPECT OF THE WORK, INTERSTITIAL POINT GENERATION, HAS THE POTENTIAL OF REPLACING FAULTY SIGNALS IN SUCH AREAS AS PHASED ARRAY RADAR SYSTEMS. SUFFICIENT WORK HAS BEEN ACCOMPLISHED TO MERELY DESCRIBE THE THEORY AND GENERATE A LIMITED NUMBER OF TEST CASES, BUT THESE RESULTS SHOW GREAT PROMISE.

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| TRIAD MICROSYSTEMS, INC.<br>540 N. GOLDEN CIRCLE DRIVE, SUITE 210<br>SANTA ANA, CA 92705<br>JAY W. WAGER<br>TITLE:<br>THROUGH THE EARTH COMMUNICATIONS<br>TOPIC: 250 OFFICE: BMO/PMX | AF | \$ 51,917 |
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A CRITICAL PROBLEM RELATED TO ASSURED MISSILE LAUNCH IS THE

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>----- | AWARDED<br>AMOUNT<br>----- |
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EXISTENCE OF ROBUST COMMUNICATIONS. PRESENT SYSTEMS USE A VARIETY OF SPACE, AIRBORNE, AND POINT-TO-POINT RADIO COMMUNICATIONS, SUPPLEMENTED BY LAND WIRE SYSTEMS. INCLUDING FUTURE LASER SYSTEMS ALL OF THESE ARE SUBJECT TO SERIOUS DISRUPTION FROM NATURAL, NUDET, AND JAMMING INTERFERENCE. THE INNOVATIVE CONCEPT PRESENTED HEREIN CAN PROVIDE LOW RATE COMMUNICATIONS ESSENTIALLY IMMUNE FROM THESE INTERFERENCES.

THIS PROPOSED CONCEPT USES INDUCED SEISMIC WAVES TO PROVIDE ROBUST COMMUNICATIONS. DEEP UNDERGROUND BASING COULD EXPERIENCE ONE-WAY RANGES UP TO 10 NM AND BANDWIDTHS OF SOME 20 HZ, OR MORE. MOBILE SURFACE BASING COULD EXPERIENCE RANGES OF 20 NM AND BANDWIDTHS OF 40 HZ, OR MORE. THESE COMMUNICATIONS WOULD BE IMMUNE FROM NATURAL OR MAN INDUCED, ELECTRICAL OR MECHANICAL INTERFERENCE.

THE OBJECTIVES OF THIS PHASE I EFFORT WILL BE TO CONCEPTUALLY DESIGN THE SYSTEM AND FORECAST ITS PERFORMANCE. TO ACHIEVE THESE OBJECTIVES IT WILL BE NECESSARY TO REVIEW THE EXISTING ANALYSIS BASE, MODEL THE TRANSMISSION MEDIA, CONCEPTUALLY DESIGN THE TRANSMITTER AND RECEIVER ELEMENTS, AND FORECAST PERFORMANCE USING THE EXISTING EMPIRICAL DATA AND MODELED ENVIRONMENTS. THE RESULT WILL BE QUANTATIVE ESTABLISHMENT OF THE FEASIBILITY AND OPERATING PARAMETERS OF THIS METHOD OF ROBUST COMMUNICATIONS.

TRIMBLE NAVIGATION  
1077 INDEPENDENCE AVENUE  
MOUNTAIN VIEW, CA 94043  
RALPH ESCHENBACK

NAVY \$ 50,000

TITLE:  
GPS HEADING & ATTITUDE DETERMINING  
INSTRUMENT INVESTIGATION  
TOPIC: 84 OFFICE: NSWC

TRIMBLE NAVIGATION POSSESSES A WORKING GPS RECEIVER CAPABLE OF TRACKING DOPPLER FREQUENCY TO .04 HZ WITH LESS THAN 1 SEC AVERAGING. THIS IMPLIES THAT #1 DEGREE HEADING AND ATTITUDE ACCURACIES CAN EASILY BE OBTAINED WITH 3 ANTENNAS SEPARATED BY LESS THAN 1 METER ON A COMMON GROUND PLANE. INNOVATIVE DESIGN PERMITS COMMON MODE REJECTION OF A MAJOR ERROR SOURCE, WHICH FOR OTHER KNOWN DESIGNS IS A SIGNIFICANT PROBLEM. TRIMBLE IS A COMMERCIAL COMPANY WITH AN EXCELLENT REPUTATION IN LORAN NAVIGATION RECEIVERS. THE PROPOSED HEADING AND ATTITUDE SENSOR DESIGNED FOR THE COMMERCIAL MARKET WILL DEFINITELY COST LESS THAN OUR COMMERCIAL LORAN

FISCAL YEAR 1984

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RECEIVER. (\$2995).

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| TSE, INC.<br>P. O. BOX 31, 541 E. HECTOR STREET<br>CONSHOHOCKEN, PA 19428<br>HARRISON FITELJORG, II<br>TITLE:<br>DEVELOP A NEW CLOSURE SYSTEM FOR CLOSING MUNITIONS CONTAINERS<br>TOPIC: 228            OFFICE: AD/CZO | AF | \$ 28,128 |
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THE PURPOSES OF THIS PROJECT ARE TO EXAMINE CURRENTLY USED LATCHING SYSTEMS FOR MUNITIONS CONTAINERS, TO DETERMINE THE FAILURES OR WEAKNESSES OF THOSE LATCHING SYSTEMS, AND TO FIND OR DEVELOP LATCHING SYSTEM WHICH WILL MAKE POSSIBLE MORE SECURE CLOSING OF THOSE CONTAINERS. THE PROJECT WILL BE CARRIED OUT IN THREE STAGES. FIRST, THE CURRENTLY USED LATCHING SYSTEM WILL BE TESTED AND EXAMINED IN ORDER TO DETERMINE ITS WEAKNESSES AND THE PRECISE WAYS IN WHICH IT IS INADQUATE. AT THE SAME TIME, THE CONDITIONS AND REQUIREMENTS OF USE WILL BE DETERMINED. SECOND, EXISTING STANDARD LATCHES/LATCHING SYSTEMS WILL BE EXAMINED TO DETERMINE WHETHER ANY ARE AVAILABLE TO REPLACE THOSE NOW USED. THIRD, VARIOUS NEW DESIGN POSSIBILITIES WILL BE DEVELOPED, EXAMINED, AND STUDIED FOR MANUFACTURING DIFFICULTIES AND COSTS.

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| UNIVERSAL ENERGY SYSTEMS, INC.<br>4401 DAYTON-XENIA ROAD<br>DAYTON, OH 45432<br>JOHN A. WOOLLAM<br>TITLE:<br>DIAMONDLIKE CARBON COATINGS FOR OPTICAL SYSTEMS<br>TOPIC: 44            OFFICE: DRXMR-PP | ARMY | \$ 48,007 |
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MILITARY OPTICAL SYSTEMS NEED HARD, CORROSION-RESISTANT COATINGS. DIAMONDLIKE CARBON HAS MANY DESIRABLE PROPERTIES FOR THIS PURPOSE: HARD, RESISTENT TO ETCH, ROUGHNESS FILLING, AND TRANSPARENT IN THE VISIBLE TO INFRARED. WE ARE PREPARING TO COAT COMMON INFRARED DETECTOR MATERIALS SUCH AS IN, SB, GE, HG, CD, AND TE WITH DIAMONDLIKE CARBON. WE WILL THEN TEST THESE COATINGS FOR OPTICAL PERFORMANCE,

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>----- | AWARDED<br>AMOUNT<br>----- |
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CORROSION RESISTENCE, REPRODUCIBILITY, AND ADAPTABILITY TO PRODUCTION.

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| UNIVERSAL ENERGY SYSTEMS, INC.<br>4401 DAYTON-XENIA ROAD<br>DAYTON, OH 45432<br>JOHN A. BAKER<br>TITLE:<br>MODIFICATION OF OXIDE PROPERTIES ON RAPIDLY QUENCHED ALUMINIDE<br>P/M ALLOYS<br>TOPIC: 40            OFFICE: AVPO | AF | \$ 55,748 |
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RAPIDLY QUENCHED ALUMINIDE ALLOYS ARE OF IMPORTANCE IN POWER METALLURGICAL (P/M) FABRICATION OF LIGHT WEIGHT HIGH STRENGTH STRUCTURAL PARTS INTENDED FOR USE IN ADVANCED AEROSPACE SYSTEMS. THE ULTIMATE MECHANICAL PROPERTIES OF THESE COMPACTED PARTS DEPENDS CRITICALLY ON THE OXIDE SKIN OF THE POWDERS AS OBTAINED FROM DIRECT POWDER QUENCHING OR GRINDING OF RAPIDLY SOLIDIFIED RIBBON MATERIAL. THE BRITTLE OR DUCTILE PROPERTIES OF THE OXIDE WILL DETERMINE HOW WELL IT CAN BE BROKEN UP EITHER THROUGH MECHANICAL ATTRITION OR WHEN THE POWDER UNDERGOES HOT SHEAR CONSOLIDATION. MAXIMUM DESTRUCTION OF THE OXIDES IS IMPORTANT PRIOR TO OR DURING THE COMPACTING OF THE POWDERS. THIS EFFECT CAN OCCUR THROUGH A CRUMBLING ACTION OF THE OXIDE SKIN AND DIRECT INCORPORATION OF THE PARTICULATES INTO THE COMPACTED ALLOY THEREBY ADDING PARTICULATE DISPERSANT STRENGTHENING. THE OBJECTIVE OF THE PROPOSED RESEARCH IS TO DEVELOP MECHANICAL, CHEMICAL, AND/OR PHYSICAL METHODS FOR TREATING THE OXIDE IN ORDER TO MODIFY ITS DUCTIBILITY PROPERTIES. THIS WILL INITIALLY BE APPROACHED BY DEVELOPING METHODS FOR EVALUATING AND ANALYZING THE OXIDE SKINS. THE RESULTS OF THIS WORK WOULD HOPEFULLY LEAD TO A MODIFIED VERSION OF DEGASSING BY HEAT TREATMENT RESULTING IN A LESS ADVERSE EFFECT ON SECOND PHASE DISPERSANTS IN THE RAPIDLY SOLIDIFIED MATERIALS.

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| UNIVERSAL ENERGY SYSTEMS, INC.<br>4401 DAYTON-XENIA ROAD<br>DAYTON, OH 45432<br>GARY D. STREBY<br>TITLE:<br>QUANTITATIVE FLUID FLOW ANALYSIS USING LOW COST DIRECT DIGITAL<br>IMAGING TECHNIQUES<br>TOPIC: 105            OFFICE: AFWAL | AF | \$ 44,843 |
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VISUAL ANALYSIS IS PRESENTLY UTILIZED IN MANY FIELDS OF RESEARCH

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>----- | AWARDED<br>AMOUNT<br>----- |
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AND DEVELOPMENT TO OBTAIN QUALITATIVE DATA AND IN INDUSTRIAL PROCESS FOR MONITORING AND CONTROL. THESE VISUAL DATA SYSTEMS ARE VERY EXPENSIVE AND COMPLEX DUE TO THE CONVERSION OF VISUAL INFORMATION TO DIGITAL DATA NECESSARY FOR COMPUTER USE. NEW SOLID STATE DIRECT DIGITAL IMAGING DEVICES ARE NOW AVAILABLE AT LOW COST FOR USE IN VISUAL DATA ACQUISITION. SUCH DEVICES SHOULD BE STUDIED TO DETERMINE THEIR APPLICABILITY IN THE FIELD OF FLUID FLOW ANALYSIS FOR USE IN GOVERNMENT AND INDUSTRIAL RESEARCH AND DEVELOPMENT PROGRAMS TO MORE FULLY UTILIZE PRESENT TEST FACILITIES.

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| UNIVERSAL ENERGY SYSTEMS, INC.<br>4401 DAYTON-XENIA ROAD<br>DAYTON, OH 45432<br>JOHN A. BAKER | AF | \$ 62,372 |
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TITLE:  
SILICON DOPED GALLIUM BY ION IMPLANTATION FOR IMPURITY BAND CONDUCTION DETECTORS  
TOPIC: 74 OFFICE: AFWAL/XRPM

THE GOAL OF THIS RESEARCH PROGRAM WILL BE THE PRODUCTION OF HEAVILY DOPED GALLIUM IN SILICON (GREATER THAN  $4 \times 10$  ATOMS/cm ) BY ION IMPLANTATION. THE PRODUCT WILL BE ANALYZED TO DETERMINE THE CHARACTERISTICS OF IMPURITY BAND CONDUCTION AS IT APPLIES TO THE DEVELOPMENT OF A THIN (4 MICRONS) INFRARED DETECTOR. THE UES TANDETRON ION BEAM ACCELERATOR WILL BE EMPLOYED TO IMPLANT GALLIUM INTO SILICON USING SEVERAL BEAM ENERGY VALUES RANGING FROM 400 KEV TO 6 MEV, PRODUCING A UNIFORM DISTRIBUTION OF GALLIUM OVER THE FIRST 4 MICRONS. ANNEALING OF THE SILICON SURFACE TO A DEPTH SLIGHTLY GREATER THAN THE DAMAGE REGION WILL BE PERFORMED USING PULSED LASER AND INCOHERENT LIGHT OR RESISTIVE HEATING. THE RECRYSTALLIZING SOLID WILL PLACE THE GALLIUM ATOMS IN SUBSTITUTIONAL SITES AND WILL PROMOTE SINGLE CYRSTAL RECRYSTALLIZATION OF THE DAMAGED SILICON. RBS, SPREADING RESISTANCE, DLTS, HALL AND PHOTOCONDUCTIVITY EQUIPMENT WILL MEASURE DEPTH DISTRIBUTION, ANALYZE GALLIUM UNIFORMITY, DETECT IONIZED IMPURITIES AND DEFECTS, MEASURE ELECTRICAL CHARACTERISTICS OF IMPURITY BAND CONDUCTION, AND PROVIDE INFORMATION CONCERNING PHOTOCONDUCTIVITY. THE LONGER TERM GOAL OF UNDERSTANDING THE PHYSICAL LAWS GOVERNING THE NATURE OF IBC WILL COME FROM DATA OBTAINED FROM FUTURE STUDIES.

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| UNIVERSAL ENERGY SYSTEMS, INC.<br>4401 DAYTON-XENIA ROAD<br>DAYTON, OH 45432<br>SOKKA M. DORAIVELU | AF | \$ 54,190 |
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TITLE:  
ADVANCED SIMULATION LANGUAGE FOR PROCESS MODELING AND PROCESS CONTROL IN METAL-WORKING  
TOPIC: 78 OFFICE: AFWAL/XRPM

THIS PROPOSAL IS AIMED AT DEVELOPING A CONCEPT FOR IDENTIFYING A

FISCAL YEAR 1984

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MODEL OF CONCURRENCY AND LANGUAGE TO DESCRIBE PARALLELISM INHERENT IN PROCESS SIMULATION (FINITE ELEMENT ANALYSIS) OF METAL-WORKING PROCESSES) AND PROCESS CONTROL. THE MAIN GOAL IS TO DEVELOP THE ADVANCED PARALLEL HARDWARE SYSTEMS TO (i) IMPROVE THE EXECUTION-TIME EFFICIENCY OF THE APPLICATION PACKAGES AND (ii) CONTROL MATERIAL TESTING AND INDUSTRIAL PROCESSES IN METAL WORKING. THE APPROACH IS TO CAPTURE BOTH A MODEL OF CONCURRENCY AND LANGUAGE FOR DESCRIBING CONCURRENT AND PARALLEL ALGORITHMS USING THE ALREADY DEVELOPED CONCURRENCY MODEL AND LANGUAGE BY THE INVESTIGATORS. DURING PHASE I, RESEARCH WILL BE DIRECTED TOWARDS IDENTIFYING CONCURRENT "PROCESSES" WHICH EXIST IN THE RIGID-VISCO-PLASTIC FEM APPLICATION SOFTWARE CALLED ANALYSIS OF LARGE PLASTIC INCREMENTAL DEFORMATION (ALPID) THAT HAS BEEN FULLY DEVELOPED AND VALIDATED UNDER BATTELLE COLUMBUS LABORATORIES - U. S. AIR FORCE PROCESSING SCIENCE PROGRAM FOR TWO DIMENSIONAL MATERIAL FLOW PROBLEMS. BASED ON THE CONCURRENCY MODEL, A LANGUAGE FOR DESCRIBING PARALLELISM WILL BE DEVELOPED. THE SAME PROCEDURE WILL BE FOLLOWED TO SOLVE PROBLEMS IN PROCESS CONTROL OF SLOW STRAIN RATE UPSETTING TEST/PROCESS. IN PHASE II, SOFTWARE SYSTEMS WILL BE DEVELOPED TO (i) TRANSLATE FROM HIGH-LEVEL ENGINEERS' DESCRIPTIONS OF APPLICATION SOFTWARE INTO EXECUTABLE PROCESS-GRAPH PROGRAMS AND (ii) MAP FROM THESE PROCESS GRAPHS ONTO PARALLEL HARDWARE FOR IMPROVING EXECUTION-TIME EFFICIENCY.

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| UNIVERSAL ENERGY SYSTEMS, INC.<br>4401 DAYTON-XENIA ROAD<br>DAYTON, OH 45432<br>SOKKA M. DORAIVELU<br>TITLE:<br>AN APPRENTICE SYSTEM FOR PROMPTING AND GUIDING DIE DESIGN AND<br>PROCESS SIMULATION<br>TOPIC: 79 | AF | \$ 66,795 |
| OFFICE: AFWAL/XRPM   |    |           |

THIS RESEARCH PROPOSAL IS AIMED AT DEVELOPING AN APPRENTICE SYSTEM FOR PROMPTING AND GUIDING DIE DESIGN PROCEDURE AND PROCESS SIMULATION. THE APPROACH IS A NOVEL ONE BECAUSE IT SYNTHESIZES THE AVAILABLE TECHNIQUES FROM SOFTWARE ENGINEERING (SE), DATA BASES (DB), OPERATING SYSTEMS (OS), ANALYTICAL MODELING (AM), AND ARTIFICIAL INTELLIGENCE (AI) INTO A USEFUL PERSPECTIVE FOR INFORMATION-HANDLING AND PROBLEM-SOLVING ACTIVITIES INVOLVED IN DIE DESIGN PROCEDURE AND PROCESS SIMULATION. THE PROPOSED SYSTEM WILL OFFER A POTENTIAL

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>----- | AWARDED<br>AMOUNT<br>----- |
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CAPABILITY FOR PROMPTING AND AIDING THE DESIGN ENGINEER IN HIS TASK OF FINDING EFFECTIVE SOLUTIONS TO COMPLEX PROBLEMS. THIS WILL ALLOW THE DESIGN ENGINEER TO CONSIDER MANY POSSIBLE OPTIONS AND ALSO ACCELERATE THE PROCESS WITH OR WITHOUT HIS INTERMEDIATE INTERVENTION TO PRODUCE AN ADEQUATE OR OPTIMUM DESIGN. THE FEASIBILITY OF THE CONCEPT WILL BE TESTED FOR EXTRUSION-PROCESS SIMULATING AND DIE DESIGN IN PHASE I. IN PHASE II A GENERIC APPRENTICE SYSTEM WILL BE DEVELOPED AND TESTED FOR OTHER UNIT PROCESSES SUCH AS FORGING, POWDER METALLURGY FORMING, AND SHEET-METAL WORKING.

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| UNIVERSAL ENERGY SYSTEMS, INC.<br>4401 DAYTON-XENIA ROAD<br>DAYTON, OH 45432<br>RABI BHATTACHARYA<br>TITLE:<br>OHMIC CONTACT FORMATION OF GaAs BY ION BEAM MIXING<br>TOPIC: 72            OFFICE: AFWAL/XRPM | AF | \$ 63,061 |
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THE REPRODUCIBLE FORMATION OF HIGH RELIABILITY OHMIC CONTACT IN A N-TYPE GaAs IS A MAJOR PROBLEM IN THE GaAs BASED ELECTRONIC DEVICE TECHNOLOGY. STANDARD TECHNOLOGY UTILIZES FURNANCE ANNEALING OF AUGER EUTECTIC COMPOSITION WITH AN OVERLAYER OF NI AT TEMPERATURES IN THE RANGE OF 400-450 DEGREE C. THIS TECHNIQUE, ALTHOUGH IT WORKS, IS NOT VERY RELIABLE. BESIDES, THERE IS A NEED IN THE INDUSTRY TO DEVELOP A TECHNIQUE THAT WILL ALLOW THE FABRICATION OF OHMIC CONTACT AT LOW TEMPERATURE. ION BEAM MIXING IS AN ATTRACTIVE ALTERNATIVE TO THERMAL ALLOYING. SO FAR, NO ONE HAS APPLIED THE ION BEAM MIXING TECHNIQUE TO FABRICATE OHMIC CONTACT TO N-TYPE GaAs. A PROPOSAL IS MADE HEREIN TO INVESTIGATE THE USE OF ION BEAM MIXING AS A TECHNIQUE FOR FORMING OHMIC CONTACT ON N-TYPE GaAs. THE BEST COMBINATION OF ION IMPLANTATION PARAMETERS SUCH AS ENERGY, MASS AND DOSE FOR OBTAINING MIXED LAYERS AT THE INTERFACE WILL BE DETERMINED. THE CONTACT RESISTIVITIES OF THE MIXED LAYERS WILL BE MEASURED BEFORE AND AFTER ANNEALING AT LOW TEMPERATURES.

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| UNIVERSAL ENERGY SYSTEMS, INC.<br>4401 DAYTON-XENIA ROAD<br>DAYTON, OH 45432<br>LARRY G. HARDING<br>TITLE:<br>COMPUTER-BASED DEVELOPMENT OF STEAM PROPULSION PLANT OPERATOR TRAINING (SPPOT) MATERIALS<br>TOPIC: 116            OFFICE: NPRDC | NAVY | \$ 54,825 |
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THE TASK IS TO CONDUCT AN ECONOMIC AND TECHNICAL FEASIBILITY STUDY

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>----- | AWARDED<br>AMOUNT<br>----- |
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TO DETERMINE WHETHER THE HIGH LABOR-INTENSIVE EFFORTS TO PRODUCE SPPOT TRAINING MATERIAL CAN BE REDUCED THROUGH INNOVATIVE COMPUTER-BASED CAPABILITIES. THE STUDY WILL RESULT IN AN ECONOMIC FEASIBILITY REPORT AND A TECHNICAL FEASIBILITY REPORT BASED ON A JOB ANALYSIS OF THE SPPOT AUTHORIZING PROCESS, REVIEW OF SPPOT INPUT MATERIALS AND REVIEW OF STATE-OF-THE ART CAPABILITIES OF CURRENT SYSTEMS. THIS TASK COVERS BOTH NEW MATERIAL GENERATION AND EFFECTIVE MAINTENANCE OF MATERIALS, WHICH INCLUDES IDENTIFYING, LOCATING, AND UPDATING ALL MATERIALS AFFECTED BY A CHANGE OR REVISION.

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| UNIVERSITY RESEARCH ENGINEERS & ASSOC<br>166 PERKINS ROW<br>TOPSFIELD, MA 01983<br>THOMAS P. CALLAHAN<br>TITLE:<br>MECHANICAL SANDBAG FILLER<br>TOPIC: 47 | NAVY                 | \$ 49,810 |
|   | OFFICE: MARINE CORPS |           |

THE OBJECTIVE OF PHASE I IS TO ESTABLISH THE FEASIBILITY OF A CONCEPT TO DESIGN AND BUILD A SPECIAL PURPOSE MACHINE THAT WILL HAVE THE CAPABILITY OF FILLING AND SECURELY CLOSING AT LEAST 600 SANDBAGS PER HOUR. THE MACHINE WILL BE MOTOR OPERATED, OPERABLE BY ONE PERSON IN A COMBAT ENVIRONMENT AND TRANSPORTED BY A TACTICAL VEHICLE. THE BENEFITS FROM SUCH A DEVICE WOULD INDIRECTLY BE THE PROTECTION OF PERSONNEL AND EQUIPMENT IN A COMBAT ENVIRONMENT. THE CONSTRUCTION SPEED WHEN BUILDING FIELD FORTIFICATIONS, PERSONNEL SHELTERS, AMMUNITION BUNKERS AND GUN EMPLACEMENTS, IS EXTREMELY IMPORTANT. THE PHASE I EFFORT WILL ENTAIL A CAREFUL EVALUATION OF THE OPERATING ENVIRONMENT, POTENTIAL CONTENT VARIATIONS OF THE ON-SITE MATERIAL, ETC., PRIOR TO DEVELOPING A DETAILED SET OF DESIGN SPECIFICATIONS AND OPERATING REQUIREMENTS. THE PRELIMINARY DESIGN CONCEPT IS COMPARED TO THE SPECIFICATION, AND THE STATE-OF-THE-ART IN SOIL HANDLING TECHNOLOGY. A DESIGN RISK AND FIELD RELIABILITY ASSESSMENT IS MADE AS A PART OF THE SYSTEM EVALUATION. AN ENGINEERING MODEL COULD BE MADE TO DEMONSTRATE CRITICAL SUBASSEMBLIES BEFORE ADVANCING TO PHASE II. THE POSSIBLE COMMERCIAL APPLICATIONS ARE SIGNIFICANT; ESPECIALLY IN THOSE GEOGRAPHIC REGIONS THAT ARE SUBJECTED TO SEASONAL FLOOD CONTROL PROBLEMS.

FISCAL YEAR 1984

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| VER-VAL ENTERPRISES, INC.<br>97 HILL AVENUE<br>FORT WALTON BEACH, FL 32548<br>MARK MADAMBA<br>TITLE:<br>DEVELOP NEW CLOSURE SYSTEMS FOR CLOSING MUNITIONS CONTAINERS<br>TOPIC: 228            OFFICE: AD/CZO | AF           | \$ 48,139                  |

THE DESIGN OF MUNITIONS CONTAINERS INCLUDE MECHANICAL LATCH MECHANISMS USED TO SECURE THE TOP OF THE CONTAINER. ALL LATCHES ARE DESIGNED TO BE MANUALLY ENGAGED AND A LARGE NUMBER HAVE AN ADJUSTMENT WHICH ALLOWS AN INCREASE IN SEALING PRESSURE, SUCH AS THE COMMONLY USED "OVER CENTER DRAW BOLT LATCH."

THESE LATCHES THROUGH USE AND WEAR, HAVE A TENDENCY TO BECOME OUT OF ADJUSTMENT. WHEN THIS OCCURS THE PRESSURE ACTION CANNOT BE OBTAINED, THEREBY CREATING AN INSECURE CONTAINER SEAL. THESE LATCHES WERE DESIGNED TO BE HAND ENGAGED, WHICH IN ITSELF DOES NOT PRESENT A PROBLEM WHEN OPENING AND CLOSING ONE OR TWO CONTAINERS. THE PROBLEM ARISES (WHICH IS MORE COMMONLY THE CASE) WHEN MANY CONTAINERS ARE OPENED AND CLOSED DURING MAINTENANCE AND HIGH TEMPO READINESS EXERCISES. INSTEAD OF CLOSING THE LATCHES BY HAND A MORE COMMON PRACTICE IS TO USE THE FOOT (AND SOMETIMES KICK) TO CLOSE THE LATCHES. THERE IS NO SPECIAL TOOL DESIGNED TO OPEN OR CLOSE THE LATCH. ANOTHER COMMON PRACTICE IS TO USE A SCREW DRIVER, EVEN THOUGH FROM A TECHNICAL STANDPOINT, THIS CONSTITUTES MISUSE OF A HAND TOOL. SINCE THE LATCH MECHANISMS PROVIDE A POSITIVE SEAL, IT BECOMES MOST IMPORTANT THAT THEY FUNCTION PROPERLY IN ORDER TO PROVIDE THE DESIRED PROTECTION FOR THE ENCASED WEAPON.

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| VERAC INC<br>10975 TORREYANA RD SUITE 300<br>SAN DIEGO, CA 92121<br>HAROLD W SHARP<br>TITLE:<br>MATH MODEL FOR WEAPON TRAJECTORY SIMULATION<br>TOPIC: 26            OFFICE: ASD/YWF | AF | \$ 74,979 |
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THE PHASE I EFFORT WILL ESTABLISH THE REQUIREMENTS FOR THE TRAJECTORY

FISCAL YEAR 1984

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MODEL AND PROVIDE THE BASIS FOR THE GENERATION OF THE COMPUTER PRODUCT SPECIFICATION.

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| VERAC INC<br>10975 TORREYANA RD SUITE 300<br>SAN DIEGO, CA 92121<br>CHARLES E HART<br>TITLE:<br>ALL MOBILE TACTICAL AIR FORCE<br>TOPIC: 27            OFFICE: ASD/XRZ | AF | \$ 74,999 |
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THIS PROPOSED PHASE I RESEARCH EFFORT WILL BE A SYSTEMATIC, INTENSIVE STUDY TOWARDS GREATER UNDERSTANDING OF THE TACTICAL AIRCRAFT MOBILITY PROBLEM. IT EXPLORES THE FEASIBILITY OF DEVELOPING A DETAILED PLAN FOR MAKING MOBILITY POSSIBLE FOR CURRENT AND FUTURE U.S. AIR FORCE TACTICAL AIRCRAFT THROUGH INNOVATIVE USE OF PRESENT AND NEAR TERM TECHNOLOGIES. AIRBASE AND OPERATIONAL CHARACTERISTICS ASSOCIATED WITH PERMANENT SITE BASES, DISPERAL BASES AND MOBILITY BASES WILL BE DESCRIBED. MEASURES OF MERIT FOR BENEFITS OF INCREASED MOBILITY WILL BE ESTABLISHED. AIRCRAFT CHARACTERISTICS, OPERATIONAL/ MAINTENANCE AND LOGISTICS CONCEPTS, MISSION TASKING, AIRCRAFT TECHNOLOGIES WHICH CAN ENHANCE MOBILITY, GROUND EQUIPMENT TECHNOLOGIES WHICH CAN ENHANCE MOBILITY AND INNOVATIVE APPLICATIONS OF NON-AIRCRAFT TECHNOLOGIES WILL BE REVIEWED AND PRESENTED IN A SERIES OF MATRIX ORDERS WHICH WILL MAKE MORE APPARENT FEASIBLE METHODS OF GAINING A DESIRABLE LEVEL OF MOBILITY. THIS WILL LEAD INTO A PHASE II EFFORT FURTHER DEFINING THE MOST FEASIBLE METHODS AS DETERMINED IN PHASE I, OF ESTABLISHING A MOBILITY CAPABILITY IN U.S. AIR FORCE TACTICAL AIRCRAFT. THE CHANGES REQUIRED TO GAIN THE MOBILITY WILL BE MEASURED AND VALIDATED IN VERAC'S COMPUTER WARGAMING MODELS AND INCORPORATED IN AN AIR FORCE DEVELOPMENT PLAN.

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| VERAC, INC.<br>10975 TORREYANA ROAD, SUITE 300<br>SAN DIEGO, CA 92121<br>DR. RICHARD D. BINKOWSKI<br>TITLE:<br>U.S. ICBM DIRECTED ENERGY WEAPON VULNERABILITY STUDY<br>TOPIC: 282            OFFICE: BMO/PMX | AF | \$ 52,087 |
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THE U.S. ICBM DIRECTED ENERGY WEAPON (DEW) VULNERABILITY STUDY

FISCAL YEAR 1984

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ESTABLISHES FIRST ORDER DEW VULNERABILITY SUSCEPTIBILITY LEVELS FOR SELECTED U.S. ICBM COMPONENTS. IT THEN RELATES THOSE LEVELS TO THREAT SYSTEM CONCEPTS WHICH COULD DELIVER THE LETHAL BEAMS ON TARGET UNDER TYPICAL ENGAGEMENT CONDITIONS, DEVELOPS FIRST ORDER HARDENING CONCEPTS AND ACCOMPLISHES DESIGN/HARDNESS TRADE-OFF ANALYSES RELATIVE TO THE DEFINED THREAT SYSTEM CONCEPTS. THE SCOPE OF TARGETS INCLUDE THE PEACEKEEPER, SMALL ICBM AND MINUTE-MAN III WITH EMPHASIS IN THAT ORDER OF PRIORITY. THE PHASE I STUDY OUTPUTS ARE FIRST ORDER CONCEPTS OF U.S. ICBM HARDENING/COUNTER-MEASURES AND RECOMMENDATIONS FOR A FOLLOW-ON PHASE II EFFORT.

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| VERAC, INCORPORATED<br>10975 TORREYANA ROAD, SUITE 300<br>SAN DIEGO, CA 92121<br>LARRY KRUHMIN | NAVY | \$ 67,625 |
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TITLE:  
 VERAC'S COMPILATION AND INVESTIGATION OF ADVANCE DSMAC ALGORITHMS TO IMPROVE OPERATIONAL PERFORMANCE  
 TOPIC: 33 OFFICE: JCMPO

THE DIGITAL SCENE MATCHING AREA CORRELATOR (SDMAC) IS USED BY UNMANNED VEHICLES TO PROVIDE LOW ALTITUDE GUIDANCE POSITION UPDATES TO THE INERTIAL NAVIGATION SYSTEM. IN ORDER TO ENHANCE CURRENT OPERATION OF DSMAC, VERAC, INCORPORATED PROPOSES TO ACCOMPLISH THE FOLLOWING:

1. COMPILER DATA ON CURRENT DSMAC SYSTEM IN ORDER TO DEFINE ITS CAPABILITIES AND LIMITATIONS.
2. ANALYZE EXISTING VISUAL DIGITIZED DATA SOURCES TO DEFINE CANDIDATE CORRELATION PARAMETERS.
3. IDENTIFY SELECT CORRELATION ALGORITHMS AND EVALUATE THEIR POTENTIAL FOR ENHANCEMENTS USING ARTIFICIAL INTELLIGENCE TECHNIQUES BASED ON THE PARAMETERS DEFINED ABOVE.
4. USING ENGINEERING ANALYSIS AND SIMULATIONS, EVALUATE THE NAVIGATION IMPROVEMENT ATTAINED USING THE ENHANCEMENTS DEFINED.

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| VERDIX CORPORATION<br>7655 OLD SPRINGHOUSE ROAD<br>MCLEAN, VA 22102<br>DR. JERRY SHELTON | AF | \$ 69,022 |
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TITLE:  
 DECISION AID SUPPORT ENVIRONMENT  
 TOPIC: 238 OFFICE: DORM

THE DECISION AID SUPPORT ENVIRONMENT (DASE) PROJECT ADDRESSES THE

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>---- | AWARDED<br>AMOUNT<br>----- |
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REQUIREMENTS AND DESIGN ISSUES SURROUNDING THE DEVELOPMENT OF AN ADA-BASED ENVIRONMENT SUPPORTING THE DEVELOPMENT AND OPERATIONS OF DECISION AIDS. THE PROJECT WILL ANALYZE EXISTING AND ENVISAGED DECISION AIDS AND DECISION AID LANGUAGES IN ORDER TO DERIVE REQUIREMENTS ON THE DASE. THE SUITABILITY OF ADA FOR DECISION AID SUPPORT WILL BE THOROUGHLY INVESTIGATED, AND MECHANISMS FOR INTERFACING ADA WITH OTHER DECISION AID LANGUAGES WILL BE EXAMINED. THE PHASE I EFFORT WILL ALSO DETERMINE THE FEASIBILITY OF INTER-OPERABLE DECISION AID DATABASES AND USER INTERFACES THAT CAN BE EFFECTIVELY UTILIZED BY DECISION AIDS WRITTEN IN DIFFERENT LANGUAGES. THE DASE APPROACH WILL INTEGRATE PROCEDURAL LANGUAGES WITH ARTIFICIAL INTELLIGENCE LANGUAGES, USING EACH LANGUAGE WHERE IT IS BEST SUITED FOR DEVELOPMENT.

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| VERITE'/TECHNOLOGY GROUP<br>1614 WEST AHAHEIM ROAD<br>HARBOR CITY, CA 90710<br>PHILIP A. DE LANGIS<br>TITLE:<br>WIRELESS 12 LEAD CARDAC MONITORING SYSTEM FOR PULMONARY STRESS TESTING<br>TOPIC:        96            OFFICE: SGRD-RMA | ARMY | \$ 49,489 |
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PHASE ONE WILL DETERMINE THE FEASIBILITY AND PERFORMANCE CHARACTERISTICS OF A 12-CHANNEL MULTIPLEXED TRANSMITTER/RECEIVER TELEMETRY SYSTEM UTILIZING A UNIQUE MODE OF MODULATION (CONTINUOUSLY VARIABLE SLOPE DETECTION CVSD) THAT ALLOWS TRANSMITTER TO REMAIN IN A "POWER-OFF" CONDITION ABOUT 90% OF THE TIME FOR A 12-CHANNEL SYSTEM (ABOUT 99% OF THE TIME FOR A SINGLE-CHANNEL SYSTEM). DVSD CONFINES TRANSMISSION TO ONLY THOSE INTERVALS WHEN A RATE OF CHANGE OF SENSOR-GENERATED INFORMATION IS DETECTED. TRANSMITTER HAS A DUTY CYCLE OF ABOUT 9-10% FOR A 12-LEAD SYSTEM (ABOUT 1% FOR SINGLE-CHANNEL OPERATION). THIS EXTREMELY LOW POWER CONSUMPTION GREATLY EXTENDS LIFE OF THE SMALL (HEARING-AID SIZE) BATTERY TO BE USED. CVSD ALSO GREATLY EXTENDS TRANSMISSION RANGE WHILE COMPLYING WITH FCC REGULATIONS. USE OF VSLI CIRCUITRY WILL OBTAIN A MICRO-MINIATURIZED MODULAR TRANSMITTER THAT NEEDS NO ADJUSTMENTS. SYSTEM RECEIVER WILL BE A HIGH-RELIABILITY, EXTREMELY FREQUENCY-STABLE, LOW NOISE UNIT THAT NEEDS NO ADJUSTMENT OR CALIBRATION BY OPERATING PERSONNEL.

FISCAL YEAR 1984

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| VERSAR INC.<br>P.O. BOX 1549, 6850 VERSAR CENTER<br>SPRINGFIELD, VA 22151<br>DR. ROBERT G. SHAVER<br>TITLE:<br>CONDUCTIVE RETICULATED RESILIENT POLYMER FOAM<br>TOPIC: 83 OFFICE: AFWAL/XRPM | AF           | \$ 54,238                  |

METAL DEPOSITION AND COATING PROCESSES DEVELOPED AT VERSAR INC. MAKE IT POSSIBLE TO MODIFY COMMERCIALY AVAILABLE RETICULATED FOAM MATERIALS SO THAT THEY WILL BE MORE CONDUCTIVE WITHOUT DEGRADING OTHER PROPERTIES UNACCEPTALY. THEREBY THE PROBLEM OF ELECTROSTATIC CHARGE BUILDUP DURING AIRCRAFT REFUELING OPERATIONS CAN BE ALLEVIATED AND THE RISK OF FIRES REDUCED. TWO PARALLEL APPROACHES ARE SUGGESTED: METAL COATING THE FOAM STRUCTURE AND METAL IMPREGNATING THE FOAM POLYMER MASS. EITHER SHOULD ACHIEVE THE OBJECTIVE OF REDUCED RESISTIVITY AND GOOD PHYSICAL PROPERTIES IN THE TREATED FOAM. WE PROPOSE TO INVESTIGATE A NUMBER OF COMBINATIONS OF METALS AND PROCESSES INVOLVING COBALT, NICKEL, COPPER, SILVER, GOLD AND PALLADIUM. FROM THESE WILL BE SELECTED THE BEST IN TERMS OF ATTAINED CONDUCTIVITY, PROCESSING EASE, AND FREEDOM FROM MATERIALS PROBLEMS. THE BEST PROCESS (ES) WILL BE USED TO PRODUCE SPECIMENS THAT WILL BE EVALUATED UNDER MIL-B-83054 TO SHOW THAT FEASIBILITY HAS BEEN ATTAINED IN PHYSICAL PROPERTIES AS WELL AS CONDUCTIVITY. A WORKING RELATIONSHIP ALREADY EXISTS BETWEEN VERSAR AND AFWAL (MLBT) FROM JOINT EVALUATIONS OF OTHER MATERIALS.

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| VERSAR INC.<br>6850 VERSAR CENTER<br>SPRINGFIELD, VA 22151<br>NORMAN W. GABEL<br>TITLE:<br>LOW TOXICITY CHEMICAL/BIOLOGICAL AGENT DECONTAMINANTS<br>TOPIC: 246 OFFICE: BMO/PMX | AF | \$ 62,315 |
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VERSAR PROPOSES TO EXAMINE THE EFFECTIVENESS OF COMMERCIALY AVAILABLE CLAYS SUSPENDED IN LIQUID MEDIA TO REMOVE ORGANOPHOSPHORUS POISON, MUSTARD, PROTEINACEOUS MATERIAL, AND POLYNUCLEOTIDES FROM CONTAMINATED OBJECTS. THIS EFFECTIVENESS WILL BE EVALUATED BY

FISCAL YEAR 1984

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MEASURING AND COMPARING THE COMPONENTS OF THE PARTITIONING/SORPTIVE PROCESS THAT ARE RESPONSIBLE FOR REMOVAL OF THE AGENTS. PHASE I EXPERIMENTS WILL TEST: (A) SORPTION OF CHEMICAL/BIOLOGICAL AGENTS FROM LIQUID MEDIUM BY SORBENT, (B) SORPTION OF CHEMICAL AGENT BY PERMEABLE SURFACE MATERIAL IN THE PRESENCE OF LIQUID MEDIUM, AND (C) RETENTION OF CHEMICAL/BIOLOGICAL AGENT BY SORBENT. CLAY-CONTAINING FORMULATIONS FOR DECONTAMINATION, UNLIKE FORMULATIONS WHICH CONTAIN STRONG OXIDIZERS OR BASES, SHOULD NOT DAMAGE THE SURFACES OF INTERIOR CONSTRUCTION MATERIALS OR STATE-OF-THE-ART ELECTRONIC EQUIPMENT. FURTHERMORE, REMOVAL OF AGENTS BY SORPTION WITH CLAY IS RAPID, E.G., ADSORPTION OF SOMAN BY CLAY SUSPENDED IN HEXANE IS ABOUT 90% COMPLETE WITHIN 30 SEC. THE RESULTS OBTAINED FROM PHASE I WILL ENABLE THE AIR FORCE TO DECIDE WHICH COMBINATIONS OF SORBENT AND SUSPENDING LIQUID TO DEVELOP FOR DECONTAMINATING THE INTERIOR OF A DEEP BASE.

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| VIGYAN RESEARCH ASSOCIATES, INC.<br>28 RESEARCH DRIVE<br>HAMPTON, VA 23666<br>SAHJENDRA N. SINGH<br>TITLE:<br>CONTROL OF ROBOTS AND MANIPULATORS BASED ON INVERTIBILITY, SERVO-COMPENSATION AND ULTIMATE BOUNDEDNESS<br>TOPIC:       5       OFFICE: DARPA | DARPA | \$ 48,026 |
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FOR PRECISE AND FAST TRAJECTORY FOLLOWING BY THE ROBOTIC SYSTEMS THE CONTROL SYSTEM DESIGN BASED ON SINGLE-INPUT, SINGLE-OUTPUT MODEL FOR EACH JOINT IS NOT ADEQUATE. WE PROPOSE TO TAKE AN APPROACH FOR CONTROLLER DESIGN BASED ON RECENT RESULTS ON INVERTIBILITY AND FUNCTIONAL REPRODUCIBILITY IN MULTIVARIABLE NONLINEAR SYSTEMS. THE CONCEPT OF FUNCTIONAL REPRODUCIBILITY IS RELATED TO THE ABILITY OF SYSTEMS TO FOLLOW DESIRED TRAJECTORIES AND THUS IS QUITE APPROPRIATE FOR DESIGNING CONTROLLER SO THAT ROBOT TRAJECTORY CAN AVOID OBSTACLES AND CERTAIN FORBIDDEN REGIONS. FOR THE DESIGN FIRST THE MATHEMATICAL MODEL USING LAGRANGIAN APPROACH WILL BE DERIVED. TO THIS END, WE MAKE JUDICIOUS CHOICE OF CONTROLLED OUTPUTS OF THE ROBOTIC SYSTEM. PRIMARY LOOP WILL BE DESIGNED BASED ON RIGHT INVERTIBILITY AND REPRODUCIBILITY RESULTS. ALTHOUGH, THIS CONTROLLER DOES GIVE ABILITY TO THE ROBOT AND MANIPULATOR TO FOLLOW DESIRED PATHS, THE PERFORMANCE DETERIORATES UNDER CHANGE OF PAYLOAD. IN ORDER TO HAVE GOOD TRACKING ABILITY UNDER PARAMETER VARIATIONS WHEN THE ROBOTS PICKS AND DROPS

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>----- | AWARDED<br>AMOUNT<br>----- |
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HEAVY LOADS, OUTER-LOOP USING SERVOCOMPENSATION AND ULTIMATE BOUNDEDNESS THEORY AROUND THE PRIMARY LOOP WILL BE DESIGNED. THE FEEDBACK GAINS WILL BE DESIGNED BASED ON EXTENSIVE COMPUTER SIMULATIONS.

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| VIKING INSTRUMENTS CORPORATION<br>701 CLEAR SPRING ROAD<br>GREAT FALLS, VA 22066<br>RUSSELL C. DREW<br>TITLE:<br>DEVELOPMENT OF AN ADVANCED MINIATURIZED MASS SPECTROMETER FOR RAPID RESPONSE CHEMICAL/BIOLOGICAL WARFARE AGENT DETECTION<br>TOPIC: 245            OFFICE: BMO/PMX | AF | \$ 48,000 |
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ADAPTION OF A MINATURIZED MASS SPECTROMETER TO NEAR-INSTANTANEOUS DETECTION OF BW AND CW AGENTS IS PROPOSED AS AN EARLY WARNING AND MONITORING DEVICE FOR USE IN DEEP BASES OR IN OTHER SETTINGS THAT MAY NEED SUCH PROTECTION. THE TECHNOLOGY UPON WHICH THIS DEVELOPMENT IS BASED IS DERIVED FROM THE COMPACT, LIGHTWEIGHT, RUGGED AND HIGHLY AUTOMATED GAS CHROMATOGRAPH/MASS SPECTROMETER THAT WAS DEVELOPED BY NASA AND FLOWN SUCCESSFULLY ON THE TWO VIKING MARS LANDER MISSIONS. IN THIS PHASE I EFFORT, THE FEASIBILITY OF REMOVING THE MS AND PERFORMING DIRECT MS DETECTIONS WILL BE DETERMINED. IN ORDER TO IMPROVE THE UNAMBIGUOUS DETECTION OF COMPOUNDS OF INTEREST, TWO OPTIONS WILL BE EVALUATED; (1) DIRECT MS WITH EOID DETECTION AND COMPUTER-AIDED CHEMICAL COMPOUND SIGNATURE MATCHING; AND (2) TANDEM MS/MS WITH SELECTED ION MONITORING OF PRIMARY MOLECULAR IONS IN THE FIRST STAGE AND DETAILED CONFIRMATION OF THE TARGET COMPOUNDS BY MATCHING DAUGHTER ION DETECTION FROM THE SECOND STAGE. DETECTION OF COMPOUNDS THAT SIMULATE CW AGENTS WILL BE DEMONSTRATED ON A BREADBOARD MS SYSTEM.

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| VIRGINIA RESEARCH ASSOCIATES<br>607 RAINBOW RIDGE DRIVE<br>BLACKSBURG, VA 24060<br>DR. JOSEPH A. SCHETZ<br>TITLE:<br>NEW FLOW VISUALIZATION TECHNIQUE FOR WATER TUNNEL TESTING OF COMBUSTORS<br>TOPIC: 105            OFFICE: AFWAL | AF | \$ 22,646 |
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A NEW TECHNIQUE FOR VISUALIZING THE FLOW IN WATER TUNNEL OF COM-

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>---- | AWARDED<br>AMOUNT<br>----- |
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BUSTORS AND MIXERS IS PROPOSED. THE TECHNIQUE IS BASED UPON THE USE OF A NEWLY DEVELOPED TYPE OF MATERIAL - NEUTRAL-DENSITY, BILIQUID FOAMS OR "POLYAPHRONS." THESE MATERIALS ARE SMALL, SPHERICAL GLOBULES OF ONE LIQUID ENCAPSULATED IN A THIN FILM OF ANOTHER LIQUID. THEY DO NOT DISSOLVE, BREAK-UP OR COALESCE WHEN INJECTED INTO WATER. THEY ARE EASY TO SEE AND PHOTOGRAPH IN WATER, AND THEY CAN ALSO BE DYED TO A VARIETY OF INTENSE COLORS. PRELIMINARY TESTING HAS SHOWN GREAT POTENTIAL IMPROVEMENTS OVER ALL EXISTING METHODS. THE PHASE I PROGRAM INVOLVES A THOROUGH TRIAL APPLICATION USING A REALISTIC COMBUSTOR MODEL AT REPRESENTATIVE TEST CONDITIONS.

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| VISIDYNE CORPORATION<br>P. O. BOX 2867<br>CONROE, TX 77305<br>DR. WM J. BENJAMIN<br>TITLE:<br>SURVEY OF EXTENDED WEAR CONTACT LENSES FOR POTENTIAL USE BY COMBAT AIRCREWS<br>TOPIC: 102      OFFICE: SGRD-RMA | ARMY | \$      0 |
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AN EVALUATION OF AVAILABLE EXTENDED-WEAR HYDROGEL CONTACT LENS FOR POSSIBLE USE BY MILITARY AIRCREWS UNDER COMBAT CONDITIONS. THIS EVALUATION WILL QUANTITATIVELY AND OVALITATIVELY CHARACTERIZE EACH SUCH LENS AGAINST DOA PROVIDED MILITARY REQUIREMETNS. THE RESULT WILL BE THE SELECTION OF A FAMILY OF LENSES FOR FURTHER CLINICAL AND FIELD INVESTIGATION AND EVALUATION.

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| VISIDYNE, INC.<br>5 CORPORATE PLACE SOUTH BEDFORD ST.<br>BURLINGTON, MA 01803<br>DR. STEVEN H. LANGER<br>TITLE:<br>INTERMEDIATE ALTITUDE SHOCK WAVE DYNAMICS AND CHEMISTRY<br>TOPIC: 1      OFFICE: OAM | DNA | \$ 63,193 |
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INTERMEDIATE ALTITUDE (~50-100 KM) NUCLEAR EVENTS PRODUCE A STRONG SHOCK. THE MATERIAL HEATED BY THIS SHOCK RADIATES IN MANY IR MOLECULAR BANDS. ACCURATE MODELING OF THE IR EMISSION IS POSSIBLE ONLY IF THE GAS STRUCTURE NEAR THE SHOCK CAN BE DETERMINED. A NUMERICAL

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>----- | AWARDED<br>AMOUNT<br>----- |
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HYDRODYNAMICS CODE THAT USES A DYNAMICAL ADAPTIVE GRID (DAG) CAN GIVE HIGH SPATIAL RESOLUTION NEAR THE SHOCK WHILE THE SHOCK PROPAGATES OVER LARGE DISTANCES, WITHOUT REQUIRING LARGE AMOUNTS OF COMPUTER TIME. WE PROPOSE TO WRITE AN ADAPTIVE GRID CODE THAT IS DESIGNED SPECIFICALLY TO CALCULATE THE QUANTITIES OF INTEREST FOR MODELING IR MOLECULAR BANDS. THIS COULD LATER BE INCLUDED IN THE ROSCOE CODE (OR ITS DERIVATIVES) TO YIELD IMPROVED MODELS OF IR EMISSION.

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| VISIDYNE, INC.<br>5 CORP PL, S. BEDFORD ST.<br>BURLINGTON, MA 01803<br>ORR SHEPHERD<br>TITLE:<br>FIELD OF VIEW MONITOR FOR BALLOONBORNE LIDAR<br>TOPIC: 207            OFFICE: AFGL/XOP | AF | \$ 67,000 |
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A FIELD OF VIEW MONITOR IS PROPOSED TO AUGMENT A BALLOONBORNE LIDAR SYSTEM WHICH WILL BE USED TO STUDY ATMOSPHERIC PROPERTIES IN THE ALTITUDE REGION FROM 35 KM TO THE GROUND. THE MONITOR WILL PROVIDE INFORMATION REGARDING TERRAIN AND CLOUD CONDITIONS IN THE LIDAR FIELD OF VIEW, AND SUCH KNOWLEDGE WILL SIGNIFICANTLY ENHANCE THE ANALYSIS OF LIDAR DATA. THE BALLOONBORNE NADIR-LOOKING FIELD OF VIEW MONITOR WILL CONSIST OF AN INTENSIFIED CHARGE INJECTION DEVICE CAMERA WHICH WILL PROVIDE REAL TIME HIGH SPATIAL RESOLUTION VIDEO IMAGERY OF A 3 DEGREE BY 4 DEGREE FIELD UNDER STARLIGHT ILLUMINATION CONDITIONS. COALIGNED WITH THE CAMERA WILL BE A 10 PM RADIOMETER WHICH WILL PROVIDE VERY ACCURATE TEMPERATURE MEASUREMENT WITHIN A 20 MR PIXEL. CORRELATION OF THE DATA FROM EACH OF THESE TWO STATE OF THE ART SENSORS WITH THAT FROM THE LIDAR WILL PROVIDE THE REQUIRED CLOUD AND GROUND TERRAIN INFORMATION.

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| VRA<br>P.O. BOX 50<br>BLACKSBURG, VA 24060<br>CLARK H. LEWIS<br>TITLE:<br>RV BOUNDARY LAYER PLASMA<br>TOPIC: 253            OFFICE: BMO/PMX | AF | \$ 48,892 |
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CARBON, EPOXY AND TEFLON ARE SOME OF THE MOST COMMON AND FREQUENTLY

FISCAL YEAR 1984

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USED MATERIALS FOR RV APPLICATIONS. UNDER HYPERSONIC REENTRY CONDITIONS AT HIGH ANGLES OF ATTACK THE ABLATION PRODUCTS FROM THESE MATERIALS MAY SIGNIFICANTLY AFFECT THE FLOWFIELD CHEMISTRY AROUND THE BODY, THE ELECTRON CONCENTRATION IN THE SHOCK-LAYER AND THE INITIAL PROFILE DATA FOR THE WAKE CALCULATIONS. IN THIS EFFORT WE PROPOSE TO DEVELOP A COMPUTATIONAL SCHEME FOR PREDICTING SUCH NON-EQUILIBRIUM FLOWFIELDS. IN PHASE I OF THIS EFFORT, WE WILL STUDY THE VISCOUS HYPERSONIC REENTRY FLOWS AT MODERATE ANGLES OF ATTACK IN A CARBON-AIR SYSTEM. WE WILL EXTEND AND MODIFY OUR EXISTING THREE DIMENSIONAL NONEQUILIBRIUM VISCOUS SHOCK-LAYER SCHEMES (FOR AIR ONLY) TO INCLUDE A FINITE-RATE CHEMICALLY REACTING CARBON-AIR GAS CHEMISTRY MODEL, AND RUN SOME SAMPLE CASES TO VALIDATE THE CODE. IN PHASE II, WE WILL EXTEND THIS SCHEME TO STUDY MORE COMPLICATED SYSTEMS COMPOSED OF TEFLON AD EPOXY ABLATION PRODUCTS IN FINITE-RATE CHEMICALLY REACTING AIR. DUE TO THE LARGE NUMBER OF SPECIES INVOLVED, A MAJOR PART OF THE EFFORT WILL INVOLVE AN EXTENSIVE LITERATURE SURVEY TO OBTAIN THE THERMODYNAMIC, TRANSPORT AD THERMOCHEMICAL PROPERTIES OF THESE SPECIES AD THE REACTION RATE DATA.

W. J. SCHAFER ASSOCIATES, INC.  
22222 SHERMAN WAY, #205  
CANOGA PARK, CA 91303  
JEFFREY B. SHELLAN

NAVY

\$ 63,864

TITLE:  
ANTI-REFLECTIVE WINDOW COATINGS  
TOPIC: 104 OFFICE: NWSC

THE OBJECTIVE OF THIS TASK IS TO DESIGN SPECIALIZED AR COATINGS FOR USE IN STATE-OF-THE-ART MULTI-ELEMENT OPTICAL SYSTEMS. COMPUTER PROGRAMS USING THE LATEST SYNTHESIS TECHNIQUES WILL BE USED AND MERIT FUNCTIONS TAILORED TO OPTIMIZE THE SYSTEM PERFORMANCE FOR THE SPECIFIC MISSION CONSIDERED. IN PARTICULAR, AR COATINGS THAT MINIMIZE SPURIOUS REFLECTIONS IN OPTICAL ELEMENTS USED IN STAR SENSING WILL BE DEVELOPED. AN EMPHASIS WILL BE PLACED ON DESIGNS THAT USE MATERIALS THAT ARE STABLE IN A VARIETY OF ENVIRONMENTS AND THAT DO NOT REQUIRE OVERLY RESTRICTIVE THICKNESS CONTROL ON THE LAYERS. SENSOR RESPONSE, AS WELL AS THE SPECTRAL DISTRIBUTION OF THE LIGHT SOURCE, WILL BE USED IN FINDING THE BEST COATINGS. THE COATINGS DESIGNED, USING A VARIETY OF COMPUTER METHODS, WILL BE COMPARED TO ONE ANOTHER AS WELL AS TO MORE GENERAL AR COATINGS CURRENTLY BEING USED. THE MOST PROMISING

FISCAL YEAR 1984

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DESIGNS WILL LATER BE DEPOSITED AND TESTED IN A FOLLOW-UP PROGRAM.

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| W. W. GAERTNER RESEARCH, INC.<br>205 SADDLE HILL ROAD<br>STAMFORD, CT 06903<br>DR. W. W. GAERTNER<br>TITLE:<br>AUTOMATIC OPTICAL RECOGNITION OF PARTIALLY OBSCURED GROUND TARGETS<br>TOPIC:        2            OFFICE: DRSMC-RAM(D) | ARMY | \$ 60,707 |
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W.W. GAERTNER RESEARCH, INC. HAS DEVELOPED A VERY HIGH-SPEED 3D GRAPHICS SYSTEM FOR REAL-TIME TARGET SIMULATION AND WEAPONS TRAINING. IT IS NOW PROPOSED TO USE THIS SYSTEM TO COMPUTE 2D TEMPLATES FROM 3D MODELS OF THE MOST CHARACTERISTIC FEATURES OF TYPICAL TARGETS, AND TO EXECUTE A TEMPLATE-MATCHING ALGORITHM BETWEEN THESE SYNTHETIC TEMPLATES AND PARTIAL VIEWS OF SEMI-OBSCURED TARGETS CAPTURED ON A FRAME FROM AN IR, LLTV OR DAYLIGHT MONOCHROME OR COLOR CAMERA. THE SPEED OF THE NEW TEMPLATE GENERATION AND MATCHING HARDWARE IS SO HIGH THAT IT SHOULD ALLOW THE EXECUTION OF THE TARGET RECOGNITION PROCESS IN NEAR-REAL TIME, A GOAL WHICH WOULD NOT BE REALISTIC WITHOUT THE EXISTENCE OF THE ABOVE W.W. GAERTNER RESEARCH, INC. SUPER HIGH-SPEED GRAPHICS SYSTEM. THE OUTPUT FROM THE SYSTEM WOULD BE A TARGET IDENTIFICATION, RANGE AND DIRECTION PLUS A STATISTICAL MEASURE OF THE CONFIDENCE IN THE IDENTIFICATION. IT IS PROPOSED UNDER PHASE I TO IMPLEMENT A BASIC DEMONSTRATION OF THE CONCEPT USING THE W.W. GAERTNER RESEARCH, INC. IN-HOUSE GRAPHICS AND IMAGE PROCESSING SYSTEM. GIVEN SUCCESS, FULL-FLEDGED DEVELOPMENT COULD BE CARRIED OUT UNDER PHASE II.

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| W. W. GAERTNER RESEARCH, INC.<br>205 SADDLE HILL ROAD<br>STAMFORD, CT 06903<br>DR. W. W. GAERTNER<br>TITLE:<br>LSI OR VLSI CHIPS FOR LOW-COST COMPUTER IMAGE GENERATION (CIG)<br>TOPIC:        110            OFFICE: NTEC | NAVY | \$ 69,368 |
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LOW-COST CIG SIMULATORS FOR WEAPONS TRAINING COULD BE PRODUCED

FISCAL YEAR 1984

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THROUGH THE USE OF VLSI CHIPS SPECIFICALLY DESIGNED TO CARRY OUT THE MAJOR FUNCTIONS OF IMAGE GENERATION, NAMELY 3-D PERSPECTIVE, DIFFUSE REFLECTION AND SHADING, HIDDEN SURFACE REMOVAL AND OCCULTATION IN GENERAL, CLIPPING AND AREA FILL. THESE CHIPS WILL BE FAST ENOUGH TO ALLOW COMPUTATION AT 60 FRAMES/SEC WITH A RESOLUTION OF 1024 X 1024 OR 1280. THESE CHIPS WILL REPLACE THOUSANDS OF INTEGRATED CIRCUITS ON THE COMPLEX AND COSTLY CIRCUIT BOARDS CURRENTLY NEEDED IN HIGH-RESOLUTION REAL-TIME CIG SYSTEMS. W.W. GAERTNER RESEARCH INC. IS PRODUCING SUCH SYSTEMS AND HAS ACTIVE SIMULATOR INSTALLATIONS AT NADC, WPAFB, FORT RUCKER, BOEING, GRUMMAN, VOUGHT, MARTIN-MARIETTA, HONEYWELL AND OTHERS. THE PROPOSED WORK WOULD CONSIST OF (A) IDENTIFYING THE FUNCTIONS TO BE REDUCED TO CHIP FORM, (B) PARTITIONING THEM INTO SUBFUNCTIONS OF A COMPLEXITY WHICH CAN BE HANDLED BY PRESENT VLSI TECHNOLOGY, (C) DEFINING THE CONVERSION PROCESS, (D) ESTABLISHING SOURCES AND PRICES FOR THE CHIPS, AND (E) PERFORMING AN ECONOMIC ANALYSIS TO DERIVE THE PROJECTED COST OF A VLSI CIG SYSTEM AS A FUNCTION OF THE NUMBER OF UNITS PRODUCED.

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| WAUGH CONTROLS CORPORATION<br>9001 FULLBRIGHT AVENUE<br>CHATSWORTH, CA 91311<br>MILTON H. NOVEMBER<br>TITLE:<br>WIDE RANGE FUEL FLOW METER<br>TOPIC: 139      OFFICE: AEDC/DOT | AF | \$ 50,000 |
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OBJECTIVES OF THIS PROJECT ARE TO INVESTIGATE TWO INNOVATIVE DESIGNS FOR TURBINE METERS HAVING AN ACCURACY OF 1% OR BETTER OVER A WIDE RANGE OF FLOW RATES, IN THE AREA OF 140 OR 1 OR BETTER. ANALYSES WILL BE PERFORMED TO DETERMINE THE EXPECTED PERFORMANCE CHARACTERISTICS OF EACH DESIGN, AND ONE DESIGN SELECTED FOR BREADBOARD DESIGN, FABRICATION AND TEST. DESIGNS TO BE STUDIED AND TESTED INCORPORATED NOVEL MEANS FOR OVERCOMING THE VARIOUS DRAG FORCES WHICH LIMIT LINEARITY, ACCURACY AND REPEATABILITY OF TURBINE METERS AT FLOW RATES BELOW THE NORMAL RANGE ACHIEVABLE WITH CONVENTIONAL DESIGNS. A WORKING MODEL WILL BE TESTED FOR ACCURACY, LINEARITY, REPEATABILITY AND RELIABILITY, WITH THE RESULTS EVALUATED FOR FUTURE IMPROVEMENTS AND DEVELOPMENT INTO A PRODUCT SUITED FOR USE BY THE GOVERNMENT AND PRIVATE JET ENGINE TESTING FACILITIES. SUCH A METER IS WIDELY NEEDED IN ORDER TO OBTAIN ACCURATE FLOW.

FISCAL YEAR 1984

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DATA OVER WIDE RANGES OF FLOW RATES DURING ENGINE ACCELERATION. SEVERAL SIGNIFICANT INDUSTRIAL APPLICATIONS ARE ALSO ANTICIPATED.

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| WEBB RESEARCH CORP<br>769 PALMER AVE<br>FALMOUTH, MA 02540<br>DOUGLAS C. WEBB<br>TITLE:<br>A SWITCHED STATE SOURCE OF OCEAN ACOUSTIC TOMOGRAPHY<br>TOPIC: 6B            OFFICE: ONR | NAVY | \$ 40,360 |
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THIS PROPOSAL CONCERNS AN ACOUSTIC SOURCE FOR OCEAN ACOUSTIC TOMOGRAPHY. A SWITCHED STATE DESIGN IS PROPOSED. THIS APPROACH HAS NOT YET BEEN REDUCED TO PRACTICE, HOWEVER, THE RESEARCH RISKS MAY BE OFFSET BY THE PROMISE OF EXCELLENT PERFORMANCE IN TOMOGRAPHY APPLICATIONS. A SWITCHED STATE SOURCE COMPARED TO A CONVENTIONAL SOURCE OF THE SAME BANDWIDTH, FREQUENCY, AND EFFICIENCY WILL BE SMALLER, LIGHTER, LESS EXPENSIVE, AND EASIER TO DEPLOY. THESE GAINS ARE QUITE SIGNIFICANT, AS PRACTICAL CONVENTIONAL SOURCES WILL BE IN THE \$100-300K RANGE. THE PERFORMANCE GAIN CAN BE CONSIDERED AS A RESULT OF RADIATING ONLY THE SPECIFIC PHASE AND/OR FREQUENCY ENCODED SIGNAL REQUIRED FOR THE TOMOGRAPHIC EXPERIMENT. A CONVENTIONAL SOURCE CAN TRANSMIT ANY CODE, AND THIS UNIVERSALITY REQUIRES THAT IT BE LARGER THAN A SWITCHED STATE SOURCE. THE RESEARCH APPROACH PROPOSED INCLUDES THE DESIGN, CONSTRUCTION AND TESTS OF A PROTOTYPE TRANSDUCER, AND PRELIMINARY DESIGN OF A PHASE II SOURCE.

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| WESTERN COMMUNICATIONS INCORPORATED<br>926 EAST SAINT ANDREW STREET<br>RAPID CITY, SD 57701<br>MICHAEL A. LEES<br>TITLE:<br>EXAMINING METHODS USED TO ASSESS HUMAN PERFORMANCE DURING THE OPERATION OF A DYNAMIC VEHICLE: A LITERATURE REVIEW AND CRITIQUE<br>TOPIC: 97            OFFICE: SGRD-RMA | ARMY | \$ 45,636 |
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AS THE SOPHISTICATION OF HIGH TECHNOLOGY COMBAT VEHICLES INCREASES, THE HUMAN OPERATOR MAY BECOME THE WEAK LINK, PREVENTING MISSION

FISCAL YEAR 1984

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ACCOMPLISHMENT DUE TO INCREASED WORKLOAD AND STRESS. TO ADDRESS THE OPERATOR PERFORMANCE ASPECTS OF DYNAMIC COMBAT VEHICLES, THE MILITARY SCIENTIST OR ENGINEER REQUIRES A USEABLE SOURCE DOCUMENT TO FACILITATE THE DEVELOPMENT OF TESTS OR EVALUATIONS OF MILITARY VEHICLES. THIS PROPOSAL SUGGESTS AN APPROACH THAT WOULD REVIEW THE SCIENTIFIC LITERATURE TO IDENTIFY THE MAJOR HUMAN PERFORMANCE ASSESSMENT METHODS THAT HAVE BEEN USED TO ASSESS OPERATOR PERFORMANCE IN A DYNAMIC VEHICLE. THESE RESEARCH REPORTS WILL BE FURTHER EXAMINED TO DETERMINE THE APPLICABILITY OF EACH MAJOR APPROACH TO PERFORMANCE ASSESSMENT IN MILITARY VEHICLES. THIS LITERATURE REVIEW AND CRITICAL EXAMINATION OF THE RESEARCH REPORTS WILL YIELD AN IMPORTANT BACKGROUND DOCUMENT THAT IS BOTH RELEVANT TO THE EVALUATION OF HUMAN PERFORMANCE IN A DYNAMIC VEHICLE, AND IS STRUCTURED FOR READY USE BY MILITARY SCIENTISTS AND ENGINEERS.

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| WESTON GEOPHYSICAL CORPORATION                            | AF               | \$ 49,250 |
| P. O. BOX 550   |                  |           |
| WESTBORO, MA 01581  |                  |           |
| VINCENT J. MURPHY   |                  |           |
| TITLE:  |                  |           |
| SIMULATED GROUND RESPONSE USING NON-LINEAR ELASTIC MODULI |                  |           |
| TOPIC: 214  | OFFICE: AFGL/XOP |           |

THE PROPOSED RESEARCH IS RELATED TO A LONG STANDING NEED FOR THE KNOWLEDGE OF MODULI VALUES OF EARTH MATERIALS AS THEY EXIST AT LARGE STRAIN LEVELS SUCH AS DURING EARTHQUAKE LOADINGS. THE DETERMINATIONS OF SUCH MODULI AT LOW STRAIN LEVELS ARE THE OBJECTIVES OF NUMEROUS WESTON GEOPHYSICAL PROJECTS BY THE DESIGNATED PRINCIPAL INVESTIGATOR FOR MANY YEARS; IN ADDITION, AND ON NUMEROUS OCCURRENCE, SUCH LOW STRAIN DATA WERE COMPARED TO STATICALLY DETERMINED MODULI VALUES. ATTEMPTS TO RECONCILE DIFFERENCES BETWEEN LOW LEVEL AND HIGH LEVEL DATA HAVE GENERALLY LED TO ONLY "RULE-OF-THUMB" RELATIONSHIP WHOSE RELIABILITY IS UNCERTAIN.

THE NEED FOR RESEARCH AND DEVELOPMENT OF SUCH A RELATIONSHIP, BETWEEN LOW STRAIN LEVEL MODULI AND HIGH STRAIN LEVEL MODULI IS THEREFORE APPARENT IN ORDER TO CORRECTLY PREDICT THE EFFECTS OF EARTHQUAKES ON MAN MADE STRUCTURES, SUCH AS TALL BUILDINGS, SILOS OF VARIOUS TYPES, AND OTHER ABOVE-GROUND AND IN-GROUND FACILITIES OF A CRITICAL NATURE WHOSE FUNCTION MUST BE ASSURED DURING EVENTS OF STRONG SHAKING. THE WORK EFFORTS OF THIS PHASE I RESEARCH PROPOSAL WILL THEREFORE

FISCAL YEAR 1984

| SUBMITTED BY<br>----- | DEPT<br>---- | AWARDED<br>AMOUNT<br>----- |
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CONSTITUTE THE INITIAL TASKS LEADING TO THE DEVELOPMENT OF SUCH A RELATIONSHIP FOR MODULI VALUES AT THE DIFFERENT STRAIN LEVELS.

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| WILFRED BAKER ENGINEERING<br>218 E. EDGEWOOD PLACE<br>SAN ANTONIO, TX 78209<br>DR. WILFRED E. BAKER<br>TITLE:<br>DEVELOPMENT OF DYNAMIC AIRBLAST GAGE FOR 80,000 psi EXPLOSIVE ENVIRONMENT<br>TOPIC: 70                      OFFICE: WESVB | ARMY | \$ 84,941 |
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A DESIGN FOR A RUGGED, HIGH-FREQUENCY, ACCELERATION-INSENSITIVE AIRBLAST GAGE IS PROPOSED. THE PROPOSED GAGE SHOULD HAVE ITS FUNDAMENTAL VIBRATION FREQUENCY ABOVE 400 KHZ, BE ROUGHLY CYLINDRICAL IN SHAPE WITH DIAMETER AND LENGTH BOTH LESS THAN ONE INCH, AND HAVE BUILT-IN COMPENSATION WHICH WILL LIMIT SPURIOUS SIGNALS DUE TO ACCELERATION TO VERY LOW LEVELS. FULL-SCALE OUTPUT FOR AN APPLIED AIRBLAST PRESSURE OF 80,000 PSI SHOULD BE ABOUT 30 MV WITH AMPLIFIER GAIN OF ONE, AND 300 MV WITH A LOW AMPLIFIER GAIN OF 10. SIGNAL CONDITIONERS WILL NOT BE A PART OF THE GAGE, BUT CAN BE REMOVED THOUSANDS OF FEET WITH NO IMPAIRMENT OF GAGE RESPONSES.

THE PROPOSAL SHOWS THE DESIGN CONCEPT, GIVES RESULTS OF DESIGN CALCULATIONS TO PREDICT GAGE RESPONSE, AND PRESENTS A PROGRAM FOR FINAL DESIGN, CONSTRUCTION OF PROTOTYPE GAGES, AND BLAST AND ACCELERATION TESTING OF THE PROTOTYPE GAGES.

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| XMCO INC.<br>8200 GREENSBORO DRIVE, SUITE 801<br>MCLEAN, VA 22102<br>ANTHONY F. QUATTROMANI<br>TITLE:<br>LOGISTICS SUPPORT ANALYSIS OF MAJOR WEAPONS ACQUISITION<br>TOPIC: 118                      OFFICE: AMD/RDO | AF | \$ 59,711 |
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THE OBJECTIVES OF THIS STUDY ARE: (1) TO IDENTIFY CURRENTLY AVAILABLE LARGE-SCALE ANALYTICAL MODELS THAT, ALONE OR IN COMBINATION, ADDRESS THE ENTIRE LOGISTIC ENVIRONMENT AND

FISCAL YEAR 1984

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POTENTIALLY CAN BE IMPLEMENTED ON LESS EXPENSIVE AND EASIER TO USE MICROCOMPUTERS; AND (2) TO DETERMINE THE PRACTICALITY OF IMPLEMENTING SELECTED MODELS ON MICROCOMPUTERS, GIVEN CURRENT ANALYTICAL AND MICROCOMPUTER TECHNOLOGIES. THE STUDY WILL IDENTIFY THOSE ANALYTICAL MODELS THAT HOLD THE GREATEST POTENTIAL MICROCOMPUTER IMPLEMENTATION AND WILL ASSESS THE ABILITY OF CURRENT MODELS TO ADDRESS THE ENTIRE LOGISTICS ENVIRONMENT. ALTERNATIVE APPROACHES TO APPLYING MICROCOMPUTER TECHNOLOGY TO THE MODELS WILL BE DEVELOPED. THE STUDY WILL SUGGEST AN APPROACH TO THE USE ON MICROCOMPUTER TECHNOLOGY IN SUPPORTABILITY ANALYSIS BASED ON CURRENT AND EMERGING TECHNOLOGIES.

TOTAL NUMBER OF AWARDS: 370 TOTAL AMOUNT AWARDED: \$19,450,618

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