

ARMY SMALL BUSINESS INNOVATION RESEARCH PROGRAM

SUBMITTING PROPOSALS ON ARMY TOPICS

Topics

Topics A86-001 – A86-035

Commander
Armament Research and Development Center
U.S. Army Armament, Munitions, and Chemical Command
ATTN: SMCAR-RAM
SBIR PROGRAM
Dover, NJ 07801

Topics A86-036 – A86-039

Commander
U.S. Army Armament, Munitions, and Chemical Command
ATTN: AMSMC-PC-B(A) Mr. Henry
Procurement Directorate
Edgewood Site/Bldg. E4455
Aberdeen Proving Ground, MD 21010

Topics A86-040 – A86-046

Commander
U.S. Army Aviations Systems Command
ATTN: AMSAV-PSRS
SBIR PROGRAM
Building 102
4300 Goodfellow Blvd.
St. Louis, MO 63120-1798

Topics A86-047 – A86-076

Commander
U.S. Army Communication – Electronics Command
ATTN: AMSEL-PC-CM-E
SBIR PROGRAM
Fort Monmouth, NJ 07703-5008

Topics A86-077 – A86-095

Commander
U.S. Army Laboratory Command
ATTN: AMDEL-TI
SBIR PROGRAM
2800 Powder Mill Road
Adelphi, MD 20783-1145

Topics A86-096 – A86-104

Commander
U.S. Army Belvoir R&D Center
ATTN: STRBE-PM/P&P Division
SBIR Program
Ft. Belvoir, VA 22060

Topics A86-105 – A86-112

Commander
U.S. Army Missile Command
ATTN: AMSMI-IYBA
Bldg. 4488
SBIR Program
Warren, MI 48090

Topics A86-113 – A86-123

Commander
U.S. Army Armament, Munitions, and Chemical Command
ATTN: AMSMC-PC-B(A) Mr. Henry
Procurement Directorate
Edgewood Site/Bldg. E4455
Aberdeen Proving Ground, MD 21010

Topics A86-124 – A86-132

Director
U.S. Army Materials and Mechanics Research Center
ATTN: AMXMR-PP
Program Planning Division
Bldg. 131 Room 143
405 Arsenal Street
Watertown, MA 02172-2719

Topics A86-133

Commander
U.S. Army Armament, Munition and Chemical Command
Procurement Directorate-Edgewood Site
ATTN: AMSMC-PR-B(A)
Bldg. E4455
SBIR Program
APG-EA, MD 21010

Topics A86-134 – A86-140

Director
U.S. Army Natick Research and Development Center
ATTN: STRNC-P
SBIR Program
Kansas Street
Natick, MA 01760

Topics A86-141 – A86-156

Director
U.S. Army Ballistic Research Laboratory
ATTN: AMXBR-PM-B
Bldg. 328, Room 229A
SBIR Program
Aberdeen Proving Ground, MD 21005-5006

Topics A86-157 – A86-183

Commander
U.S. Army Test and Evaluation Command
ATTN: AMSTE-PR
SBIR Program
Aberdeen Proving Ground, MD 21005-5006

Topics A86-184

Commander
Directorate of Contracting
Bldg. 46
ATTN: ATZE-DOC
SBIR Program
Carlisle Barracks, PA 17013-5002

Topics A86-185 – A86-190

Commander
U.S. Army Engineering Topographic Laboratories
ATTN: ETL-PRO
Plans & Programs Office, Building 2592, Room AG
SBIR Program
Ft. Belvoir, VA 22060

Topics A86-191 – A86-200

Commander
U.S. Army Construction Engineering
Research Laboratory
ATTN: Chief Procurement and Supply Branch
2902 Newmark Drive
Bldg. #1, Room 175-1
SBIR Program
Champaign, IL 61821

Topics A86-201

Commander
U.S. Army Cold Regions Research And Engineering Laboratory
ATTN: CRREL-AL
72 Lyme Road
SBIR Program
Hanover, NH 03755-1290

Topics A86-202 – A86-208

Commander
U.S. Army Waterways Experiment Station
P.O. Box 631
SBIR Program
Vicksburg, MS 39180-00631

Topics A86-209 – A86-220

Commander
U.S. Army Medical Research And Development Command
ATTN: SGRD-RMA
SBIR Program
Ft. Detrick
Frederick, MD 21701

Topics A86-221 – A86-225

Commander
U.S. Army Research Institute For the Behavioral and Social Sciences
ATTN: PERI-BR
SBIR Program
5001 Eisenhower Avenue
Alexandria, VA 22333-0001

ARMY RESEARCH TOPICS FOR FY86 SBIR SOLICITATION

A86-001 TITLE: FEASIBILITY STUDY FOR A ROBOTIC CONTROL SYSTEM FOR A ROBOTIC HOWITZER

CATEGORY: Exploratory Development

DESCRIPTION: A study is required to determine the possibility of upgrading the robot control system presently in use on the Integrated Smart Artillery Synthesis (ISAS) robotic howitzer into a multipurpose system. The new system should be able to perform all the functions currently being performed by the fire control system and the robot control system autonomously.

A86-002 TITLE: FEASIBILITY STUDY FOR APPLICATION OF ROBOTIC VISION IN A WEAPON SYSTEM

CATEGORY: Exploratory Development

DESCRIPTION: The (ISAS) Robotic Ammunition Handling system is presently controlled by activation of preprogrammed routines which allow the robot to maneuver and perform its required tasks. This system provides little adaptability to a changing environment and requires a large data base of programmed routines. A vision Z(not necessarily optical) capability would allow the robot to make its own decisions, should a change in environment occur, without a programmer inputting a new routine.

A86-003 TITLE: NEW ANALYTICAL PROCEDURES FOR ENERGETIC MATERIALS

CATEGORY: Exploratory Development

DESCRIPTION: There is a need for rapid analytical analysis during production processes to insure quality control.

A86-004 TITLE: NEW SYNTHETIC ROUTES FOR ENERGETIC MATERIALS

CATEGORY: Exploratory Development

DESCRIPTION: The expense of chemical energy munitions is, among other things, related to production. Costs could be reduced by simpler chemical routes to end products. A cheaper simpler synthesis of HMX would be desirable.

A86-005 TITLE: NEW ENERGETIC MATERIALS TO IMPROVE PERFORMANCE, COST EFFECTIVENESS, AND SAFETY

CATEGORY: Exploratory Development

DESCRIPTION: It is desirable to improve the energy output and decrease the sensitivity without increasing costs of chemical munitions.

A86-006 TITLE: NEW LOADING PROCEDURES FOR ENERGETIC MATERIALS

CATEGORY: Exploratory Development

DESCRIPTION: It is necessary to develop loading procedures to minimize defect structure in resulting casts.

A86-007 TITLE: NEW HIGH SPEED/HIGH RESOLUTION DIAGNOSTIC EQUIPMENT

CATEGORY: Research

DESCRIPTION: In order to experimentally study the effect of physical design such as shape on the detonation wave, new high speed/high resolution diagnostic techniques are needed.

A86-008 TITLE: COMPUTER MODELING OF DETONATION PHENOMENA

CATEGORY: Research

DESCRIPTION: New more sophisticated models taking into account actual chemical steps and kinetics are required to properly model detonation.

A86-009 TITLE: CREATION OF DATA BASE ON ENERGETIC MATERIALS

CATEGORY: Exploratory Development

DESCRIPTION: In order that charge designers have ready access to data, there is need for a centralized computer, rapidly accessible data bank of basic characteristics of energetic materials.

A86-010 TITLE: EPOXY COATINGS

CATEGORY: Research

DESCRIPTION: Methods of determining stresses due to epoxy coatings on thin films.

A86-011 TITLE: COMPUTER SIMULATION OF TWO CENTER TUNED ESCAPEMENTS

CATEGORY: Research

DESCRIPTION: A computer model which would simulate the motion of the type of escapement found in many fuzes (e.g. XM772) in order to predict arming time and improve performance.

A86-012 TITLE: COMPUTER SIMULATION OF INVOLUTE ESCAPEMENT

CATEGORY: Exploratory Development

DESCRIPTION: A computer model which would simulate the motion of the type of escapement found in the Copperhead S&A (M740 Fuze) in order to predict arming distance and improve performance.

A86-013 TITLE: TURN COUNTER

CATEGORY: Exploratory Development

DESCRIPTION: The use of pendulum to count turns in an S&A to measure safe separation distance.

A86-014 TITLE: ARMAMENT SYSTEM SOFTWARE QUALITY – EXPERT SYSTEM FOR TEST PROGRAM SETS

CATEGORY: Exploratory Development

DESCRIPTION: Test Program Sets (TPS) consist of all the hardware and software necessary to assure that the Unit Under Test (UUT) is working correctly. The TPS includes the UUT program and the necessary documentation to test, fault detect, and fault isolate the Line Replaceable Units (LRU) and the Shop Replaceable Units (SRU) to required level. There is a need to achieve minimal qualification/verification testing by minimizing the number of fault insertions necessary, while maintaining an acceptable level of quality, to verify and validate Test Program Sets (TPS). An expert system is needed to provide assistance in determining which faults need to be inserted in order to adequately qualify the TPS's go/no-go chains.

A86-015 TITLE: ARMAMENT SYSTEM SOFTWARE QUALITY – INCIPIENT FAILURE DETECTION DEVICES.

CATEGORY: Exploratory Development

DESCRIPTION: Reliability is a major concern on today's battlefield. Low reliability reduces the probability of mission success and increases logistics costs. There are two major types of reliability failures. One type is predictable and is due to wearout of components/sub systems while the other is of the random variety. Much work is currently under way to improve maintenance techniques to deal with wearout related failures. Also, built-in-test (BIT) is used to query the system for failures that have already occurred. If the weapon system fails without warning, as in the case of a random failure, both mission and lives are jeopardized.

No methodology currently exists to any great extent to identifying impending (incipient) failures in weapon systems. The intent of this proposal is to establish an incipient failure detection capability through the generation of a generic failures data base and the establishment of a relationship with computer/sensor capability and capacity and desired prediction goals.

A86-016 TITLE: ARMAMENT SYSTEM SOFTWARE QUALITY – AUTOMATED SOFTWARE REQUIREMENTS SPECIFICATION ANALYZER

CATEGORY: Exploratory Development

DESCRIPTION: The process for reviewing requirements specifications has in the past been achieved through manual techniques. For example, the analysis of a requirements spec for the identification and traceability of system requirements is a labor intensive effort, even when automated trace tools are applied. The idea behind this effort is to formulate an expert system which will be able to scan a requirements specification and identify at least 80% of the system requirements states. By use of an optical character reader (OCR), one can input a requirement specification automatically and apply the expert system. The desired output will then be a data base of requirements formatted such that it can be used as direct input to SMCS or TAGS tools.

A86-017 TITLE: ARMAMENT SYSTEM SOFTWARE QUALITY – SOFTWARE TEST HOOKS

CATEGORY: Exploratory Development

DESCRIPTION: In today's software intensive weapons systems, it is required to provide software test points, or test hooks, which permit the diagnosis of hardware, software and/or operator induced faults. These hooks are to be, identified early in the development of the software, utilized during testing, and provide support assistance to fielded systems. There is a need to develop a generic test hook design concept and considerations checking for items such as memory overhead, computation speed, a potential linking to build in test (BIT), etc.

A86-018 TITLE: THE DEVELOPMENT OF AN ADA PROGRAM DESIGN LANGUAGE
EVALUATION METHODOLOGY AND DEFINITION

CATEGORY: Advanced Development

DESCRIPTION: Ada is a programming language designed in accordance with requirements defined by the U.S. Department of Defense for its mission-critical embedded real-time systems. Overall, these requirements call for a language that is portable, has real time capabilities, modularity, facilities parallel processing and exception handling. With the declaration of Ada as the single standard programming language for DoD embedded real time applications, a number of questions and controversy have arisen regarding the use of Ada as the Program Design Language (PDL). These questions generally pertain to the scope of using Ada as a PDL, the detailed mechanics of the PDL description, as well as the criteria for evaluating an Ada PDL. The objective of this research is to define the scope of use for Ada as a PDL by determining if Ada can be used for system architectural definition, as a software requirements definition or simply for detailed software design representation. In addition, this research effort will answer the following often asked questions pertaining to an Ada PDL and use the questions and answers as an evaluation methodology for Ada PDL submissions.

*Does the Ada PDL aid in the Ada learning process?

*Does the Ada PDL encourage design instead of coding?

*Should the Ada PDL be a subset or superset of Ada?

*Is the Ada PDL easily converted to Ada?

*Should an Ada PDL be compilable?

*What is the real advantage of using an Ada PDL and does the Ada PDL being evaluated/reviewed meet convey this advantage?

*Does the Ada PDL provide suitable documentation for both the development and maintenance phases?

A86-019 TITLE: PREDICTION ALGORITHM

CATEGORY: Exploratory Development

DESCRIPTION: Advanced filtering and prediction algorithms development for Air Defense application based on technology in computer hardware, sensor and software techniques. The capability that VHSIC technology offers should be considered in the development of algorithms. The algorithm development should examine parallel processing of various target models versus a single target model, game theoretics, dynamic modeling and other modeling techniques. Advanced sensor technology should also be evaluated which could be provided for non standard target of these measurements, i.e. target dimensions and aspect angle, and the utilization of these measurements for algorithm development.

A86-020 TITLE: AMMUNITION LOGISTICS

CATEGORY: Advanced Development

DESCRIPTION: There is an urgent requirement for non system advanced development programs in support of Ammunition Logistics. These programs should provide for the development, demonstration, and evaluation of new ammunition logistic, resupply, and packaging concepts and initiatives.

These efforts, when coupled with other ongoing programs, are intended to produce an improved ammunition logistics system capable of supporting Army 21. This system will be characterized by:

- o Improved ammunition packaging for current and future ammunition; i.e., lighter, less cube, user friendly, cheaper, ease of decontamination, and NBC protection.
- o Improved ammunition handling – improved materials' handling equipment, including automated and/or robotic operations.
- o More efficient wholesale transportation from CONUS plants to OCONUS ports
- o Better user inventory control and management of ammunition stocks.

- New/improved armored resupply vehicles and tactical transportation systems.
- An ammunition logistics command, control, and communication (C3) system integrated with the tactical user systems network.
- Improved methods to reduce ammunition vulnerability and improved survivability.

A86-021 TITLE: MICRO MINIATURE ELECTRONIC/OPTICAL ACCELERATION SENSOR FOR IMPROVED SMART MUNITIONS PERFORMANCE

CATEGORY: Exploratory Development

DESCRIPTION: Innovative approaches for acceleration sensors are needed with improved performance capabilities. Improvements in guidance technology are dependent on development of acceleration sensors with wider ranges of operation and capabilities for multi-dimensional resolution of motion. New concepts for acceleration sensors are sought which may have applications for angle of linear rate sensing and which will encourage digital signal processing. The acceleration sensor should be of minimal size and weight while retaining the performance requirements for guided projectile applications.

A86-022 TITLE: MICRO MINIATURE ELECTRONIC/OPTICAL SAFE SEPARATION SENSOR FOR IMPROVED SMART MUNITIONS PERFORMANCE

CATEGORY: Exploratory Development

DESCRIPTION: Existing technologies supplied to acceleration sensors for detection of safe separation distance and timing are unsuitable due to limited range, size, reliability, ruggedness and cost. Novel concepts for an intrinsically stable and simple accelerometer for safe separation sensors for guided and smart munitions are therefore sought. The desired accelerometer should be a micro miniature device of absolute minimum dimensions. Its range of operation should be within fractions of a G to tens of G's. By design, the proposed concept should be able to withstand rough handling, wide ranges of ambient temperatures, and random launch and flight vibrations.

A86-023 TITLE: MICRO MINIATURE ELECTRONIC OPTICAL MAGNETIC MOMENT SENSOR FOR IMPROVED SMART MUNITIONS

CATEGORY: Exploratory Development

DESCRIPTION: The development of compact, high sensitivity, moderate magnetometer technology. Large magnetic moments generally represent real targets which are not as easily or cheaply produced as other decoys. Thus, incorporation of magnetic moments sensors into a "smart" projectile targeting system could improve overall performance by rendering it less vulnerable to decoys. Innovative concepts are sought which will encourage this sensing technology. Other potential applications include magnetic antennas for detection of EM signals and compass headings.

A86-024 TITLE: DYNAMIC HIGH PRESSURE – HIGH TEMPERATURE DIAGNOSTICS

CATEGORY: Exploratory Development

DESCRIPTION: Innovative approaches are solicited for the measurement of pressure and temperature in the hostile environments of gun interiors. Diagnostics which are applicable at temperatures in the range of 3000 K and pressures 700 MPA are required. The sensors must respond to dynamic fluctuations with rise times of 0.1 msec or less. The proposals should address novel approaches to the requirement for rugged sensors and techniques which can be used to measure interior ballistic parameters such as pressure, temperature and heat transfer in large caliber (105mm and greater) guns.

A86-025 TITLE: ADVANCED GUN PROPULSION TECHNOLOGY

CATEGORY: Exploratory Development

DESCRIPTION: Development of advanced solid and liquid propellant gun systems offers the potential for application of new technology in several areas. Characterization of liquid propellant systems is of considerable interest including ignition and combustion aspects and flow visualization. Proposals are solicited which address the design, improvement, and development of gun propulsion systems and propelling charge design, areas of interest include development of novel energetic materials for igniters and propellants, novel methods of ignition, application of advanced diagnostics to ignition and combustion and muzzle flash characterization, measurement of in bore projectile acceleration and other new technology which can be applied to develop more efficient and higher performance gun systems.

A86-026 TITLE: MATERIAL REPLACEMENT

CATEGORY: Basic Research

DESCRIPTION: Develop a suitable replacement for Nylon 6/6 for ammunition applications that will not be affected by explosives, propellants, or humidity.

A86-027 TITLE: GUN BARREL DEVELOPMENT

CATEGORY: Exploratory Development

DESCRIPTION: Develop a composite/ceramic gun barrel that will be substantially lighter and have the same service life as the steel barrels now used on small caliber ammunition.

A86-028 TITLE: ARTIFICIAL INTELLIGENCE ROBOTICS

CATEGORY: Basic Research

DESCRIPTION: A basic research program which has been initiated encompasses the fields of Artificial Intelligence and Robotics for applications to weapon platform control and fire control systems. The thrust of the program is to develop a fundamental understanding of symbolic processing with specific applications to machine learning, adaptive control, machine vision and expert systems.

A86-029 TITLE: MACHINE VISION

CATEGORY: Exploratory Development

DESCRIPTION: Techniques or mathematical algorithms applicable for machine recognition of patterns are desired in support of fire control subsystems capable of recognizing targets on the battlefield. Emphasis is placed on efficient coding of target controls and on fast (real time) processing algorithms.

A86-030 TITLE: THERMAL DESTRUCTION TECHNOLOGY FOR HAZARDOUS WASTES

CATEGORY: Engineering Development

DESCRIPTION: The Sherco Incinerator (using infrared type of heating) will be used for the disposal of the various toxic material generated at Radford and other plants. Work may be extended to include controlled incineration of red water and chemicals resulting from the binary chemical processes.

A86-031 TITLE: SURVEY OF CURRENT TECHNOLOGY FOR NO_x ABATEMENT

CATEGORY: Management & Support

DESCRIPTION: The contractor will conduct a thorough survey of the market for NO_x abatement technologies and will match specific abatement processes to the NO_x emission sources. A cost analysis will be made and investigation protocol will be established for pilot task.

A86-032 TITLE: ASSESSMENT OF HAZARDOUS OPERATIONS

CATEGORY: Management & Support

DESCRIPTION: Survey of hazardous production operations at the Army munition plants with the objective to assess need for performing function as currently done and eliminating personnel from the operation. The assessment will result in recommendations for process modification and the removal of operators from hazardous environment.

A86-033 TITLE: AUTOMATED CUP INSPECTION

CATEGORY: Engineering Development

DESCRIPTION: This effort is proposed to develop a piece of equipment to inspect dimension and hardness of the incoming case cups. This system should possess the ability to inspect and conduct the data analysis for 5.56mm through .50 cal.

A86-034 TITLE: MUZZLE FLASH DIAGNOSTICS

CATEGORY: Exploratory Development

DESCRIPTION: There is a need to characterize muzzle flash with respect to intensity; chemical composition; and temperature. This will require developing a portable system with fast time-resolution capabilities.

A86-035 TITLE: LIQUID GUN DIAGNOSTICS

CATEGORY: Exploratory Development

DESCRIPTION: Characterization of liquid propellant gun systems is of considerable interest including ignition and combustion aspects and flow visualization. Proposals are solicited which address the design and diagnostics which are applicable to understanding ignition and combustion in liquid propellant gun systems.

A86-036 TITLE: AIR FILTRATION OF TOXIC GASES USING MEMBRANE TECHNOLOGY

CATEGORY: Research, Exploratory Development

DESCRIPTION: Innovative methods for the removal of toxic vapors such as hydrogen cyanide, cyanogens chloride, phosgene and the nerve agent GB, using state-of-the-art filter membrane technology is needed. Candidate systems should be capable of removing toxic vapors to a level of one part in one hundred thousand or less. Size, weight, and operational power requirements are important considerations.

A86-037 TITLE: SUPERADSORBENTS FOR GAS FILTERS

CATEGORY: Research, Exploratory Development

DESCRIPTION: Superadsorbents with dynamic adsorption and equilibrium absorption capacities for the removal of toxic vapors from contaminated environments greater than ASC whetlerite activated carbon are being sought. Power, size, and weight requirements for collective and individual protection filters utilizing these superadsorbents are important considerations. Ability to perform in humid atmospheres and stable shelf life are important considerations in the selection of these superadsorbents.

A86-038 TITLE: DEVELOPMENT OF MICROSENSOR-COMPATIBLE RECEPTOR-BASED ASSAYS

CATEGORY: Exploratory Development

DESCRIPTION: Receptor-based assays presently fall into two main categories – radioligand binding and patch clamp electrodes. For various reasons, neither of these techniques is especially conducive to interfacing with current concepts for fieldable microsensors (i.e. small devices capable of transducing an optical or electrochemical signal into an electronic output). Alternate assays are desired and should meet the following criteria:

1. utilize a naturally occurring, well-characterized receptor (eg; the acetylcholine receptor).
2. monitor receptor binding or response to specific agonist/antagonists by generating a fluorescent, optical, or electrochemical signal which can be interfaced with a microsensor.
3. exhibit low background (less than 10 per cent).
4. exhibit relative stability (minimum of 3 days storage at ambient temperature).
5. exhibit rapid kinetics (less than 10 minutes)
6. exhibit sensitivity to at least 1 microgram per ml for receptor ligands.

A86-039 TITLE: DETECTION OF PATHOGENIC MICRO-ORGANISMS

CATEGORY: Research

DESCRIPTION: Investigate factors which determine virulence among human pathogens as opposed to non-infective organisms which could serve as the basis for the rapid detection of hazardous airborne biological organisms. What are the common characteristics which determine virulence? Are there genetic “common denominators” which could be exploited in separating them from innocuous organisms? What does a pathogen “lose” during serial tissue culture passes in the process of making an attenuated live vaccine? How do pathogens differ as a group from the non-infective organisms? Is rapid, generic biodetection based on these differences feasible?

A86-040 TITLE: DEVELOPMENT OF INTEGRALLY STIFFENED WOVEN STRUCTURAL PERFORMS

CATEGORY: Research

DESCRIPTION: The cost of composite structures is limiting their application in the next generation aircraft. Application of textile weaving technology to fabricating integrally stiffened composite structures. Woven structural performs, including multiple stiffeners, need further investigation. The integrally stiffened woven performs should include fiber orientations consistent with conventional composite structural designs. Structural performance needs to be demonstrated using aerospace grade graphite and Kevlar reinforcements with 3500 cure resins and compared with state-of-the-art composite structures.

A86-041 TITLE: THERMOPLASTIC COMPOSITES FOR AIRCRAFT

CATEGORY: Research

DESCRIPTION: Aerospace grade fiber reinforced thermoplastic composite materials offer significant cost and performance benefits as compared to conventional thermoset materials. The application of thermoplastic to woven integrally stiffened structural performs requires thermoplastic reinforced material to have handlability similar to the bar fiber reinforcements. Techniques to coat individual fibers with fiber reinforcement need to be investigated. Typical fiber reinforcements of graphite and Kevlar with PEEK, K polymer and Eyton thermoplastics should be considered for study. Coated and blended thermoplastic composites need to be demonstrated through fabrication and testing of woven specimens. Studies should also be conducted to study the wetting efficiency.

A86-042 TITLE: REAL-TIME ROTORCRAFT SIMULATION

CATEGORY: Exploratory Development

DESCRIPTION: The sophistication of mathematical models used in real-time simulation of rotorcraft aeromechanics characteristics is typically listed by the capabilities of the simulation computer system. There is a need to develop an innovative solution to this limitation. Specifically, a simulation system which has the following attributes is needed: affordability, parallel processing with high-speed/pipelined processors, a processor instruction set and numerical precision tailored to engineering problems, rapid and low-overhead data transfer between processor, programmability in high-order language(s), ability to interface the system easily with other devices, appropriate system software, and expandability of the system hardware to meet the needs of the math model.

A86-043 TITLE: COMPUTATIONAL FLUID MECHANICS CALCULATIONS

CATEGORY: Exploratory Development

DESCRIPTION: Depending on the computer system used, calculations associated with computational fluid mechanics (CFD) frequently require excessive time to complete. There is a need to develop an innovative approach to reducing the time required for CFD calculations and to expand the computer system to match the requirements of the CFD problems. Specifically, a system for solving CFD problems which have the following attributes is needed: affordability, parallel processing with high-speed/pipeline processors, a processor instruction set and numerical precision tailored to engineering problems, rapid and low overhead data transfer between processors, programmability in high-order language(s), and appropriate system software.

A86-044 TITLE: COMPUTER ARCHITECTURE FOR ONLINE PROCESSING OF ACOUSTIC SIGNALS

CATEGORY: Exploratory Development

DESCRIPTION: Recent advances in signal processing are utilizing new system architectures for online processing of large amounts of discrete acoustic data. New developments in acoustic detection will require specialized computer designs to maximize the effectiveness of the total sensor array. The 6.2 research will integrate the sensor and computer requirements to yield improved data processing techniques for the Army. The requirement is for new and efficient micro-processing and acoustic sensor designs that would near real time direction and identification of rotary-wing aircraft signatures.

A86-045 TITLE: UNIVERSAL ENGINE HISTORY RECORDER

CATEGORY: Exploratory Development

DESCRIPTION: Separate history recorders are developed for each engine. Current electronic capability has reached a point where it would be feasible to develop a recorder which could be common to several engines with an attendant development and acquisition cost savings. A small business electronic firm should be able to survey engine requirements and define and develop a unit which could be used on any turboshaft engine.

A86-046 TITLE: EVALUATION OF FIBROUS/ELASTOMERIC MATRIX COMPOSITES

CATEGORY: Exploratory Development

DESCRIPTION: The recent development of elastomeric matrix materials offers significant potential for innovative design concepts in composite aircraft structures. There is a need to identify candidate elastomeric (flexible) matrix systems and evaluate their application for aircraft primary structures. Test coupons would be fabricated of promising matrix systems combined with typical reinforcing fibers for evaluation of static and fatigue mechanical properties. Following this evaluation, ballistic test specimens of selected elastomeric and epoxy matrix composites could be fabricated and tested.

A86-047 TITLE: EM PROPAGATION IN IONIZED MEDIA – STATE OF THE ART ASSESSMENT

CATEGORY: Research

DESCRIPTION: The Army 21 concept as related to real time battlefield communications has underscored the need for reliability, insured connectivity and enhanced survivability of strategic, operational and tactical reciprocal communications modes (links) among national command authority, theater commanders and the battlefield arena. Electromagnetic propagation in an adverse electronic environment is an integral part of the communication network, and it impacts directly on these needs. In particular, the following specific EM propagation considerations are of interest:

1. Reliability of HF radio (from short to extended distances) through better use of the frequency spectrum and adaptive HF techniques which automatically vary power and frequency selection.
2. HF frequency spectrum management systems based on changing propagation conditions predictions and/or real time channel evaluation.
3. Propagation aspects of spread spectrum HF techniques (frequency hopping and direct sequence)
4. Meteor burst and other anomalous propagation for ECM resistant communication.
5. Propagation aspects of digital signals across the electromagnetic spectrum (multipath, dispersion, fadings, etc.)
6. Propagation aspects of satellite/earth communications.
7. Propagation in the nuclear environment across the electromagnetic spectrum.
8. Radio noise (natural and manmade).
9. Propagation media characteristics (ionosphere, space environment).
10. Natural/man made propagation media modification.
11. Techniques for assessment of ionized propagation media state.

The objective of this task is to perform state-of-the-art assessment of the above subjects with a view towards the relation of these to the Army's goal of real time, reliable, continuous and survivable communications goal. Gaps of knowledge in these fields which need addressing to meet the Army's requirements should be identified.

A86-048 TITLE: ADVANCED FACILITIES TO EXPEDITE DESIGN AND EVALUATION OF COMMUNICATIONS SYSTEMS.

CATEGORY: Research

DESCRIPTION: Facilities are needed which will significantly reduce the time and cost to design, test, and evaluate Army Communications systems. These facilities must provide the ability to quickly create realistic test cases to predict and evaluate system performance in a way that could be easily understood by combat developers as well as communications engineers. The dynamics of the battlefield must be easy to represent in an accurate manner,

including air and ground vehicle motion, propagation effect in densely foliated and rough terrain based on Defense Mapping Agency data, threat systems and strategy, and user communications traffic needs. Communications systems must be easy to represent to the degree of accuracy desired, including adaptive antennas, wire and glass cable, signal processors, virtual circuit and packet switches, concentrators, network controllers/managers, etc. The ease with which these items can be represented and modified for quick reaction use, and shared by many organizations is paramount.

A86-049 TITLE: DIRECT GROWTH/FUSION CIRCUITRY DEVICES ON OPTICAL FIBER

CATEGORY: Research

DESCRIPTION: There has been rapid acceptance of fiber optic communications systems. These systems consist of discrete components which include the fiber, a transmitter, and a receiver. In these systems an electrical signal is converted to an optical signal. The next stage in the development of these systems is in the area of integrated optics; the aim of which is to be able to do as much signal processing as possible directly on the optical signal itself. It is of interest to explore the possibility of fabricating active and passive device elements, such as switches, guides, couplers, sources and detectors on or around optical fibers. Such on-line detection and signal processing would be extremely useful in the long term for fiber optic data bus/network communication and result in physically smaller sized systems. The developed technology would have far reaching implication in optical computer techniques. Specifically, the proposed work would investigate the growing or fusing of emitter, detector, or modulator devices directly onto the optical fiber.

A86-050 TITLE: ARTIFICIAL INTELLIGENCE FOR COMMAND AND CONTROL

CATEGORY: Exploratory Development

DESCRIPTION: The tactics of doctrine of the modern battlefield dictate the need for intelligent machines to assist human operators. The technology associated with encapsulating knowledge and techniques used in AI to capture the reasoning process that human experts perform promises to provide a significant impact on future computer system for the military. Future military systems will be required to be self-learning and interactive. Self learning systems are systems that are able to make significant changes in their internal processing logic in response to user commands or based on demands which have been placed on the system in the past. These systems are extremely important in the military environment because they create significant operational capabilities across a diverse set of applications. They are fundamentally superior and inherently more reliable than the conventional rigid systems because they can be made more fault tolerant and possible can be given limited properties of self-diagnosis and self repair.

In addition to self-adapting systems, the following AI technology advances are required to insure the adequacy of future military systems:

1. Improved man/machine interfaces, such as natural language understanding and generation.
2. The ability to represent and reason with data that is imprecise, incomplete, and not totally reliable.
3. Improved methods for knowledge acquisition and
4. Methods for maintaining/enhancing expert systems once they are fielded out.

A86-051 TITLE: OPERATOR-FRIENDLY DATA BASE MANIPULATION

CATEGORY: Basic Research

DESCRIPTION: A computer program utilizing an authoring language needs to be developed on a SIGINT Data Base. Situational scenarios need to be developed that guide the computer operator through a decision tree based on the type and amount of intelligence available through the computer aided instruction (CAI). Critical Nodes and conditional decisions are to be developed that define the conditions that exist based on the SIGINT Data. The computer program shall include modeling for tactical, fixed station strategic, airborne, ground, and multi-

intelligence sensor information for a rapid application development system. Computer program development shall allow for inputting data base information for different missions at different geographical locations. Loading of the data base shall be by simple load of floppy disks with a minimum of operator entries. Computer program shall be on an IBM Personnel Computer or equivalent. Work to be performed shall require TS/SI clearances.

A86-052 TITLE: INTEGRATED POWER CIRCUITS

CATEGORY: Exploratory Development

DESCRIPTION: Jammer amplifier and transmitter circuits need to be lighter and cheaper. Integrated circuit technology has made low power analog and digital circuits extremely cheap. It is desired to perform similar integration on power circuits, handling 100-400 W output power per basic power module. These power modules would be in the HF and VHF bands, e.g., 1-100 MHz, 80-400 MHz. The basic power modules would be used alone or in assemblies to make up a large transmitter. The use of integrated circuit concepts should increase reliability and decrease costs. The circuit substrate could be used for a cooling surface and the circuit could be designed mechanically to have modular, self-aligning cooling passages for liquid or air cooling when assembled in large transmitters.

A86-053 TITLE: SKYWAVE HFDF CRITICAL NODES

CATEGORY: Basic Research

DESCRIPTION: A computer model needs to be developed of critical HF communications occurring within the rear echelon of the enemy force area. Methods that require investigation to determine emitter location accuracy include azimuthal, Single Station Location (Elevation), and DTOA. Computer model shall be developed on four station DF system with time to compute location, throughput, distance to transmitters, S/N, capability of DF system, CEP, condition of ionosphere plus other parameters to be controllable from the computer input terminal. A possible model to be used for the condition of the ionosphere would be through the use of oblique ionograms determine relative heights of the ionosphere throughout the area of interest. Using virtual heights of the ionosphere a computer algorithm would be developed to allow for spatial interpolation to a point of interest to each of the DFDF net stations. Predictions of emitter location accuracy would then be computer based on three dimensional model of the ionosphere. Various conditions and types of signals of interested shall be simulated to allow for proper investigation of DF net accuracy and importance of data. Model shall simulate high priority HF signals that occur given different state of readiness for the enemy forces. Work to be performed shall require TS/SI clearances.

A86-054 TITLE: IBM-PC EXPERT/DB INTERFACE MECHANISMS

CATEGORY: Exploratory Development

DESCRIPTION: Develop a software mechanism for the IBM-PC family of computers that would allow a resident AI/Expert functionality to control the processing of raw input data into an independent large Data Base (20,000+ records). This work would seek to provide interface for Expert Systems with vast amounts of processed information which would be maintained by a standard DEMS and then call upon standard graphic routines to display data in appropriate formats. The Expert System should be in an AI language (LISP based) and the DBMS/Graphics software should be a commercially available package. Purpose of this effort will be to allow integration of AI/Expert functions into existing systems that have Data Bases being maintained on the IBM-PC family of computers. The AI/Expert technology would perform the critical time consulting tasks involved in Data Base maintenance, update, and interface.

A86-055 TITLE: ADAPTIVE JAMMER

CATEGORY: Exploratory Development

DESCRIPTION: Present jamming systems are broadband, e.g., 10-80 MHz to handle a variety of threats. Extension of this bandwidth capability to handle the entire HF/VHF, 3-300 MHz, is a very desirable but an extremely difficult design problem to handle power efficiently and to minimize spurious outputs, harmonics, efficiently couple to an antenna, etc. In many military problems the presented threat may only occupy a portion of the jammer's bandwidth, hence the system is in a sense over designed. It is desired that the jamming system be able to automatically reshape its output frequency response to match a given threat. The system should also be able to change its class of operation, e.g., from Class A to Class D, when it might be allowable to produce more harmonics in order to produce more power vs. a given threat. This reconfiguration capability should be executable in seconds under software/firmware control, i.e., under an artificially intelligent system controller. When the system reconfigures itself relatively slowly, it should retain a reasonable instantaneous bandwidth. In the case of, for example, 3-300 MHz range, the instantaneous bandwidth could be 1 MHz one time, 30-80 MHz the next, so that in any dense RF subband, instantaneous jamming response would be available. A benefit of this approach to transmitter design is that one variable 3-300 MHz jammer could replace several fixed narrow band jammers. Hence, logistics costs can be significantly reduced.

A86-056 TITLE: HF EMITTER IDENTIFICATION

CATEGORY: Basic Research

DESCRIPTION: HF transmissions need to be identified to the transmitter and platform causing the emanation. Basic research needs to be conducted that rapidly scans the frequency band of .5 to 30 MHz in two seconds or less. Resolution of different signals must be determined to 50 Hz. A historical data base of all signals on the air of up to 2000 emitters must be maintained and properly cataloged. New births must be identified and mode analysis performed to a proper call to better than 90% confidence with a S/N of 10db. Signal features must be developed to allow proper recognition of emitters to a specific transmitter with better than 95% confidence. Possible features that could be used to identify the emitters are modulation, passband, apparent ripple, modulation index, over modulation, carrier drift, envelope rise time, ringing, asymmetry plus any additional data that results in the ability to identify the specific emitter. All of the above will be computerized with a second order capability of recording the signal (pre-detected IF and demod output) and allowing for human recognition. Signals must be stored in digital memory with a recall capability of better than 25 msec from digital memory and greater storage capacity when using a combination of digital and analog memory. Recall from digital memory must be performed within 2 msec. Digital and analog memory require 65 db dynamic range and two MHz bandwidth. Work to be performed shall require TS/SI clearances.

A86-057 TITLE: MILITARIZED 4.5 INCH WINCHESTER DISK DRIVE.

CATEGORY: Engineering Development

DESCRIPTION: The overall weight of this drive should be under 20 lbs. The number of platters used is left to the designer, but a capacity of at least 10 Mbytes and a transfer rate of at least 1 Mbps are expected. The power dissipation of the drive and formatter should be no more than 100 watts. In addition, the formatter should allow for the connection of several of these drivers.

Discs must be easily and quickly removable for secure transportation and storage of classified data. The unit must comply with NACSIM 5100A.

A86-058 TITLE: SMALL MILITARIZED PRINTER

CATEGORY: Engineering Development

DESCRIPTION: The printer should print 80 columns with a speed of at least two lines per second. The characters printed should include alphanumeric, graphic, and special characters. The printer's weight should not exceed ten

pounds, after being militarized. The printer should run of DC supply of 5, 12, 24, or 28 volts with current not exceeding six amps. The overall power requirements should not exceed 150 watts. The interface should accept an RS-232 connector for serial communications, or a NTDS connector for parallel communications.

A good starting point might be a printer similar to a Panasonic EUY-5E which weighs under two pounds.

The unit must comply with NACSIM 5100A.

A86-059 TITLE: COMPUTER-AIDED JAMMING CALCULATIONS FOR RANGE AND DOPPLER CORRELATED RADARS

CATEGORY: Exploratory Development

DESCRIPTION: This effort is directed at developing software that will calculate the jamming modulation parameters to counter radars with Doppler velocity gates and Doppler plus range correlated tracking gates. The next generation of radars use both range delay and Doppler to determine target range. Target data that does not provide a time delay plus Doppler that correlates to a particular range can be removed from the tracking data and thus remove elementary jamming. There is a need to develop software that can calculate the correct Doppler and range rates for jamming. The software should be written in Basic, run on an MS-DOS computer and the source code should be included with unlimited rights to the government.

A86-060 TITLE: PASSIVE SINGLE-SITE TARGET RANGING TECHNIQUES

CATEGORY: Exploratory Development

DESCRIPTION: Passive ground based Electronic Support Measures (ESM) direction finding (DF) systems normally require the use of multiple, spatially separated, coordinated collection/DF sites in order to range on ingressing airborne targets. Multiple site DF triangulation techniques are used to estimate target aircraft effective range. The use of multiple ground based DF sites represents significant operational complexity and expense. The purpose of this task is to develop passive ESM/DF processing techniques which will permit effective real-time estimation of target aircraft range from a single collection site. The work task should include simulation of the technique and determination of performance bounds.

A86-061 TITLE: RESEARCH IN ARTIFICIAL INTELLIGENCE FOR ELECTRONIC WARFARE SYSTEMS

CATEGORY: Exploratory Development

DESCRIPTION: In the EW Mission, there are several application areas that appear as likely candidates for the use of AI-techniques. Some of these include: ELINT System Management, Jammer Power Management, Threat Warning, Management of Unmanned Systems, Simulation, Maintenance, and Training. On each of these areas, there is a significant need for human expertise in terms of background, experience, and judgment. The primary goal in the application of AI techniques to EW systems is to capture the knowledge of experts and replicate it for use by non-experts. An extension of this goal is to replace the human operator, especially when logistic or hazardous considerations make replacement appropriate.

A86-062 TITLE: AIRCRAFT MULTI-SPECTRAL RADIO FREQUENCY/ELECTRO-OPTICAL INFRARED COUNTERMEASURES

CATEGORY: Exploratory Development

DESCRIPTION: A bank of tunable RF bandpass filters shall be developed for use in the Multichannel Steerable Null Antenna Processor (MSNAP). The bank of six filters will tune over the 225 to 400 MHz band, providing isolation between the receive and transmit signals of a band I AN/GRC-103 radio. Each of the six filter channels will protect one of the antenna element receive paths of the MSNAP, in order to permit duplex operation through MSNAP antenna array. The filters must be phase matched to permit null processing, and must occupy a total volume of no more than one cubic foot.

A86-063 TITLE: RF FILTERS FOR MULTICHANNEL STEERABLE NULL ANTENNA PROCESSOR (MSNAP)

CATEGORY: Exploratory Development

DESCRIPTION: A bank of tunable RF bandpass filters shall be developed for use in the Multichannel Steerable Null Antenna Processor (MSNAP). The bank of six filters will tune over the 225 to 400 MHz band, providing isolation between the receive and transmit signals of a band I AN/GRC-103 radio. Each of the six filter channels will protect one of the antenna element receive paths of the MSNAP, in order to permit duplex operation through the MSNAP antenna array. The filters must be phase matched to permit null processing, and must occupy a total volume of no more than one cubic foot.

A86-064 TITLE: IMPROVED MOISTURE-RESISTANT POTTING MATERIALS/TECHNIQUES FOR IMAGE INTENSIFIERS

CATEGORY: Advanced Development

DESCRIPTION: An image intensifier tube assembly consists of an image intensifier vacuum tube module, a miniature high voltage power supply, and an inert filter (i.e. potting) material inside a metal or plastic housing. The power supply, which runs off of a battery, provides voltages to the tube module ranging from several hundred to six thousand volts, at currents up to nearly ten microamperes. To do this, the power supply typically draws anywhere from ten to fifty milliamperes to current from this battery. The purpose of the potting material is to provide the mechanical stability and electrical insulation needed to sustain stable intensifier operation. The problem with the present potting material (RTV-11) is that in humid environments, moisture penetrates the RTV encapsulation and causes leakage currents along the tube module high enough to overwhelm the power supply and shut the intensifier down. The development program will address new potting materials, such as addition-cure RTV's and new potting techniques, such as coating the tube module with a hydrophobic material prior to potting. The efficiency of new materials and techniques will be evaluated by monitoring intensifier operation in a minimum 95% relative humidity environment over periods of up to several days. Up to twenty-five (25) tube modules and miniature power supplies, along with Level III drawings for intensifier housing, will be furnished by the Government for this development program.

A86-065 TITLE: INFRARED DETECTOR ARRAYS

CATEGORY: Exploratory Development

DESCRIPTION: Infrared photovoltaic diode arrays in the 3-5um and 8-12um spectral band are being developed for military applications. Detector arrays are processed on thin film epitaxially grown layers. The detectors are very sensitive to processing conditions and the surfaces of epitaxial layers must be carefully prepared to minimize surface leakage and noise. Low frequency (one-over-f) noise due to surface leakage and bulk defects is a detector performance problem. High quality diodes are characterized by high resistance at zero bias, large reverse bias breakdown voltage, low reverse leakage current, and response uniformity across the array. Arrays are typically arranged in a two dimensional format with from 500 to 5000 individual elements.

Processing infrared arrays involves photolithography, metallization, thin film insulator deposition, wet chemical etching, and plasma etching. Each process must be carefully controlled to achieve uniformity across the detector chip and minimize process induced defects.

A86-066 TITLE: TUNABLE LASER MATERIALS DEVELOPMENT FOR THE NEAR INFRARED

CATEGORY: Research

DESCRIPTION: The Army has a current need for efficient solid-state tunable laser materials operating in the near infrared and at room temperature. Transition metal ion dopants in oxide and fluoride host materials have been known to exhibit tunable laser activity over bands extending from the visible to the near infrared. The proper selection of the dopant ion and lattice host combination is critical to achieving a stable crystalline environment for enhanced tunable laser efficiency. A competing and deleterious process that must be avoided may take place through excited state absorption and may reduce the dopant ions' lasing intensity and tenability range.

The present effort is oriented towards the selection of possible tunable laser materials candidates that would operate under the most favorable conditions in the near infrared band. Small samples of selected tunable materials would be made or purchased and tested spectroscopically, and for possible laser behavior in the near infrared band. Such a study would aid in the theoretical understanding of tunable laser materials and in better prediction of their behavior.

A86-067 TITLE: TUNABLE LASER PARAMETER OPTIMIZATION

CATEGORY: Research

DESCRIPTION: The Army is involved in the development of efficient solid state tunable laser materials. The parameters that are of importance in this development are: quantum efficiency, fluorescence band wavelengths, stimulated emission cross-section and energy transfer between sensitizer ions and lasing ions. The conditions for optimizing these parameters are not fully understood at the present.

The proposed work would initially concentrate on a limited number of crystals selected for their potential ease of characterization. In these crystals the effort would be to study the mechanisms which optimize the above-mentioned parameters in order to gain leverage on the ultimate goal of achieving high efficiency in these solid state tunable laser materials.

An example of a crystal that could be studied for parameter optimization is gallium scandium gadolinium garnet. This crystal is known for its high efficiency at one micron wavelength. However, it is not as well understood for its vibronic tunable laser output when singly doped with an element such as chromium.

A86-068 TITLE: IMPROVEMENTS IN MATERIALS AND DESIGN OF HOLOGRAPHIC OPTICAL ELEMENTS

CATEGORY: Exploratory Development

DESCRIPTION: Innovations are needed to provide increased performance of holographic optical elements. Investigation of the feasibility of new materials which offer environmental stability advantages is needed. Applications include holographic mirrors, filters and lenses. Flexible substrate configurations are also of interest. The reliable production of high quality optical elements suitable for use in imaging equipment needs to be examined with emphasis on the optical advantages of diffractive elements, low cost mass production and environmental stability.

A86-069 TITLE: TUNABLE FILTERS FOR THE VISIBLE/NEAR INFRARED

CATEGORY: Research

DESCRIPTION: Fast tuning filters are needed to reflect or transmit narrow bands of laser energy between 0.4 microns and 1.2 microns while transmitting or reflecting (respectively) a high percentage of the remainder of the band. Tuning times of 1 microsecond or less are desired with optical densities of 4 or greater (reflection mode). This device should be self-activating, i.e., respond to unknown input light and reflect it within 1 microsecond. Also, it must not degrade the optical quality of an image transmitter through the device. Fields of view up to 20 (+10) are desirable even though smaller fields of view are acceptable in certain applications. These devices will be used in various Electro-Optic applications involving lasers.

A86-070 TITLE: INTERFACE AND DIGITAL RECORDING ELECTRONICS FOR AIRBORNE TEST SYSTEM

CATEGORY: Advanced Development

DESCRIPTION: The work will be in support of the Army's ASSET Program. ASSET is an airborne test system installed on a UH-1 helicopter. The system consists of a special turret to stabilize electro-optical sensors, a computer based controller, and high speed recording equipment. The system will be used to obtain high quality airborne infrared image data and will also act as a test bed for next generation sensors and automatic target cuers.

The proposed contract would be to design, build and write software for interface electronics to the ASSET computer and recording equipment. The ASSET computer is an HP9826S with RS 232, IEEE-488, Mil Std 1553 interfaces as well as a high speed data bus and other custom electronics. The effort would include:

- a. Maintain existing custom interfaces and high speed digital reformatter.
- b. Design and fabricate an interface to a Litton LR 80 Inertial Navigation System.
- c. Hardware and software required to automate the collection of aircraft position, heading, velocity, etc, for data logging purposes.
- d. Provide a fiber optic link for high speed sensor data from the ASSET turret.
- e. Design and fabrication of custom interfaces from ASSET sensors to a variety of NVEOL sensor processors (PATS II, MTAP, ATC).
- f. Design and fabrication of special electronic interfaces for recording of image data from next generation infrared imaging sensors.

A86-071 TITLE: DEVELOPMENT OF RADIOCHROMIC DOSIMETER

CATEGORY: Engineering Development

DESCRIPTION: Develop reproducible radiochromic waveguide dosimeter elements and then use this technique to produce a limited number of dosimeter assemblies suitable for a thorough evaluation and testing. Such dosimeters would be self contained and would read the combined gamma plus neutron dose. They should contain the associated excitation (LEO) and sensing (photo-diode) devices. Several active sensors of such dosimeters were built in the 4247 775 and 4489 240. This work would have to be done in close coordination with the scientists of this activity. Should lead to engineering development and eventually to mass production of these devices.

A86-072 TITLE: GAMMA/BETA RADIATION DETECTOR

CATEGORY: Exploratory Development

DESCRIPTION: A program to develop a solid state detector/matched preamplifier capable of detecting gamma radiation to background level. The detector should be operable at voltages at or less than 10 volts. It should be

small, capable of being incorporated in an instrument of cigarette package size, and cover a dose-rate range from approximately 0.1 Rad/h to .01 mRad/h.

It should ultimately be capable of being manufactured (detector only) for less than \$50. It should show promise of being operable over the full range of military environments. It should be sufficiently survivable to be operable even after an appreciable neutron or gamma dose.

A86-073 TITLE: TACTICAL PATH INTEGRATING TEMPERATURE GRADIENT SENSOR

CATEGORY: Basic Research

DESCRIPTION: The vertical aiming accuracy of direct fire weapons can be adversely affected by atmospheric refraction. This is particularly important in desert environments where there are strong temperature gradients within the first few meters of the earth's surface. It is the temperature gradient which causes the refractive effect. The refractive effects only become important for path lengths of 2 km or more. The optical path represents an integrated value of the temperature gradient between the receiver and the target.

A need exists for a sensor which will remotely determine an integrated temperature gradient between a direct fire aiming system and a target. This device should be a passive sensor and should be capable of being incorporated into the fire control system of a tank's computer.

A86-074 TITLE: ARTIFICIAL INTELLIGENCE FOR TACTICAL WEATHER EFFECTS

CATEGORY: Exploratory Development

DESCRIPTION: The explosive growth in the ability to collect data on the modern battlefield dictates that computers will have to assume an ever increasing role in the analysis of these data and in assisting the commander with reaching optimal decisions. AI technology offers a promising solution to this problem by providing a means to structure knowledge and solve problems in much the same way as a human expert.

Much of the work presently accomplished in the Intelligence Preparation of the Battlefield, meteorological effects in particular, is conducive for transfer to an AI "expert" system. The ability of these systems to represent and structure complex data, cope with non-linear effects, and manipulate data that is both incomplete and unreliable offers a significant assistance to the military analyst. The design of modular knowledge bases dealing with the environment and its effects on military systems will have a significant impact as a force multiplier on the future battlefield.

A86-075 TITLE: LOW TEMPERATURE HUMIDITY MEASUREMENT

CATEGORY: Basic Research

DESCRIPTION: A need exists for the accurate measurement of the wet bulb or dew point temperature to determine relative humidity when the ambient temperature is between 0 and -70 degrees Fahrenheit. It is known that the relative humidity or the amount of moisture in the atmosphere has an important impact upon systems and materials being tested in an Arctic environment.

The relative humidity parameter is a required input to surveillance and performance testing of many systems and materials. For example, the long term effect of the presence of humidity on missile systems must be measured in order to determine future storage requirements. Another example is the testing of electro-optical weapons and sensors. The observation parameters such as fog and smoke depend upon the amount of moisture in the air for their formation and life span. A satisfactory technique for obtaining accurate measurements of dew point or wet bulb temperature at ambient air temperatures between 0 and -70 degrees does not exist.

A86-076 TITLE: HIGH-RELIABILITY SOFTWARE

CATEGORY: Advanced Development/non systems

DESCRIPTION: One very important component of computer software quality is reliability. Software reliability means that the software performs its required functions correctly and does not behave in an unexpected fashion. Unlike hardware, software does not wear out or perform at a degraded level due to age. There have been many examples of reliability problems with software, and in each case, further testing, program changes, and improved operational procedures have corrected the problems so they did not recur. With the growing population of computer weapons systems taking on increasingly critical functions, software reliability takes on progressively greater importance. Improved procedures/tools to build highly reliable software are needed.

A86-077 TITLE: COMPONENTS FOR RECHARGEABLE AMBIENT TEMPERATURE HIGH ENERGY BATTERIES

CATEGORY: Research and Exploratory Development

DESCRIPTION: The Army requires a high energy battery chemistry with the following characteristics:

1. Operation over the full military temperature range.
2. Theoretical energy density over 250 W hrs/lb based on active materials.
3. Internal current density over 2 mA/cm² over full temperature range.
4. Low materials costs to make use as a throwaway battery feasible under some conditions.
5. Reversibility of electrodes to allow use as a rechargeable battery under some conditions.
6. Indefinitely long storageability at ambient temperatures.

The goals listed above will be furthered through the development of new or improved cell components including:

1. Improved Negative Plate

Lithium is normally chosen as the negative plate materials in such cells. R&D activities should focus upon the improvement of recyclability of lithium (for rechargeable batteries) and the stability of lithium in electrolytes (for good battery storage). Approaches include alloying of the lithium, application of coatings to the lithium surface and addition of reagents to the electrolyte which will generate useful coatings on the lithium electrode.

2. Improved Electrolytes

Electrolyte must be compatible with the highly reducing lithium electrode and the highly oxidative cathode. Improved electrolytes meet the two latter conditions and provide increased electrolyte conductivity and higher lithium cycle life and storageability. New electrolyte formulations may comprise mixtures of organic and inorganic solvents and organic inorganic lithium salts.

3. Improved Cathodes

One of the most successful cathodes for ambient temperature rechargeable lithium batteries has comprised the active material, TiS₂, the polymeric binder, polytetrafluoroethylene, the electronic conductor, graphite and a conductive screen. In improved cathodes, the replacement for TiS₂ would possess higher Gibbs free energies for formation of the corresponding lithium-insertion reduction product and improved kinetics for that process. The electronic conductivity for the active material would be high, eliminating the need for an inert conductive powder (e.g., graphite). A "binder" superior to PTFE would provide good cohesion of the active material with enhanced cathode flexibility, increased ease of manufacture (particularly for very thin electrodes) and enhanced resistance to mechanical expansion-contraction cycles.

4. Improved Separator

Most separator materials are based on the use of glass or polyethylene as the raw material. These materials are limited with respect to reactivity with lithium (particularly molten lithium) compatibility with organic and inorganic electrolytes and ability to withstand lithium dendrite penetration (during re-charge). Improvements will address those problems and also present the possibility of preparing very thin sheets of separator either freestanding or adhered to the lithium electrode.

5. Charge/Overdischarge Controls

Improved electronic charge and overdischarge control systems are required which have very low drains (microamps) during standby, are insensitive to transients and are accurate, precise and reliable over a wide range of environmental conditions.

A86-078 TITLE: NEW CONCEPTS FOR MILLIMETER WAVE ELECTRONIC SCAN ANTENNAS

CATEGORY: Exploratory Development

DESCRIPTION: Design and develop a unique, low-cost electronic scan antenna for operation in the 35 GHz frequency region. A new and novel design approach should be proposed for a two dimensional planar array utilizing electronic phase scan capability in one plane. This approach would be required to be less complex than conventional phased array designs employed at microwave frequencies in order to insure cost-effectiveness and ease of fabrication at millimeter wavelengths and permit scaling up to the 94 GHz frequency region. The thrust of the program therefore should be to develop a low-cost, reliable antenna for compact, rugged, high performance munition guidance.

A86-079 TITLE: ADVANCED 94 GHz SOURCES

CATEGORY: Research

DESCRIPTION: Investigate a number of advanced GaAs electronic device structures for possible application as 94 GHz sources in Army MLRS-TGW systems. Investigation to include, but is not limited to, notch front, graded drift region, heterojunction, and ballistic launched Gunn structures in both discrete (conventional) and planar (surface orientated) configurations. Research shall consider device concept, design, and modeling with subsequent processing into a final structure and evaluation at 94 GHz. Operation at 94 GHz can be second harmonic with parameters of interest being power output, frequency, and efficiency.

A86-080 TITLE: MILLIMETER WAVE GaAs IMPATT DIODE MATERIAL DEVICES AND TECHNOLOGY

CATEGORY:

DESCRIPTION: GaAs IMPATT devices generate more power, both pulsed and CW, with higher efficiency than any other microwave/millimeter wave solid state device. To exploit this advantage, improvements are necessary in the technology of GaAs epitaxial materials growth, device chip processing and packaging. Additionally, to realize the full potential of better doping profiles, improved materials on accurate model of the IMPATT diode operation is necessary. For millimeter wave operation this is particularly true because many physics of device limitations remain unknown.

The principal goals of the program will be 1.) to develop tighter controls over epitaxial material growth, device processing, metallization and packaging to produce higher yields, wafer-to-wafer uniformity and reproducibility; 2.) to develop a large signal model of IMPATT operation using computer aided analysis to correlate GaAs IMPATT performance with various doping profiles. This then provides the basic guidance for the design of optimum, high power, high efficiency devices and 3.) to develop an accurate thermal model which will predict the means both

through device and circuit technologies to minimize frequency and phase “chips” in IMPATT oscillators and amplifiers, respectively.

A86-081 TITLE: PHYSICS AND CHEMISTRY OF SUBMICRON CIRCUIT FABRICATION AND OPERATION

CATEGORY: Research

DESCRIPTION: Integrated circuit (IC) devices must be reduced to submicron and ultrasubmicron dimensions to enable fastest possible signal processing speeds in a variety of military electronic systems. Important problems bearing on successful production and application of these advanced IC are (a) the delineation of small elements on the semiconductor chip, (b) control of atomic-scale defects arising in manufacture or in high-stress operation, and (c) development of comprehensive theoretical models for optimal operation. Some pertinent research areas are (a) electron-beam lithography, resists, and dry etching methods; (b) spectroscopy and atomic-scale definition of defects; (c) carrier transport in the ballistic regime, in 2-dimensional structures, and in quantum supermatrix arrays.

A86-082 TITLE: PATTERNING OF GaAs AND AiGaAs ULTRA-SUBMICRON DEVICE STRUCTURES

CATEGORY: Research

DESCRIPTION: Future military requirements for real-time information acquisition and processing in tactical EW, DC3I, and smart munitions establish a need for ultralarge-scale and superhigh-speed integrated circuit microelectronics. New classes of solid-state devices, for example, quantum-well supermatrix structures, promise the possibility of ultrahigh-speed (picosecond) switching and high-frequency (10-100 GHz) mm wave components for microwave/microelectronic integration. These devices exploit the concept of one-, two-, and three-dimensional electron confinement through the use of molecular beam epitaxy (MBE) and ultrafine-lithographic techniques. Research into the formation of ultra-submicron device structures in GaAs and GaAlAs from 1,000 to 100 Å is required. Techniques such as wet etching and/or plasma etching (RIE, RIBE, CAIBE, etc) and their associated chemistries are to be evaluated in terms of ultimate resolution, aspect ratios, ease of use, etc. Knowledge of concomitant processing procedures such as lithography, masking and surface preparation is requisite.

A86-083 TITLE: LOW-LOSS SURFACE ACOUSTIC WAVE (SAW) FILTERS USING MONOLITHIC CONSTRUCTION

CATEGORY: Exploratory Development

Objective: Investigate, develop and demonstrate compact, high performance SAW bandpass filters operating in the 200-400 MHz frequency range. The filters are to utilize monolithic unidirectional transducers with an apodized electrode design for narrowband (1%) performance, less than 6 dB insertion loss and greater than 40 dB out-of-band signal rejection. SAW IF filters are finding increasing usage in communications systems (both ground and satellite). To make these filters even more cost effective, it is important to reduce their insertion loss to eliminate the need for an amplification stage to recover the loss.

A86-084 TITLE: DIGITAL SPECTROSCOPY OF PIEZOELECTRIC CRYSTALLINE MEDIA

CATEGORY: Exploratory Development

DESCRIPTION: Apply the methods of digital spectroscopy to the precision determination of the effective permittivity and attenuation tensors of single crystal and composite structures comprised of piezoelectric crystalline media at microwave, millimeter wave and optical frequencies as functions of temperature and orientation. These basic material properties are required to be known to greater precision in order to more accurately design acoustic

wave devices at higher frequencies and take full advantage of advances in circuitry. The objective is to achieve improved low noise oscillator designs for air defense radar receiver applications.

A86-085 TITLE: CRYSTAL PLATE ANGLE CORRECTION

CATEGORY: Exploratory Development

DESCRIPTION: The frequency versus temperature characteristics of crystal resonators depend primarily on the angles of cut of the crystal plate. State-of-the-art cutting techniques cannot provide the angles of cut accuracies required for the high yield fabrication of precision resonators. Cost effective methods of correcting and maintaining the angles of cut subsequent to cutting need to be developed. Of special interest are SC-cut resonators, for SC-cut resonators are expected to be the principal cut used in future C3, navigation, radar and IFF systems. Angles of cut accuracies of a few seconds of arc are required in some applications.

A86-086 TITLE: RADIATION HARDENED OSCILLATORS

CATEGORY: Exploratory Development

DESCRIPTION: Evolving C3, navigation, radar, and IFF systems require ever tighter tolerances on frequency standards and clocks. As the tolerances become tighter, the radiation induced frequency shifts become an increasing portion of the tolerances. For some systems currently under development, the radiation induced frequency shifts are a major limitation on the achievable system performance.

Novel methods of reducing the frequency shifts due to low and high levels of ionizing radiation, and due to energetic neutrons need to be developed.

A86-087 TITLE: PACKAGING OF HIGH PRECISION RESONATORS

CATEGORY: Exploratory Development

DESCRIPTION: High precision quartz crystal resonators are the key frequency determining element in the frequency standards and clocks used in modern military C3, navigation, radar, and IFF systems. One of the major causes of instabilities in resonators is due to the support structure of the resonator. Improved methods of supporting the resonators need to be developed. The method can include novel plate geometries, and improved mounting and bounding techniques. The method must minimize the instabilities due to stress relief and contamination, while providing a rugged resonator. Ultraclean, low cost methods of hermetically sealing resonators are also sought.

A86-088 TITLE: MILITARIZED WATCH (MIWATCH)

CATEGORY: Exploratory Development

DESCRIPTION: A militarized wristwatch (MILWATCH) is required that is capable of both accurate timekeeping and accurate time transfer. The goal is to provide a convenient means of transferring time to the clocks of tactical spread spectrum systems. The initial timekeeping accuracy goal is three seconds per month. Methods of conveniently and rapidly transferring time to and from the MILWATCH need to be developed. Although the initial accuracy goal could be achieved with a manual time transfer method, automated time transfer methods are desired in order to accommodate future improvements in low power clock technology, and in order to minimize the errors introduced by the time transfer method.

A86-089 TITLE: VIBRATION INSENSITIVE CYRSTAL OSCILLATORS

CATEGORY: Exploratory Development

DESCRIPTION: Vibration induced phase noise significantly degrades the phase noise attainable with crystal oscillators. This degradation limits the performance of military systems, among which are coherent radar and navigation systems that must operate on vibrating platforms, e.g. on aircraft. Methods are required for reducing the vibration sensitivity of crystal oscillators to below 1×10^{-11} per g.

A86-090 TITLE: TERMINAL PROTECTION DEVICE ACTIVE MEDIA

CATEGORY: Research

DESCRIPTION: Develop a solid-state nonlinear medium that will be highly conductive to large voltages and highly resistive and low in capacitance to low voltages. The figure of merit is the reciprocal of the product of the resistance while conducting and the capacitance at low voltages as expressed in GHz. This function is presently performed by MOVs which are a bulk device with a figure of merit of 1 GHz, senerdiodes which are junction with a figure of merit of 20 GHz, and PIN diode limiters which are also junction devices with a figure of merit of 1000 GHz. The medium must respond without delay to instantaneous voltage surges. PIN diodes have the disadvantages that they limit only at 0.7V, and are tiny junction devices Zener diodes have the disadvantage that their figure of merit is too low. A new media is needed like the MOV which is a bulk device providing for high energy absorptioin, having an adjustable threshold in the 5 – 150 V range, instantaneous response, and high figure of merit, 100 – 1000 GHz. Once the media is developed it must be tested in configuration that provide pig-tails (as the present MOVs) and in a 50-ohm TEM through PVT.

A86-091 TITLE: LOGISTICS SUPPORT OF NUCLEAR SURVIVABLE EQUIPMENT

CATEGORY: Management & Support

DESCRIPTION: The objective of this program is to develop and document the integrated logistic support (ILS) concepts for nuclear survivable, tactical Army equipments/systems. Once hardened equipment is developed, steps need to be taken to ensure that it is produced, maintained, repaired, supported and product improved in ways which will not degrade the equipment hardening. Nuclear hardening designs, data and analysis, hardness assurance, hardness surveillance and hardness maintenance information needs to be translated and integrated into the appropriate ILS documents and procedures. Some important issues are manpower requirements, training plans, maintenance procedures, parts procurement, and development of fool proof methods to control changes to the designs or replacement of parts which might jeopardize the equipment hardening. Additionally, other nuclear survivability issues may need to be protected, e.g. redundant equipment, crew vulnerability mitigation techniques and equipment-restoration measures.

The Army has developed Data Item Descriptions which are used to collect the supporting data, plans, analyses, and reports during the equipment development phases. However, we have not learned enough about ILS to know how to integrate this information into the plans, manuals, reports, procedures, etc. that the ILS system requires. Our strategy is to find a contractor who knows about Army's ILS procedures, have him learn about nuclear weapons effects or work with a subcontractor who has experience with nuclear weapons effects. The result of this program would be a report which shows how nuclear weapons effects information is to be integrated into the ILS program, showing how specific types of information goes into manuals, reports and other documents, naming the sections and paragraph numbers, as appropriate.

A86-092 TITLE: NUCLEAR SURVIVABILITY OF NON-DEVELOPM,ENTAL ITEMS (NDI)

CATEGORY: Advanced Development

DESCRIPTION: The objective of this program is to develop the concepts and techniques to harden NDI to the initial nuclear radiation (INR). The deliverable is a guideline, how-to-do-it report.

A current major thrust of the DoD is wherever practical to buy NDI. NDI can range from off-the-shelf commercial equipment to militarized equipment. It would be the rare case where these NDI equipments are nuclear hardened. For other than the INR, hardening of the equipment can oftentimes be done without changing the internal design or construction of the equipment. With the INR threat, detailed design and performance specifications are required before hardening can proceed (INR shielding is impractical for mobile equipments). Sometimes these specifications are not available because the manufacturer considers the information to be proprietary. Moreover, the manufacturer can refuse to identify the JEDEC equivalent numbers for his coded semiconductor piece parts and then refuse to sell quantities of parts for radiation testing. Radiation testing of whole equipment without an analytical understanding of what controls the equipment responses leads to problems in defining hardness assurance (HA) and hardness maintenance (HM) programs. HA/HM is also a special problem for NDI since when buying equipment we buy the functions and not the fixed internal designs. When the manufacturer can freely change the internal designs during production, repair, maintenance or product improvement, there is no control over the nuclear radiation hardness of the equipment.

In this program, we would like a contractor who is knowledgeable about nuclear weapons effects to survey manufacturers of NDI which have actual or potential applications in the Army. Interviews with user representatives and system developers would provide another useful perspective. In particular, the Project Manager Mobile Subscriber Equipment is recommended interviewee. In this survey, the contractor would explore those issues and options for procurement of nuclear survivable systems; present all the possible options, to include hardware modifications and other approaches, such as, redundant equipment, operator intervention, software modifications, etc.; and recommend the preferred risk, cost-performance trade-off.

A86-093 TITLE: SINGLE PULSE, HIGH POWER MICROWAVE DIAGNOSTICS

CATEGORY: Research

DESCRIPTION: The new field of High Power Microwaves has provided 1-100 GHz low rep rate sources with gigawatt peak powers and pulse lengths of 1-100ms. This active field of research needs diagnostic instrumentation capable of ascertaining the spectral content, power, pulse width, mode and bandwidth for a single pulse.

A86-094 TITLE: WIDEBAND ELECTROMAGNETIC FIELD SENSORS

CATEGORY: Engineering Development

DESCRIPTION: Design and fabricate electric and magnetic field sensors to operate over a 10 kHz to 1 GHz frequency range. The electric field sensor (or sensors) will be capable of sensing electric fields in the range of 0.01 V/m to 150 kV/m. The magnetic field sensor (or sensors) will be capable of sensing magnetic fields in the range of 0.1 mA/m to 800 A/m. Each sensor will output a voltage that is directly proportional to the measured field and will work into a 50 ohm load impedance. Both active and passive sensors are acceptable. Active sensors will operate on internal low-voltage dc batteries (e.g. 12 Vdc). The volume of each sensor must be less than 400 cm³. These sensors will be interfaced to fiber-optic transmitters (Government-furnished equipment, GFE). The total package, sensor plus fiber-optic transmitter, will have a geometry for which the sensor enhancement factor can be computed analytically. Computation of the enhancement factor for each sensor in the geometry selected to house the sensor and the fiber-optic transmitter is required.

A86-095 TITLE: EW VULNERABILITY

CATEGORY: Exploratory/Advanced Development

DESCRIPTION: The US Army has an extensive program designed to stress its weapon systems to electronic warfare (EW) environments to establish their limits to hostile EW. This limit is called a system's EW vulnerability and this vulnerability is reduced by the incorporation of electronic counter-countermeasures (ECCM) into the system being develop to harden it to hostile EW. The EW environments consist of electronic countermeasures (ECM) and electronic support measures (ESM) that are used to direct, locate, and identify systems on a modern battlefield. The Army EW vulnerability assessment program requires advances in all three of these areas (ECCM, ECM, and ESM). Further, these advances must be matched with advances in the use of electromagnetic spectrum which now encompasses radio frequency (RF), millimeter wave (MW), infrared (IR), optical (O), and ultraviolet (UV) portions of the spectrum. The use of three or more of these regions is defined as multispectral and, because of the costs required to conduct EW vulnerability assessments, all advances are to address as much broadbanded or multispectral frequency coverage as possible.

A very broad base of scientific knowledge exists regarding magnetic fields, but, because of the short range and low field densities, magnetic fields have found small application in Army ESM techniques. Thus, we need to develop magnetic field applications that can be used to complement existing ESM techniques across the spectrum. Multispectral sensor concepts need to be developed to permit simultaneously across RF, mmw, ir, O, and UV frequencies in an NKC-135A aircraft environment are required for air-to-air and air-to-ground measurements.

Two major areas of ECM advancement are required. These are advanced chaff and smart munitions ECM techniques. Advanced chaff techniques are required for multispectral ECM environments. The chaff techniques proposed should consider the type of material, form, and development techniques. The smart munitions ECM techniques must be as broadbanded (multispectral preferred) as possible to minimize the costs in applying them to a wide variety of munitions currently undergoing development.

The ECCM advances are required for electro-optical (EO) devices. These ECCM techniques should be used to reduce effects of lasers used as ECM against the EO devices. Emphasis should be placed on IR, television, nightsight, and UV systems.

A86-096 TITLE: LOW EMISSIVITY SURFACE COATINGS

CATEGORY: Research

DESCRIPTION: A need exists for thin surface coatings exhibiting low emissivity (high reflectivity) in the thermal infrared (2-14 microns). Innovative research is required to formulate practicable coatings having emissivity values in the 0.5 to 0.7 range. This research may include, but is not limited to, synthesis of infrared transparent binders and highly reflective pigments. This research should also investigate the feasibility of producing coatings exhibiting a variety of emissivity values in a controlled manner.

A86-097 TITLE: LIGHT WEIGHT COMPOSITE ROADWAY SURFACING SYSTEM

CATEGORY: Research

DESCRIPTION: A lightweight, mobile and durable roadway surfacing system is needed to provide trafficable approaches to and from bridge and fording sites for military vehicles up and including MLC 70. The current aluminum extrusion panel systems are too heavy for high mobility (6.5-7.0 lb/ft²). The composite panels must be compatible with existing Access/Egress Roadway Dispensing System. This system incorporates panels 14 feet wide and 2 feet long in aluminum connected together by a hinge to form a roadway of approximately 100 feet. The panels fold out and off the dispenser in an accordion manner requiring 180 feet of rotation. The individual panels are replaceable when damaged. The roadway will be used to support vehicles over poor soil conditions (CBR 1.0) and water affected areas for upwards of 3000 crossings (10% MLC 70). Goal weight for new panel system is 5 lbs/ft² or less. Work is anticipated to encompass materials and unique geometric configurations.

A86-098 TITLE: NOVEL CONCEPTS FOR RAPIDLY DEPLOYABLE ELECTRIC POWER DISTRIBUTION SYSTEMS

CATEGORY: Exploratory Development

DESCRIPTION: Electric power usage in the field Army today continues to rise with the increased use of sophisticated weapon systems and equipment. This trend, coupled with decisions aimed at reducing total numbers of generator sets in the field, has resulted in increased interest in the distribution of electric power. In particular, consolidation of multiple loads of greater and lesser critically and multiple sources (some in standby) on the same cable-type distribution system appear a viable approach even for some tactical units. The high degree of mobility envisioned as essential on the modern battlefield mandates that these cable-type electric power distribution under field conditions which will yield rapid deployment/redeployment and high mobility. Specifically, connector systems are fragile and susceptible to environmental degradation and to be both slow to engage/disengage and cumbersome to handle. New ideas are needed which will provide for low loss, multiple conductors, resistance to environmental effects and rapid fault resistant connection/disconnection. Other novel approaches in the area of cable-type electric power distribution systems are encouraged.

A86-099 TITLE: NOISE REDUCTION OF IC ENGINE DRIVEN GENERATOR EQUIPMENT

CATEGORY: Exploratory Development

DESCRIPTION: Innovative Techniques are sought to reduce the noise emissions and to attenuate the emitted noise from internal combustion (priority diesel) engine driven electrical power generation equipment. Objectives are to significantly reduce the aural signature while having minimum impact on weight, volume and performance.

A86-100 TITLE: INNOVATIVE CONCEPTS FOR COOLING TACTICAL SHELTERS

CATEGORY: Exploratory Development

DESCRIPTION: Devise method(s) for removing electronic heat loads from shelters during air over pressure environments created by chemical/biological air filtering systems. Use of contaminated outdoor air for cooling is not permissible.

A86-101 TITLE: DEVELOPMENT OF A LUBRICANT QUALITY MONITOR

CATEGORY: Exploratory Development

DESCRIPTION: Automotive lubricants used within the military are procured on the basis of their meeting specific performance criteria at the time of qualification. These performance tests involve rather complex, time-consuming, and costly engines dynamometer and component testing. Once qualified and identified on the appropriate Qualified Products Lists, only laboratory type tests (i.e., physical properties, additive constituents, etc) are utilized to insure product conformance.

In many instances, there could be changes within the formulations that could alter the resultant performance. These changes may or may not be detectable via the standard laboratory analyses. What is needed is a device or testing protocol that would define the overall product quality without the requirement for follow-on engine testing. This would be a mechanism to bridge the gap between the engine and component testing versus the laboratory physical/chemical property analyses. The device or testing protocol should be capable of defining lubricant quality in terms of additive package content, viscosity grade, and selected performance criteria such as anti-wear protection, detergency-dispersancy protection against high temperature oxidation, etc.

A86-102 TITLE: WELDING BRUSHES, DEVELOPMENT OF STANDARDS (QPL)

CATEGORY: Research

DESCRIPTION: The technology of welding is improving very rapidly moving from highly controlled environments to field automated applications. The use of improper welding joint brushes to clean weld joints for specific material alloys can result in contaminated joint material and thus in defective welds. Also contributing to this problem is the fact that brush manufacturing is mostly a proprietary type industry with new brush materials being introduced; for example, ceramic imbedded polymer fiber brush material. Answers (data) are needed on the effect of brush induced materials (polymers, ceramics, alloy elements) on weld joint surfaces and their effects on weld quality both good and bad. A more detailed selection of welding brush materials is needed to match the developments in welding alloy compositions and filler metal welding wire development. Qualified products listing for welding cleaning brushes is needed.

A86-103 TITLE: STABILIZATION OF THE SHIP/LIGHTER INTERFACE

CATEGORY: Advanced Development

DESCRIPTION: The Army Logistics-Over-The-Shore (LOTS) mission requires the capability to offload containers and breakbulk cargo from large oceangoing ships onto a variety of small lighterage, including landing craft, causeways, and air cushion vehicles. This must be accomplished in all types of weather conditions, including periods of high seas. During especially high sea states (Int'l SS 3 and above) problems are encountered due to the relative motion between ship and lighter, resulting in delay, damaged cargo and lighterage, and safety hazards to personnel. A need exists for innovative techniques and/or equipment to stabilize this interface, which includes the ship, the lighter, and the cargo handling equipment (crane), whether it be integral to the ship, the lighter, or mounted on a third platform.

A86-104 TITLE: SEASIDE OPERATION OF REVERSE OSMOSIS WATER PURIFICATION UNIT

CATEGORY: Exploratory Development

DESCRIPTION: In future field operations, the US Army will probably be required to produce potable water from the sea. The equipment of choice will be the standard 600 gals/hr Reverse Osmosis Water Purification Unit (ROWPU), or the 3000 gal/hr ROWPU under development. Unfortunately, operation of a water point along the ocean has always been difficult. The usual problems revolve around shallow water; tides; heavy breakers; and the presence of sand, silt, and shell fragments in the raw sea water. Specific difficulties include (1) clogging of the raw water pump, (2) lack of raw water due to a receding tide, and (3) damage of the entire intake system due to heavy seas. The problem is unquestionably a difficult one. What is needed is a new innovative idea that might solve the problem, plus a feasibility study to establish the practicality of the idea.

A86-105 TITLE: DEPOLARIZATION EFFECTS OF RADOMES

CATEGORY: Exploratory Development

DESCRIPTION: Dual-polarized receiving systems have the potential of providing a wider range of discriminants in microwave and millimeter sensors, but the depolarization effects caused by the shape and materials of the sensor radome may impair performance. This depolarization effect varies from point-to-point over the wave-front in such a way that it is difficult to assess without modeling the effects and simulating the sensor performance in a computer program. Computer-aided radome analysis is needed to help evaluate these depolarization effects and provide the basis for compensation techniques.

A86-106 TITLE: MILLIMETER WAVE SEEKER-IN-THE-LOOP SIMULATION TECHNOLOGY

CATEGORY: Exploratory Development

DESCRIPTION: In order for hardware-in-the-loop (HWIL) simulators to be able to effectively test and evaluate current and future state-of-the-art Army missile systems, the capabilities of current simulators must be modified and improved and proposed simulators must be designed with cost effective, innovative simulation tools and techniques. Currently known HWIL simulation techniques such as the matrix array, ellipsoidal reflector, and passive reflector array have fundamental limitations in displaying the electromagnetic environmental phenomenology to millimeter wave (MMW) missile systems. A wide field of view matrix array is cost prohibitive; the ellipsoidal reflector suffers from chamber reverberations; and the passive reflector array provides only passive track in the end-game. The requirement is to investigate cost effective solutions that will provide a wide instantaneous field of view to MMW seekers and sensors continuously from detection through acquisition, track, guidance and active/passive terminal phases.

A86-107 TITLE: ENHANCED CATALYSTS OF NITRIC OXIDE ACTIVATION AT MODERATE TEMPERATURES (150 TO 400 C)

CATEGORY: Applied Research

DESCRIPTION: Minimum smoke propellant compositions have a limited burning rate range believed to be caused by the slow activation/reaction of nitric oxide (NO), a major decomposition product of key ingredients. Catalysts or techniques are needed to cause NO to be activated and enter into reactions near the decomposition zone of the propellant to produce energy release and effective heat transfer to the surface. This is in a temperature region of approximately 150 to 400 C. Hence, practical catalysts, combustion modifiers or techniques are sought that will promote NO decomposition or NO reactions with fuel fragments in this temperature range. Catalysts, modifiers or techniques must be cost effective and be capable of being incorporated into solid propellant grains.

A86-108 TITLE: LOW COST 8-12 MICRON OPTICS AND DOME MATERIALS

CATEGORY: Exploratory Development

DESCRIPTION: Long wavelength infrared optical materials are expensive and limited in available materials. Missile optical domes in this spectral band are expensive and heavy. There is a need for alternative materials to provide lower cost and lighter weight domes for planned Army missile seeker developments. The investigation should include a plan to develop new optical materials which meet these objectives.

A86-109 TITLE: ADVANCED POLYMERS

CATEGORY: Exploratory Development

DESCRIPTION: There is an immediate requirement for a new generation of polymer matrix materials for advanced fiber reinforced composite rocket motor components. Current matrix materials have limited resistance to the service environment. This new technology would require the development of a matrix polymer capable of the following:

- Maintaining structural usefulness at temperatures greater than 700 F
- Be resistant to low temperature (-40 F) degradation
- Have vastly improved fracture toughness for damage tolerance
- Provide easy process ability with the reinforcing material
- Be cost effective

Emphasis should be given not only to developing improved materials, but also to understanding the composite behavior at the molecular level.

A86-110 TITLE: ORDERED POLYMERS FOR COMPOSITE STRUCTURES

CATEGORY: Exploratory Development

DESCRIPTION: There is a need for high specific strength sheet and tape reinforcement for composite structures. Ordered polymers are a viable approach; however, the commercial feasibility has not been established. A form of ordered polymer suitable for filament winding would enhance the process ability of ordered polymers in composite structure applications.

A86-111 TITLE: ADAPTIVE RADOME BORESIGHT ERROR COMPENSATION

CATEGORY: Applied Research

DESCRIPTION: A need exists for a universally applicable means of real-time compensation of the effects of radome induced boresight errors on missile guidance. This task is to develop a description of the function space represented by a typical boresight error slope map, develop a dynamical model to describe the radome error inputs to the guidance loop, design a real-time observer to estimate the errors and design an adaptive controller to provide real-time compensation of the errors. This procedure should also account for the effects of aerodynamic heating and ablation and should be universal in its application, i.e., not tailored to an individual radome. One of the payoffs from this task should be to preclude the necessity for use of prescription grinding and individual radome error mapping, thereby generating a savings in both time and cost in the radome manufacturing process.

A86-112 TITLE: EMBEDDED INTELLIGENT TUTORING SYSTEM

CATEGORY: Exploratory Development

DESCRIPTION: Effective operation of high technology weapon systems in a modern complex battlefield requires developing and maintaining high skill levels in the system operators throughout the life of the weapons system. Embedded training devices are intended to provide this function, but provide little or no identification of skill level weakness and no prompting of the student in maintaining specific skill levels. However, significantly improved results are obtained when a human instructor is available to tutor the student and emphasize skill level deficiencies. The need exists to develop an Intelligent Computer Assisted Instruction (ICAI) system that functions as an embedded intelligent tutoring system. The ICAI should be able to capture the human tutor expertise and effectively interact with individual students to identify specific skill level deficiencies and choose an appropriate tutoring strategy for prompting and training to correct the identified deficiencies.

A86-113 TITLE: ROBOTIC VEHICLE ENHANCEMENTS

CATEGORY: Exploratory Development

DESCRIPTION: To fulfill the Army requirements for all classes of robotic vehicles, tailored communication and navigations systems are required for unmanned systems. Several subsystems applicable to robotic vehicles require additional investigation and proof of concept demonstrations. Communication and navigation systems tailored specifically to robotic vehicles are required. Various communication links now being employed in manned combat vehicles can be tailored for robotic vehicle control link. Techniques for band width reduction, communication security, improved operator interface should be developed.

Integrated land navigation systems that couple internal inertial systems with external land or satellite based reference systems are required for accurate knowledge of unmanned vehicle positions. Landmark recognition may be used to augment both systems.

The above technology would supplement ongoing joint DARPA/Army programs in robotic vehicles. Potential enhancements after laboratory testing would be demonstrated during Army User Field Tests.

A86-114 TITLE: MILITARY DIESEL ENGINES

CATEGORY: Exploratory Development

DESCRIPTION: The general needs of military diesel engines include extended fuel tolerance, extended environmental tolerance, increased RAM-D, increased fuel economy, improved transient response, high power density and reduced specific heat rejection.

Some key technology areas which will allow advancements in the above areas to be accomplished include: (1) high in-cylinder capable materials and tribology systems, (2) fuel injection systems for better light load end idle fuel economy, (3) fuel and air systems for combustion control, (4) high efficiency turbomachinery, (5) full authority engine control systems, (6) techniques for friction minimization.

Work efforts which address the above areas would be most relevant to the enhancement of military diesel engines.

A86-115 TITLE: COMBAT VEHICLE CREW RESTING SYSTEM

CATEGORY: Exploratory Development

DESCRIPTION: Study vehicle crew resting system concepts for combat vehicles. Some type of resting techniques is needed to allow the vehicle crew to take rest while on the over watch mission. At present, it is a general practice to dismount the vehicle and find a place where one can lay down to get fatigue break to fulfill the physiological needs. The Army 21 concept will require crew member to stay in their vehicle up to 72 hours.

A86-116 TITLE: DUAL LEVEL HIGH COOLANT TEMPERATURE WARNING SWITCH

CATEGORY: Exploratory Development

DESCRIPTION: Cooling system failures that result in engine and transmission overheating, are a major cause of engine and transmission failures. Single temperature warning switches set at 225 F are not adequate for detecting cooling system overheating. When system pressure is low due to loose or failed radiator pressure caps. A solution to this deficiency is a dual level temperature warning switch that has the following characteristics.

The high coolant temperature warning shall provide dual warning temperatures depending on engine coolant out pressure. The warning shall be activated with coolant pressure below 7 PSIG and coolant temperature greater than 250 F and it will also activate with coolant pressure greater than or equal to 7 PSIG and coolant temperature greater than 225 F.

A single high coolant temperature warning sensor is desired, which will perform as specified above. This sensor must comply with Military Standard MIL-S-12285/2C, Installation and Environmental Considerations.

A86-117 TITLE: COOLING SYSTEM DEGRADATION INDICATOR

CATEGORY: Exploratory Development

DESCRIPTION: A major cause of engine failure in combat and tactical vehicles is cooling system degradation. No indicator of cooling system degradation now exists.

A solution is envisioned in a meter that would measure the air temperature difference between ambient air entering the engine and coolant temperature out of the engine and then compute a ratio of it to a present maximum temperature difference, so that a percent degradation in cooling system performance could be displayed when the coolant temperature exceeded 205 F.

A86-118 TITLE: ON-BOARD AUDIO TROUBLESHOOTER

CATEGORY: Exploratory Development

DESCRIPTION: The on-board audio system would complement the STE display and sensor system. It would enable lesser trained crew members to determine and resolve component and systems problems. This would be in the order of the audio troubleshooting systems now being installed in automobiles offered by the general public.

A86-119 TITLE: LOW COST, NON-INTRUSIVE TORQUE SENSOR

CATEGORY: Exploratory Development

DESCRIPTION: The availability and effectiveness of combat and tactical vehicles could be significantly increased by further improvement in engine prognostics and diagnostics techniques. These would be enhanced by a direct measurement (rather than synthesis from the measurement of other parameters) of engine output torque. A low cost and non-intrusive (easily applied in permanent installation, without impact on driveline layout) device or technique is needed for cost-effective incorporation in future Army engines. Accuracy of 2.5% at full scale and 5% at "idle" would be quite acceptable; frequency response in excess of 6400 Hz (4000 RPM x 12 cyl x 720 – 90) would be desirable but even 10Hz would be very useful.

A86-120 TITLE: EXHAUST EMISSIONS SENSING WITH SIMPLIFIED TEST EQUIPMENT (STE)

CATEGORY: Exploratory Development

DESCRIPTION: Environmental Protection Agency requirements will be imposed on military vehicles in the foreseeable future. An ability to inspect engine exhaust emission levels will be needed. It is necessary now to develop state-of-the-art technology emission sensors that are most suitable for use with the STE Family of test sets.

A86-121 TITLE: DATA-CHIPS

CATEGORY: Exploratory Development

DESCRIPTION: Engine and other equipment design and RAM-D development would greatly benefit if detailed statistical data were available from actual and extended field operations. Based on such data, significant savings in development time and cost as well as life cycle cost of the entire system would be possible as a result of designing to true requirements and directing corrective development to the root cause of the problems.

The complexity and expense of conventional data (parameter) sensing, recording, and processing prevent its mass application. A variety of ultra-sophisticated but very low cost devices would be needed to fill this void. These devices might be called: "Data-Chips". A variety of Data-Chips might be sensitive to frequency, temperature, pressure, stress, etc.; to discrete levels of these; and/or to associate time intervals. They might detect maximum values and/or they might accumulate (integrate) data. Data storage would be accomplished by some "solid state" property change which could be "decoded" at a suitable time and place.

An illustration of the concept, would be a self-energized strain gage with memory, logic, perhaps a timer, but not wires attached.

A86-122 TITLE: ISOLATED MULTIPLEX INTEGRATED CIRCUITS (IC)

CATEGORY: Exploratory Development

DESCRIPTION: In test equipment utilization, over voltaging due to attempts by the user to measure voltages above the test equipment supply voltage and high transient voltage encountered during measurements can cause damage to the multiplexer IC(s) and associated electronic devices following the multiplexer in the test equipment circuitry.

Isolated (Opto, FET, etc.) multiplexer ICS substantially reduce or eliminate these hazards. It is necessary to develop these kinds of ICs to directly replace existing non-isolated ICs in Simplified Test Equipment test sets.

A86-123 TITLE: HYBRID/LSI BUBBLE MEMORY POWER DOWN CIRCUIT FOR STE-X

CATEGORY: Exploratory Development

DESCRIPTION: Currently, discrete electronic components are used in the bubble memory power down circuitry design for STE-X. Hybrid/LSI technology could provide improvements in the failure rate, parts count and actual space claimed by the discrete circuit. A hybrid/LSI integrated circuit chip equivalent to the discrete circuit is required for the STE-X test set hardware design.

A86-124 TITLE: HIGH IMPACT STRENGTH, LOW TEMPERATURE CURING ADHESIVES

CATEGORY: Exploratory Development

DESCRIPTION: Although many adhesives have desirable properties over a wide range of temperature, commercially available adhesives must be cured at or above ambient temperature. A high impact strength adhesive which cures in less than two hours (to a reasonable fraction of full strength) at temperature as low as zero degrees Fahrenheit would find applicability in expedient field repair of combat tanks.

A86-125 TITLE: EFFECT ON RESIDUAL ELEMENTS ON THE WELDABILITY OF ARMOR STEELS

CATEGORY: Exploratory Development

DESCRIPTION: Recent changes in the steel making industry and the shift from fully integrated steel facilities to 100% scrap electric furnace operations has resulted in an increase in both the total quantity and number of residual elements. While the effect on ballistic performance may be minimal the effect on weldability may be substantial. A program is needed to determine the effect of residuals such as tin, copper, antimony, zinc, etc. on the weldability of armor steels.

A86-126 TITLE: QUIESCENT HIGH TEMPERATURE MELTING SOURCE FOR PRODUCING HIGH INTEGRITY FOILS AND/OR SURFACE LAYERS WITH SURFACE DAMAGE RESISTANCE

CATEGORY: Exploratory Development

DESCRIPTION: The use of a laminar plasma jet melting sources for controlled fusion of materials for deposition of surface layers or for chill block melt spinning is desired. A laminar plasma jet is a fundamental prerequisite for adequate process control to produce uniform products.

A86-127 TITLE: NOVEL METHODS TO PRODUCE THIN FOILS OF WEAR RESISTANT MATERIALS

CATEGORY: Exploratory Development

DESCRIPTION: Use chill block melt spinning techniques to produce continuous thin foils of wear resistant materials. These materials frequently contain high solute contents of metalloids and are consequently hard or impossible to process by conventional thermo-mechanical processing techniques and thus must be processed by inefficient powder metallurgical processing techniques. Foil performs could be conveniently placed on and easily bonded to wear sites (e.g. tank threads, forming die surfaces) on new or to be rejuvenated parts. Both labor and materials savings would be envisaged when forming such high integrity wear surfaces.

A86-128 TITLE: IMPROVED OPTICAL/ELECTRO-OPTICAL MATERIALS AND MATERIALS PROCESSING METHODS

CATEGORY: Exploratory Development

DESCRIPTION: Innovative technology is required to increase performance, availability and reduce costs of optical/electro-optical materials for Army systems. Areas of importance include:

- a. Hard Optical Coatings: Broadband sensors require hard, erosion-resistant coatings which are transparent from ultraviolet, through the visible, well into the infrared radiation wavelengths. New concepts for such coatings compatible with state-of-the-art optical materials are desired. Such concepts should also address the practicality of operating reliably and being reproducible in production mode.
- b. Single Crystal Growth: Many applications for single crystal optics are limited by size, perfection and cost of currently available single crystals. New or innovative methods of crystal growth aimed at addressing the above issues for materials such as Lithium Niobate, Strontium Barium Niobate, Gallium Arsenide, Indium Phosphide, or Magnesium doped Lithium Niobate are desired.

A86-129 TITLE: COATED TUNGSTEN POWDER

CATEGORY: Exploratory Development

DESCRIPTION: The heavy alloy grades of tungsten have been successful because they combine high density with relatively low processing temperatures. Although these alloys have significant strength and ductility compared to pure tungsten, it is desired to further enhance these properties. Impurities play a role in the final properties of the tungsten heavy alloy and are most harmful when segregated to the interface between the tungsten particles and the alloy matrix. Therefore, reducing the amount of impurities as well as grain size control will improve the properties of tungsten heavy alloy.

A86-130 TITLE: CERAMIC MATERIALS FOR LOW HEAT REJECTION DIESEL ENGINES

CATEGORY: Exploratory Development

DESCRIPTION: Advanced diesel engines with minimal or no forced cooling are desired for Army applications. Key to obtaining such engines are structurally sound ceramics and ceramic coatings capable of maintaining mechanical and physical properties and dimensional stability with time in an engine environment. Innovative materials and processing techniques are sought.

A86-131 TITLE: IMPROVED PERFORMANCE IN RESIN-MATRIX COMPOSITES

CATEGORY: Exploratory Development

DESCRIPTION: Innovative approaches are necessary to improve the performance of resin matrix composites. Areas which are being considered for study are:

- a. Development of resin matrices exhibiting minimal or zero shrinkage during cure. Minimal shrinkage being less than ½ percent when cured at 117 C (350 F). Approaches such as the incorporation of spiro compounds into epoxy matrices will be considered. The resins should also exhibit mechanical and physical properties suitable for use in structural composites.
- b. The mechanical properties of resin matrix composites produced by wet laminating techniques such as filament winding and pultrusion are often degraded by void formation. A method to eliminate or reduce the formation of voids due to entrapped air is required. Innovative approaches compatible with wet laminating processes are being sought and would be considered under this topic.
- c. Formulation and testing techniques for producing ambient-temperature, low viscosity (300-600 cp), rapid-cure (2 hours or less) repair kit resins for use in multiple woven glass and graphite repair patches. Resultant repair kits must have a long shelf life (over 1 year) and when cured exhibit chemical and mechanical properties typical of 350 F cured epoxies.

A86-132 TITLE: NONDESTRUCTIVE EVALUATION TECHNIQUES

CATEGORY: Exploratory Development

DESCRIPTION: Innovative approaches are necessary to improve the nondestructive evaluation (NDE) techniques for applications to structural materials to interest to the Army. Areas being considered for study are:

- a. Develop a NDE technique for the analysis of the signatures of flaws which are induced into ceramic materials during processing, e.g. porosity inclusions.
- b. Develop a NDE technique to predict the grain sizes in sintered materials.
- c. Develop a NDE technique for the measurement of case depth in steels. Consideration should be given to both carburized and induction hardened cases in the range of 0.2mm to 2.5mm.
- d. Develop a functional relationship to describe the reflection of ultrasound at a flat, variable roughness interface of a bulk material which considers the spectral content of the transmitted and reflected signal.

A86-133 TITLE: ADVANCED TOOLS FOR HUMAN FACTORS RESEARCH

CATEGORY: Exploratory Development

DESCRIPTION: There is a need for advanced research tools that will allow evaluations of soldier-machine interface for systems in concept evaluation and later phases of development at a minimum of personnel and equipment resource cost. Specific requirements are to identify advanced tools that are adaptable to military research needs, easily operated, reliable, and flexible enough to be operated in different research settings (.e.g cockpits, combat vehicles, indoor laboratories, and outdoor test ranges). Advanced tools that could be useful in human factors engineering research and development include; biomechanical motion analyzers, computer-aided design packages, portable computing systems for data collection and immediate analysis, high-speed video analysis, portable biotelemetry equipment and generic simulators. Advanced research tools are important ingredients of the Manpower and Personnel Integration (MANPRINT) program to impose human factors engineering considerations on the entire material research and development process. MANPRINT is one of the Army materiel research and development initiatives.

A86-134 TITLE: TESTER – INSULATED COLD WEATHER BOOT

CATEGORY: Exploratory Development

DESCRIPTION: A device is presently available and has been for 20 years which is capable of determining when water has penetrated the elastomer of the cold weather boot. It is based upon a capacitance change and an electrochemical balancing of a bridge. The need is for an upgraded version which will cost less, be easier to repair and which can be shipped around the country without disturbing the operation.

A86-135 TITLE: HEAT-SEALABLE SEWING THREAD

CATEGORY: Exploratory Development

DESCRIPTION: TO develop a heat-sealable coating for either nylon or polyester sewing thread for the purpose of sealing the material needle holes subsequent to sewing by heat process to create a water-repellent and vapor impermeable seam. The coating shall not degrade the thread's physical properties, impeded sewability, be affected by needle heat, or be tacky after a seam from the thread has been sewn and heat-sealed.

A86-136 TITLE: IMPROVED COLD WEATHER HANDWEAR SYSTEMS

CATEGORY: Advanced Development

DESCRIPTION: Current Army hand wear systems, when worn in conjunction with the appropriate standard clothing, will provide environmental protection in a 40 F to -60 F temperature range. At -60 F, current systems will provide one hour of protection to a moderately active soldier. New hand wear systems must be developed, or the current hand wear systems modified, to maintain or improve this level of protection while simultaneously effecting improvements in several of the following areas: dexterity, waterproofness, elimination/absorption of perspiration, durability, fit, sizing, comfort, weight, bulk, maintenance wind protection; grip/grasp, ease of donning and doffing, adequacy of fit adjustments, adequacy of ventilating adjustments, compatibility with the new extended cold weather clothing system, compatibility with other hand wear, appearance, and troop acceptance.

A86-137 TITLE: DEVELOP A REORTABLE NON-METALLIC SQUEEZE FOOD TUBE

CATEGORY: Exploratory Development

DESCRIPTION: Develop a 8 fluid ounce non-metallic squeeze tube capable of being retorted at 250 F after being filled with food product or liquid supplement drink. The tube would be used for feeding NBC and aircraft personnel. The neck of the tube shall be 0.430" diameter and 0.312" high. The thread size shall be 9/16 – 12 UNC (14.288 x 205 mm). The diameter of the body of the tube shall not exceed 2 inches, and shall be heat sealable on the bottom. The materials may consist of aluminum foil as a metal laminate.

A86-138 TITLE: LIFE INDICATOR FOR CHEMICAL PROTECTIVE UNIFORM

CATEGORY: Exploratory Development

DESCRIPTION: Present and proposed chemical protective uniforms rely on activated carbon to absorb toxic agents such as liquid and vapor mustard and nerve agents. Environmental contaminants, e.g. water, perspiration, exhaust smoke, surfactants, etc. may poison then activated carbon over time – whether the uniform is packaged or worn and laundered – and a convenient means is needed to indicate or determine whether the carbon still has the capacity to protect against toxic agents. The indicator may change color when the carbon activity has been depleted or the indicator may be in a portable kit which will measure the carbon activity. Such a portable kit, or indicator attached to the uniform, may rely on chemical, physiochemical, electrical, mechanical or other practical means. It should be easily maintainable and durable/usable under field conditions. The task of this effort is to develop and test such a life indicator or kit.

A86-139 TITLE: CHEMICAL PROTECTIVE FABRICS

CATEGORY: Advanced Development

DESCRIPTION: Present and proposed chemical protective uniform rely on activated carbon to absorb toxic agents. The degree of protection is basically directly proportional to the amount and/or configuration of the activated carbon

in or on the fabric of the protective uniform. However, the weight and density or compactness of the carbon inversely affect factors which relate to comfort, such as fabric weight, flexibility, air permeability, moisture vapor, transmission, etc. The objective of this task is to apply activated carbon spheres, having a diameter of approximately 0.40 mm and a surface area of approximately 1000 m²/g to a standard military fabric, such as MIL-C-44031A, Cloth Camouflage Woodland, NYCO Class 2, quarpel or NIL-C-43858A (GL), Nylon tricot black, in several patterns or densities, e.g. chemical agent protection properties of these modified fabrics. The goal is to establish a relationship between protection and carbon configuration.

A86-140 TITLE: SORPTIVE, CHEMICAL PROTECTIVE UNDERGARMENTS

CATEGORY: Advanced Development

DESCRIPTION: Present and proposed chemical protective uniforms rely on activated carbon to absorb toxic agents. An undergarment material containing activated carbon spheres at a density of approximately 200 g/m² has been developed, but little has been done to optimize the design and fit of undergarments made from this material in order to maximize comfort, ease of donning and doffing, agent protection and body waste elimination. The objective of this task is to design undergarments from government supplied, carbon-containing fabric – incorporating these features – and to quantitatively test the designs on human subjects and/or instrumented manikins. The undergarments shall be tested for comfort and functionality alone and with outer garments such as the battledress uniform, combat vehicle crewman uniform and air crewman uniform.

A86-141 TITLE: MUNITIONS LOGISTICS DECISION SUPPORT SYSTEM

CATEGORY: Exploratory Development

DESCRIPTION: The impact that munitions characteristics (such as weight, cube, sensitivity, etc.) have on the logistics system needs to be explored early in the development of a new or product-improved munition. Programs are currently ongoing to determine the relevant areas of concern within each part of the munitions logistics system, along with the data required to quantify the impacts munitions have on each other of these areas.

A decision support system capable of supporting the evaluation of the impacts munitions characteristics have on the numerous nodes and interfaces in the munitions logistics system is required.

A86-142 TITLE: IMPROVED RDX CRYSTALS

CATEGORY: Exploratory Development

DESCRIPTION: As presently manufactured in the US, RDX crystals contain intragranular cavities which may affect the sensitivity of explosive formulations containing RDX. The present manufacturing process involves precipitation from cyclohexanone. Other solvents or procedures may produce a better quality material. We would like to compare the present RDX with RDX of a similar particle size which is free of intragranular cavities. The comparison could be made with various particle sizes, but it would be convenient to use a particle size distribution similar to present Class A RDX (particle size distribution similar to present Class A RDX (particle size in the range of 100 to 150 microns). Tests would be done at the USA Ballistic Research Laboratory. The contractor would develop the process for making cavity-free crystals and produce a few kilograms of material for test purposes.

A86-143 TITLE: INERTIAL REFERENCE SYSTEM TO MEASURE BLAST INDUCED
DISPLACEMENTS

CATEGORY: Engineering Development

DESCRIPTION: An inertial reference system is needed to measure the displacement of targets during blast test in large shock tubes or high explosive simulations of nuclear weapons. The system would supplement photographic coverage when the target was obscured by dust. The system, composed of accelerometers, roll rate sensors, analog to digital converters and on board memory would be mounted on the target and record its displacement and orientation during the blast test. The system would be integrated from off the shelf hardware. The system would be bench tested, then turned over to DoD for field testing.

A86-144 TITLE: HIGH PRESSURE EQUIPMENT FOR OPTICAL LIQUID PROPELLANT STUDIES

CATEGORY: Basic Research

DESCRIPTION: Instrumentation is not currently available for studying phase transitions and other important properties of liquid gun propellants at accurately-known high pressures. Working both with laboratory researchers and manufacturers of high pressure equipment, the contractor will design, assemble, and test an apparatus for hydraulically pressurizing very small (less than 100 microliter) volumes of liquid propellant in an optical micro cell equipped with visible and infrared transmitting windows (minimum aperture 1 millimeter) to pressures of 200,000 psi, and temperatures from -60 to 60 Centigrade, with no mixing of hydraulic fluid and propellant.

A86-145 TITLE: RESEARCH IN CAD-E FOR EXPLOSIVE WAREHEAD

CATEGORY: Exploratory Development

DESCRIPTION: Currently, a number of continuum mechanics computer codes and analytical models are available which model the formation of fragments, jets, or explosively formed penetrators by explosive warheads. Improved design efficiency would result from the development of software and application of hardware to use these models interactively in a design mode. As a follow-on effort, software to provide design data as either engineering drawings or tapes to drive CAM equipment should be pursued.

A86-146 TITLE: TEMPERATURE DETERMINATION WITHIN A HOT GAS/ATMOSPHERIC MIXTURE

CATEGORY: Exploratory Development

DESCRIPTION: Development of a simulation capability for determining the infrared characteristics of a cloud of hot gas (engine exhaust) mixing with the atmosphere is needed. Conditions such as the temperature and wind speed of the atmosphere and the temperature and velocity of the hot gas would be designated, and the temperature at points within that mix would be calculated.

A86-147 TITLE: ADVANCED PACKAGING FOR ARTILLERY CHARGES

CATEGORY: Exploratory Development

DESCRIPTION: Full exploitation of robotics in emerging artillery weapons requires a minimal number of charge increment types (ideally only one, "universal" increment), minimal charge parasitic weight and volume, and specific propellant packaging characteristics (both to facilitate automated handling and zoning and to assure satisfactory ignition and combustion at all zoning levels). Current combustible case materials, however, require substantial wall thicknesses to meeting handling requirements, seriously limiting our ability to achieve the other desired characteristics, particularly if a large number of these "universal" increments is required in order to provide intermediate velocities to meet all required zoning levels. New combustible and/or consumable materials and packaging concepts need to be developed that provide the low cost, weight, and volume of the old cloth bags with the rigidity and handling characteristics of current combustible cases.

A86-148 TITLE: SURFACE REFLECTION MODELS FOR MODERATE DIELECTRICS

CATEGORY: Research

DESCRIPTION: To develop reflection models for materials having moderate dielectric constants for use in a radar scattering program. The scattering code uses raytracing to determine multiple reflection paths and shadows. The magnitude, phase, and polarization of the backscattered field and reflected field is determined at each intersection point along the ray's path using physical optics. No transmitted ray is calculated, so that the reflection models must be restricted to cases for which the dielectric properties can be incorporated into the reflected ray.

A86-149 TITLE: DISTRIBUTED DATABASE MANAGEMENT SYSTEM

CATEGORY: Engineering Development

DESCRIPTION: There is a pressing need for a flexible database management system (DBMS) in support of a wide variety of projects involving a network of disparate computing system operating under various versions of the UNIX operating system. The DBMS must support network access of databases stored on distant systems as well as access and update of data maintained on one's local system. Additionally, the DBMS must be readily adapted to future system acquisitions that do not necessarily duplicate existing hardware configurations. Efficient access to databases from applications written in C and other widely-used programming languages as well as direct interactive human access must be provided. The "relational" model must be directly supported and all features generally accepted as usual in the software industry for this style of DBMS should be provided. The emphasis of this project is not so much on database design as on substantial improvement in availability of both data and the DBMS itself in an evolving network context.

A86-150 TITLE: DRAG AND YAW ACCELEROMETER SENSING SYSTEM

CATEGORY: Engineering Development

DESCRIPTION: Design and develop accelerometer sensing systems for the purpose of making in-flight measurement of yaw motion amplitudes and/or drag deceleration. System must interface with existing IGIR Telemeter Packages. It would be used on a variety of artillery projectiles and, therefore, there may be some constraints on physical size. System or sensors must be able to survive high accelerations that accompany gun-launched projectiles (10-30,000 G's).

A86-151 TITLE: PREDICTION OF PROJECTILE BASE BLEED

CATEGORY: Basic Research

DESCRIPTION: A need exists for the capability to predict the effects of base bleed on projectile aerodynamic performance. Design engineers now are using very simplistic empirical analysis techniques to estimate the performance of projectiles utilizing the base bleed technique for achieving increased range. The required analysis would include effects of mass injection rate, temperature of the injected mass, projectile spin, effective gamma of the injected mass, local pressure in the base region, Mach number, and projectile configuration. The performance parameter of particular interest is the drag.

A86-152 TITLE: LABORATORY RAILGUN BARREL

CATEGORY: Exploratory Development

DESCRIPTION: Design and fabricate a one inch square bore laboratory railgun barrel for use with existing power supply. This device will be used to perform experimental studies of plasma armatures which propel projectiles of up to 100 grams to velocities greater than 2.0 kilometers per second. The priority of design considerations shall be:

1. Integrity of device under stress of magnetic forces
2. Utility as a testbed research device
3. Ease of replacement of inner bore surfaces
4. Ease of inserting diagnostic probes for armature diagnostics
5. Ability to accept small material test sections for bore surface studies

A86-153 TITLE: KNOWLEDGE REPRESENTATION USING MENTAL MODELS

CATEGORY: Exploratory Development

DESCRIPTION: In several classes of knowledge-based systems, it is important that the knowledge representation technique closely match that actually employed in human cognition. While there is some empirical evidence that rules, semantic nets/frames, and first order predicate logic can serve this function, recent work by Johnson-Laird and others indicates that an important aspect of human cognition is the formation of mental models that are approximately isomorphic to the situation being considered. Innovations are needed to define mental models as they would be used in knowledge-based systems, and to determine the systems and problem domains for which they are best suited. Candidate systems include message modeling and interpretation, situation assessment, battle order planning and transmission.

A86-154 TITLE: ANGULAR MOTION SENSOR

CATEGORY: Exploratory Development

DESCRIPTION: A sensor to detect the angular motion of the muzzle of a cannon is required. The device would be used in development testing of the dynamic motion of cannon during firing and could form the basis of a continuous muzzle reference system for fielded equipment. The system should be capable of resolving the three vector components of angular motion: pitch, roll, and yaw to an precision of 0.05 milliradian. The system should have a dynamic response of 25 kHz. The system should be sufficiently rugged to withstand the firing environment of the tank cannon.

A86-155 TITLE: PREDICTION OF RADAR CROSS SECTION BASED ON SOLID MODELS

CATEGORY: Exploratory Development

DESCRIPTION: A requirement for advanced vulnerability analysis is to estimate the radar cross section for postulated, non-existing aircraft. Mathematical models of the postulated vehicles can be generated to aid in these analyses. These models are in reality mathematical constructs called solid models and employ a solid modeling technique known as constructive solid geometry. With this technique a postulated vehicle (or real one, for that matter) can be modeled including physical attributes such as material type; a variety of physical and mathematical analyses will be applied to the model to yield numerous data, including weight and balance and vulnerable areas. The Army has a requirement to predict the radar cross section for postulated vehicles and needs a technique to quickly compute an estimate of the vehicles radar cross section based upon the solid model as input.

A86-156 TITLE: HIGH BURNING RATE FORMULATION RESEARCH

CATEGORY: Basic Research

DESCRIPTION: Burning rate promoters offer increased probability for fielding advanced ballistic concepts such as traveling charge.

Boron hydride (B10 and B12) salts, in particular, have shown great effectiveness as burning rate promoters in propellant formulations. Current use of these materials is based on empirical relationships. There exists a great need for gaining further understanding of the details of ingredient functioning.

The research involves formulations work to examine in detail tradeoffs in burning rate and safety properties due to different boron hydride ingredients and various binder, plasticizer and oxidizer species. In addition, new polymers and plasticizers being developed for propellants should be screened for use with boron hydrides. Finally, the effects of catalysts in promoting the efficiency of boron hydride burning rate additives should be explored. Chemical decomposition studies of ingredient combinations and propellant samples should be conducted to help unravel the chemical details of the mode of action of the B10 and B12 salts.

A86-157 TITLE: FOCAL PLANE MM IMAGERS FOR TEST INSTRUMENTATION

CATEGORY: Exploratory Development

DESCRIPTION: The instrumentation requirement is for an instrument that can be used to measure the MM wave pattern swept out by the MM radar devices on SADARM, ASSAULT BREAKER, and other Fire and Forget Weapons. The requirement for small size, small power and immunity to countermeasures, narrow frequency response, etc. are considerably reduced for a fired test instrument which is normally operated in a non-hostile environment. The literature has indicated that small array detectors (bolometers) have been assembled using small individual discrete detectors. It is assumed that the technique could be extended using printed circuit and lithographic techniques to generate small arrays such as 8 x 8 and eventually to 32 x 32 which could be used in conjunction with tracking parabolic focusing antennas to allow field measurements on free-falling MM wave devices.

A86-158 TITLE: RADAR BEAM PATH PREDICTION WITH LIMITED NUMBER OF SENSORS

CATEGORY: Exploratory Development

DESCRIPTION: The requirement is for mathematics to aid in the measurement of the MM wave pattern swept out by the MM radar services on SADARM, ASSAULT, BREAKER, and other Fire and Forget Weapons. This topic addresses the problem in terms of using the methodology of mathematics to get the most information out of existing (or elsewhere developed) sensors. The mathematics would be designed to use apriori knowledge about the emitter (beam width, scan rate, power levels, and physical location) and combine this information with the time-amplitude history of the power levels received by the sensors to give an increased accuracy prediction of the actual beam path. For example, a single unaided sensor could only give the time at which a radar beam was nearest the sensor (with a linear scan rate), a mathematically aided sensor could potentially also give the distance to the radar beam when it was nearest.

A86-159 TITLE: PROCESSOR-CONTROLLED WAVEFORM GENERATION – TO – AMPLIFIER INTERFACE

CATEGORY: Engineering Development

DESCRIPTION: Design, build and test a processor-controlled interface for application between a .1-40 Ghz arbitrary waveform generator and a set of high power amplifiers (HPA) and antenna systems. Functionally, the interface must switch and control HF from the generator to n sets of HPAs/antennas at a microsecond rate. Pre-amplifier gain and HPA output power must be under control of MICROVAX I processor. The feedback loop from HPA output must throttle the pre-amp gain to keep the HPAs linear at all times. The final package must be no more than 10 inches high and fit in a 19 inch wide rack.

A86-160 TITLE: TECHNIQUES FOR SMART SENSORS

CATEGORY: Exploratory Development

DESCRIPTION: Future surveillance/reconnaissance sensors will include microprocessors which will automatically detect, recognize, and locate targets. There is a need to determine the testing approach and target types which will best measure the performance of the sensors in terms of probability of detection/recognition and false alarm rates.

A86-161 TITLE: SPECIFYING, TESTING AND EVALUATING C3I SYSTEMS THAT EMPLOY
ARTIFICIAL INTELLIGENCE

CATEGORY: Research

DESCRIPTION: Artificial Intelligence (AI) techniques are being employed in the development of some “concept evaluation” models of military C3I systems. As AI comes to be used in Engineering Development Models, an integrated methodology for specifying, testing and evaluating in objective terms the performance of such systems is required. This task should review current and likely future applications of AI in military C3I systems and propose objective measures of performance of such systems which are meaningful to a system use and which are testable.

A86-162 TITLE: PHYSIOLOGICAL MONITORING SYSTEM

CATEGORY: Exploratory Development

DESCRIPTION: In testing developmental clothing and protective equipment it is necessary to monitor the physiological response of soldiers undergoing different activities while wearing or using the prototype equipment. A mobile, wireless system is needed to provide near real-time physiological data on test subjects. The task would be to design a mobile, wireless physiological monitoring system for use in cold regions testing down to temperatures as low as –65 Fahrenheit.

A86-163 TITLE: DETERMINING COMFORT PARAMETERS IN HEATED SPACES

CATEGORY: Exploratory Development

DESCRIPTION: Presently, testing of heating and ventilating systems in vehicles and shelters is done in accordance with MIL-STD-14720. That standard requires that heated spaces that are occupied by personnel on a permanent or semi-permanent basis must be able to maintain an effective temperature (ET) of not less than 41 F (5 C). The standard further requires that the temperature of the air at floor level and at head level should not differ by more than +9 F (+5 C). In much Army testing, these criteria seem to be unnecessary. The ET and temperatures uniformity requirements are very difficult to attain, especially in a cold-soaked armored vehicle such as a tank. Not only does a too strict requirement result in expensive overdesign of the heating system, but it can result in overheating of the crewmembers, which increases their chance for a cold injury. For example, crewmembers wearing the standard vapor barrier VB boot exposed to long periods where their foot temperature is high tend to perspire, wetting their socks. Later exposure to cold may result in cold injury.

The goal of this effort is to experimentally determine comfort parameters, especially with respect to the temperatures, for personnel occupying heated spaces dressed in the cold-dry uniform.

A86-164 TITLE: SUBJECTIVE WORKLOAD ASSESSMENT

CATEGORY: Research

DESCRIPTION: Subjective assessment of workload is usually done with a unique instrument for each application. It would standardize procedures and allow greater comparability of result if a methodology could be identified/created for US Army use in HFE test and evaluation. A methodology, if fairly straight-forward and easy to use and understand, would contribute greatly to the MANPRINT effort by allowing comparisons across systems and individuals.

A86-165 TITLE: MICROCOMPUTER CASCADABILITY AND AUTOMATED MICROCODE GENERATION

CATEGORY: Exploratory Development

DESCRIPTION: Research to date has demonstrated the feasibility and potential of the high-technology concepts of 1. non-von Neuman macro-architecture machine consisting of standardized cascadable microcomputer modules for real-time signal and image processing, and real-time instrumentation control applications requiring computing speed and power not otherwise available in microcomputer systems, and (2) retargetable automated microcode generator to automatically generate microinstructions for application programs from high-level language. These concepts offer significant potential for achieving important economics in the acquisition and utilization of standardized microcomputer-based system.

Exploratory development is now needed to produce cascadable microcomputer module and automated microcode generator prototypes.

A86-166 TITLE: AIR BLAST SHOCK MEASUREMENTS TECHNIQUES

CATEGORY: Engineering Development

DESCRIPTION: The development of accurate, reliable air blast measurement techniques using low-cost instrumentation is required for use in nuclear survivability air blast programs. These programs are extensive and are used to test systems to the effects of air blast associated with a nuclear weapon. Present instrumentation that is used is expensive and measures air blast overpressures that strain gage or equivalent techniques. It is required that new instrumentation and techniques be developed which measure the air blast effects over large system areas and do it with accuracy and repeatability. This instrumentation should be capable of being used for the measurement of air blast effects for different types of defense system applications.

A86-167 TITLE: EVALUATION OF REMOTE CONTROL FOR TARGET HELICOPTERS

CATEGORY: Exploratory Development

DESCRIPTION: Given existing remote control systems used for command and control of fixed wing aircraft, research and evaluate current techniques. Develop a conceptual system design for fullscale and subscale rotary wing target scenarios through 1992.

A86-168 TITLE: MULTI-SENSORY TRACKING MOUNT CONTROL

CATEGORY: Exploratory Development

DESCRIPTION: A test range instrumentation tracking mount will be equipped with TV, IR, millimeter wave radar, and telemetry tracking sensors. Development of a comprehensive algorithm to use outputs from all of these sensors simultaneously for tracking mount control is planned. Techniques of real time adaptive parallel processing are desired. Algorithms, parallel processing hardware configurations, and software specifications for the final system design are needed.

A86-169 TITLE: MILLIMETER WAVE INSTRUMENTATION RADAR

CATEGORY: Exploratory Development

DESCRIPTION: The tracking of missiles and sub munitions near the ground requires the use of an agile, high resolution tracking instrument. Recent developments in millimeter wave technology provide the opportunity to develop such an instrument. Detailed conceptual design of a small lightweight millimeter wave radar is required. Coherent operation is expected with 10 meter range resolution and 0.5 degree angle resolution. A highly mobile, remotely operable system is envisioned. The system should be operable after daily relocation with a high degree of reliability. It is desired to track 0.1 square meter targets to a range 10KM. Detailed conceptual design is expected to include system theory system description, major component identification, engineering cost estimates, fabrication cost estimates, and system performance estimates.

A86-170 TITLE: IMAGE PROCESSING TECHNIQUES FOR AUTOMATIC VIDEO TRACKING APPLICATIONS

CATEGORY: Exploratory Development

DESCRIPTION: A composite of previously developed video trackers is desired. A great deal of research in the area of automatic video tracking algorithms has been pursued by various government and government sponsored agencies. Several of these algorithms have been successfully implemented at WSMR but the remaining algorithms need to be identified, analyzed, and compiled into a report. Then a set of algorithms and a matching hardware architecture should be recommended for implementation as the next generation of video tracker.

A86-171 TITLE: AIRBORNE VEHICLE ATTITUDE MEASUREMENT

CATEGORY: Basic Research

DESCRIPTION: A method of accurately measuring the attitude angles (pitch, yaw, and roll) of airborne vehicles is required. Priority will be given to methods which do not require equipment on board the vehicle. Measurement accuracy in the neighborhood of +0.1 degree in each axis is required.

A86-172 TITLE: ARTIFICIAL INTELLIGENCE METHODS IN AUTOMATED VIDEO TAPE READING

CATEGORY: Advanced Development

DESCRIPTION: Existing methods for automated computer reading of data videotape are based on pattern recognition methods and ignore much knowledge about the conditions existing at the time the tests from which the data was collected, are run. Artificial Intelligence methods which apply knowledge via expert systems need to be developed in order to achieve maximal system with respect to speed and accuracy.

A86-173 TITLE: IMPROVEMENT OF DYNAPAR SOFTWARE

CATEGORY: Engineering Development

DESCRIPTION: The Army Materiel Test and Evaluation Directorate at White Sands Missile Range uses a Dynaprobe hardware system to collect data on the performance of the digital computer portions of military battlefield automated systems undergoing test. A Dynapar software package is used with the Dynaprobe to reduce the data after test completion. This software package is not compatible with the computer readily available to the test personnel.

The task to be performed consists of:

- a. Modify the Dynapar software to run on Digital Equipment Corp. VAX/VMS 11/751 computers, and
- b. Improve the modified software to provide an expanded selection of analysis programs and to work interactively with the test personnel during data analysis.

A86-174 TITLE: INCREASE PERFORMANCE (FORCE OUTPUT) OF THE LING 335 VIBRATION EXCITER

CATEGORY: Engineering Development

DESCRIPTION: To redesign the external structural and/or electromagnetic elements of the Ling Model 335 Vibration Exciter such that a continuous peak force of 25,000 pounds is attainable.

Rationale: The Ling 335 Vibration Exciters are each capable of producing 20,000 pounds of force with the use of chillers. This is not sufficient force to meet future test requirements. Therefore, it is highly desirable to increase the force capability of these vibration exciters without changing the physical external configuration of the exciters. This is necessary to preclude replacement of the rest of the exciter system.

A86-175 TITLE: PULSED NUCLEAR REACTOR FUEL TEMPERATURE MEASUREMENT DEVELOPMENT

CATEGORY: Engineering Development

DESCRIPTION: The development of techniques and systems necessary for the rapid and accurate measurement of the temperature of the fuel of a pulse nuclear reactor is required. These techniques and procedures will provide for an accurate measurement of the reactor fuel temperatures when the reactor is operated in a pulsed mode. A more accurate measurement capability is required in order to properly evaluate the thermal condition of the reactor peaks, or reaches a maximum. These techniques will provide for amore accurate assessment of the thermal stresses produced in the reactor core during pulse operation.

A86-176 TITLE: EFFECTIVE TEMPERATURE MATHEMATICAL MODEL

CATEGORY: Research

DESCRIPTION: Currently, effective temperature determination is made using a nomograph based on empirically derived data. It would be extremely useful to be able to determine effective temperature using a mathematical model with consequently greater precision than using the printer nomograph on page 164 of MIL-STD-1472C with its error due to printing anomalies, interpolation, and questimation.

A86-177 TITLE: SELECTIVE SOLVENT FOR DEPLETED URANIUM

CATEGORY: Exploratory Development

DESCRIPTION: Test firing of depleted uranium penetrators against hard targets such as armor plate often results in fragments of uranium being imbedded in the target material. The solution required is a technique/solvent that will selectively remove uranium from steel. The steel will then be available for recycling, and the uranium for recycling or for disposal as low level waste.

A86-178 TITLE: EVALUATION OF VOICE COMMAND SYSTEMS

CATEGORY: Exploratory Development

DESCRIPTION: There is a requirement to develop a methodology that accurately measures and evaluates pilot voice command systems which are planned for the new generation of Army helicopters. As aircraft become more complex, every effort is being made to reduce pilot workload. Voice command systems are a step in that direction. At the present time, little consideration is being given to procedures to evaluate the system's performance. There is a need to consider various qualitative and quantitative means of measurements as well as to consider variables inherent to such systems; i.e., fluctuations in voice levels caused by stress, etc.

A86-179 TITLE: PILOT WORKLOAD

CATEGORY: Exploratory Development

DESCRIPTION: There is a requirement to develop methodology that accurately measures and quantifies pilot workload. As aircraft become more complex, it is important that workload be considered in aircraft design. At the present time, there is no satisfactory way to quantify workload for pilots. As a result, we must rely on quantitative assessments. Development requires research on techniques to measure pilot workload.

A86-180 TITLE: TOXIC GAS DETECTION IN AIRCRAFT COCKPITS

CATEGORY: Advanced Development

DESCRIPTION: Current gas detection kits are cumbersome and are not suited to an in-flight cockpit environment. In addition, they are limited to interval sampling. Development of a continuous monitoring capability that can be used in a cockpit to detect toxic gases is required. The equipment must be small enough that it does not interfere with the pilot's duties.

A86-181 TITLE: SMALL DROPLET GENERATOR

CATEGORY: Engineering Development

DESCRIPTION: A device is required that will produce droplets having diameters between 40 and 400 micrometers reliably and reproducibly. Liquids of interest include Newtonian and non-Newtonian fluids having viscosities between 1 and 100 centistokes (1000 desired) at 25 degrees C. The device should have a built-in, integral calibration capability.

A86-182 TITLE: RUGGEDIZED GATED VIDEO CAMERA

CATEGORY: Engineering Development

DESCRIPTION: Weapon pointing data for hit probability analysis of stabilized vehicle mounted weapon systems have been obtained with gated video cameras. These cameras in conjunction with a Tracking Error Processor, and digital data acquisition system provide weapon pointing errors proportional to angular elevation and azimuth errors in real time. Since the video camera and lens combination are subjected to considerable shock and vibration in the field environment (for example, the gun tube of a tank) the contractor shall review the camera systems presently used for this task and develop a camera system which has better resolution and linearity, greater AGC range, and is smaller in size and weight.

A86-183 TITLE: CIM=BUS COMPATIBLE ARRAY PROCESSOR

CATEGORY: Engineering Development

DESCRIPTION: CMOS Industrial Microcomputer (CIM) modules are used in a variety of instrumentation systems. Although many functions are available "off the shelf" a moderate speed array processor is needed to fill several needs. Such an array processor must have local memory (data and program) and be capable of performing arithmetic operations on arrays of data (dot product, vector-scaler product, fast fourier transform FFT, etc.). the speed requirements can be expressed in terms of a 128 word FFT (floating point data in 20 ms or less).

A86-184 TITLE: INNOVATIVE METHODOLOGIES FOR MAINTENANCE OF SOLDIER HEALTH AND PHYSICAL FITNESS

CATEGORY: Exploratory Development

DESCRIPTION: There is an urgent and continuing requirement to provide the Department of the Army with relevant, concise, accurate, and timely educational information in the areas of personnel health and fitness. Consequently, research support is needed to establish a comprehensive, progressive, and sequential program which will define basic parameters associated with the maintenance of individual health and fitness for senior Army officers. This program will benefit the Army's leaders by increasing their expertise and capabilities for supervising the health and fitness of their organization.

A86-185 TITLE: CORRELATION ALGORITHM DESIGN

CATEGORY: Exploratory Development

DESCRIPTION: Develop an algorithm where all possible points of a digital image are matched to its stereo mate. Assume that most y-parallax has been removed and that estimates of x-parallax exist for each point. NXN windows are to be used to develop the discrete correlation functions wherein the measures of similarity is the normalized correlation coefficient. The design must take advantage of all computational overlap sums, sums of squares and sums of cross products when adjacent points are matched and as adjacent lines are matched. The design must provide for a nest of three correlation windows where again computational overlap is exploited and where upon option three discrete correlation functions are developed simultaneously for each match point. The output of the correlator would be new match coordinates on the stereo mate as well as relevant data characterizing the match.

A86-186 TITLE: SPATIAL DATA STRUCTURE FOR ROBOTIC VEHICLE ROUTE PLANNING

CATEGORY: Research

DESCRIPTION: There is no known spatial data structure for storing three-dimensional terrain data which algorithms can use to efficiently perform automatic route planning. There is an urgent need to develop an efficient, online data format for this work to support emerging requirements of both man-in-the-loop and autonomous robotic vehicle programs. Phase I of this proposed work will address relatively static, global level route planning from a data base of terrain elevations and descriptors over laid with tactical intelligence information. Some of the research issues to be addressed include the following: can a hierarchy of resolutions be implemented, for example, reduced resolution for long distance routes (100km) and full resolution for segments of a route (1km); what is the efficiency of operation; and can a data structure be developed which permits scrolling. A new data structure is required because typical route planners (Dijkstra or A* algorithms) require data in graph form (for example, a network of cities and distances between the cities) but terrain data bases are only available in some combination of raster and polygon format. Phase II work will address more dynamic aspects of route planning such as dynamically updating the route to accommodate unanticipated local deviations. Phase III work will address such long term research issues as dynamically integrating the terrain data, tactical intelligence, global route, actual path traversal, and navigation sensor data.

A86-187 TITLE: SMART MC&G CONTROL GENERATOR

CATEGORY: Exploratory Development

DESCRIPTION: Consider the situation where preflight knowledge, collection geometry, and sensor characteristics are known and it is required that a set of control entities be developed from a digital database of MC&G data over a region of interest. The control data will be used in one case in a tactical environment to register digital imagery to the database for screening purposes. The control data will in a second case be used to register imagery to the MC&G database for update and verification functions. Consideration must be given to both applications. Special consideration must be given to the kinds of control which will be discernible on the sensor records which include E/O, SAR, and IR. Special consideration must also be given to the state-of-the-art in vision understanding with respect to extracting corresponding image control features from the imagery. The control types will include point, linear, and a real features. The output of the smart MC&G control generator will MC&G control and associated expected image coordinates. The analysis will define the MC&G database structure that best suits such an operation. The analysis will also describe limitations imposed on the operations due to less than suitable database structures.

A86-188 TITLE: AUTOMATED EXTRACTION OF INDUSTRIAL TERRAIN FEATURES FROM DIGITAL RADAR IMAGERY

CATEGORY: Exploratory Development

DESCRIPTION: Develop methods and techniques to detect, identify, and classify automatically industrial terrain features such as petrol, oil, liquid (POL) storage facilities, pier/dock facilities, transformer years, hangers, and industrial plants from digital radar imagery. The approach should include but not be limited to computer vision techniques, knowledge engineering techniques including expert systems, and the utilization of descriptor sets for the characterization of industrial features on SAR imagery. Digitized SAR image material will be furnished by the government. Personnel and facilities of the prospective contractor must be cleared at least up to the classification level secret by the designated security elements of the Department of Defense.

A86-189 TITLE: LARGE FORMAT HIGH RESOLUTION CARTOGRAPHIC MULTICOLOR PRINTER

CATEGORY: Exploratory Development

DESCRIPTION: A requirement exists to develop a capability to rapidly produce hard copy full color cartographic products directly from digital feature data. The development of a "Large Format (44 x 60) High Resolution Cartographic Multicolor Printer is needed. This system should be based on ink jet technology, design to image color separation input files using the process color printing technique. A capability to rapidly produce high resolution products and high quality screens on a rugged, markable media is essential. A minimum visual resolution of 800 dpi is needed to meet mapping requirements. Plot time for a full format, full color image should not exceed 20 minutes. Map images, including color, text, and line art must meet rigorous accuracy and repeatability requirements to support production mapping.

A86-190 TITLE: ELECTRONIC MAP SYSTEM

CATEGORY: Research

DESCRIPTION: An Electronic Map System will consist of an electronically readable map and a map reading device. The electronically readable map will be a traditional map with an embedded or bonded material from which coordinate information may be read. The map reader will be a portable, self-contained unit for automatically reading the coordinate information of the grid and converting the information to latitude/longitude or UTM coordinates. The map reader will also have the computational power to calculate the distance between points,

direction between points, and the estimated position of points using intersection/resection or ranging. The system will be lightweight and easy to carry.

A86-191 TITLE: PORTABLE POLARIZED MICROSCOPE TECHNIQUE FOR ASBESTOS IDENTIFICATION

CATEGORY: Basic Research

DESCRIPTION: The Toxic Substances Control Act (TOSCA) prohibits the use of asbestos in new buildings and requires that old buildings such as schools be inspected for asbestos. Inspection and analysis for asbestos is quite costly and requires considerable turn around time. The proposed concept would consist of developing a simplified, portable, compact phase contrast and polarized light microscope (PC/PLM). The simplified PC/PLM microscope will enable field technicians to be trained in a short time and then to analyze for asbestos according to straightforward and rapid methods. The methods will follow suggestions made by various authors in the literature, i.e., Webber, Pupons, and Flesner, and thus rely on precedent. By means of standardization and calibration techniques the acceptability of the testing procedures thus formulated will be assured and their capability with EPA and OSHA methods guaranteed. The method will utilize comparisons of actual samples with photographs and/or photomicrographs to quantitatively and qualitatively analyze for asbestos.

A86-192 TITLE: HYBRID SENSORS FOR CONTINUOUS AIR QUALITY MONITORING

CATEGORY: Basic Research

DESCRIPTION: The objective of this work unit is to identify new sensor technologies for use in continuous air monitoring/surveillance systems. Special emphasis should be placed on hybrid sensors which combine selection of the specific species of interest, concentration measurement, and analog to digital conversion of the concentration signal, all on a single integrated circuit. Species of particular interest are CO, CO₂; H₂, H₂O, H₂S, HCN; CH₃, non-methane hydrocarbons, total hydrocarbons; sulfur oxides; nitrogen oxides, O₂, O₃ oxidants; and particulates, both less than 10 micron and greater than 10 micron mean diameter. Technologies such as semi-permeable membranes and catalytic conversion before detection should be explored. Digital concentration input should be 12- or 14-bit concentration, temperature and humidity corrected, to be directly interfaced to commercially available 80086- or 80286-based micro-computers via IEEE-448 or RS-232. Software concentration range control is desirable.

A86-193 TITLE: TECHNOLOGIES FOR DECONTAMINATION OF EFFLUENT AIRSTREAMS FROM STRIPPING TOWERS

CATEGORY: Basic Research

DESCRIPTION: The disposal of waste volatile solvents in landfills and leakage from underground storage tanks has lead to widespread contamination of groundwater in industrialized areas. The volatile solvents are often removed by air stripping, however, this can result in merely converting a water pollution problem into an air pollution problem. The purpose of this study will be to identify existing technologies and/or develop new technologies which could be retrofitted onto air stripping towers to trap and/or detoxify volatile contaminants. New process configurations should also be considered which take advantage of the economic aspect of air stripping while avoiding the undesirable emission of air pollutant.

The research should consider all technologies currently used for detoxification or removal of air pollutants, detail the effect of the concentration ranges experienced in stripping towards on the effectiveness of the detoxification and/or removal process, examine the effects of other process variables which will be dictated by the stripping operation (e.g., high humidity, temperature fluctuations, variable flowrates, etc.) and evaluate the economical and technical feasibility of retrofitting these technologies onto existing towers. In addition, new technologies for detoxification/removal should be identified, and process stream modifications investigated.

All residuals which could be generated by each process must be identified, and the cost and/or hazards of disposal must be tabulated. The effect of shock loads and intermittent operation must also be addressed.

A86-194 TITLE: GRAPHICS AND DATABASE INTERFACE

CATEGORY: Basic Research

DESCRIPTION: Microcomputer database management systems (DBMS) are being used to manage data about installation facilities and construction projects. Computer aided drafting (CAD) utilities are also available to develop graphic display of installation maps or building drawings. This proposal reflects the need to develop microcomputer software capable of producing graphic display of database information. Utilities to retrieve stored data and display the results on a map or drawing are needed. Query capabilities to the database from the drawing is also required. Limiting criteria for the database selection needs to be entered from the keyboard and from the drawing. Users should be able to take advantage of a display window to identify the space applicable to the query. Outlining an area on the screen to be included in the search of the database can be combined with selection criteria from the keyboard to utilize DBMS utilities such as data form editing and report generation. R:base 5000 DBMS will be used to store data, create screen forms, and develop reports from existing Army applications. Graphics standards such as GKS should be observed. Programs should be user friendly and allow an application developer to create and execute menu driven functions.

A86-195 TITLE: COMMUNICATION DEVICE FOR FIELD TRAINING UNITS

CATEGORY: Basic Research

DESCRIPTION: Training range automation programs will be able to generate safety fan overlay and safety data that must be communicated to units firing from a remote training area. Communication devices need to be developed that will allow the safety overlay and safety chart to be transmitted by a modem/radio combination to a field unit. These devices should interface with a microcomputer to transmit data to a suitcase size receiving unit that can accept and print charts and graphs. The receiving unit should be a battery powered, small, lightweight device utilizing readily available technology and hardware. It should be capable of accepting keyboard input to transmit firing location data to the safety officer. Once the firing location is transmitted to the range office, safety overlay and safety chart calculations will automatically be done and the results will be sent back to the firing unit so a paper copy can be printed. Portable or laptop computers with lightweight printers are suggested for development. These portable devices will then be checked out from the range control office prior to a unit starting a training exercise. While some methods do exist to accomplish this task, the cost of this equipment is prohibitive. The objective of this proposal is to minimize the system costs and remain useful to users with little or no training.

A86-196 TITLE: STRUCTURAL FOAMS

CATEGORY: Basic Research

DESCRIPTION: High strength, high stiffens, low density foams. The objective is to develop a structural foam with a 2 to 5 pound per cubic foot density, modulus of <1,000 psi, and a potential cost less than 3 dollars per pound.

A86-197 TITLE: ROOFING SYSTEMS

CATEGORY: Basic Research

DESCRIPTION: Single component roof structural deck system. A roofing/structural deck system that can be layed on structural joints such that one system provides structural decking, insulation, and a water proof membrane for flat roof systems.

A86-198 TITLE: LOW COST ELECTROMAGNETIC SHIELDING

CATEGORY: Basic Research

DESCRIPTION: The objectives of this research effort are to determine new design concepts for low cost electromagnetic shielding, to determine levels of shielding obtainable, and to make life cycle comparisons between the various alternatives.

As the automation of military command, control, communications and intelligence systems continues to expand, the need for shielding of the facilities to house these systems also expands. Most shielding designs currently in use are relatively expensive and often involve welded seam sheet steel. New construction design and methodologies to reduce shielding costs of such facilities are needed.

The electromagnetic shielding of a facility involves the complete enclosing of the volume to be protected within a continuous metal enclosure. The metal enclosure may be free standing, attached to structural walls, integrated into existing walls, or somehow sprayed onto structural walls. The requirements include:

1. Investigate construction methods and determine promising approaches to the shielding problem. Some designs with promise include:
 - a. Copper sheets with soldered seams
 - b. Galvanized steel sheets with seams joined by nailing
 - c. Galvanized steel sheets with soldered seams.
 - d. Sandwiched seams for various metals using furring strips for support and attachment.
 - e. Mesh (metal) reinforcement in concrete
 - f. Silver soldered aluminum sheet
 - g. Pop riveted aluminum sheet
 - h. Other approaches as determined.
2. Fabricate sample portions of models of facilities and attach shielding while developing optimal installation efficiency.
3. Determine material and labor costs.
4. Determine shielding levels obtainable.
5. Predict shielding performance versus time.

A86-199 TITLE: MICRO-CLEANING OF COAL AT INDUSTRIAL SCALE BOILER PLANTS

CATEGORY: Basic Research

DESCRIPTION: Micro-cleaning is defined here to mean the removal of sulfur and ash from the coal matrix on the microscopic level by pulverizing the coal prior to cleaning. The proposed system would consist of a group of equipment that could take run of the mine high ash and high sulfur-coal and refine it to a relatively low (about 1 percent) sulfur content and low (about 6 percent) ash content. This process must consider both organic and inorganic sulfur removal. The procedure should be designed so that it can be adequately handled by a technician at a typical industrial scale boiler plant. The process should crush the coal and clean it, using micro-cleaning technologies, just prior to firing in a pulverized coal burner, slagging combustor or similar fine coal combustion technology. Ideally, the process will not increase the coal cost per ton to more than \$50 (excluding the transportation). The process rate should be in the 1 to 15 tons per hour capacity range.

A86-200 TITLE: ACCEPTANCE TEST CONCEPTS FOR MECHANICAL SYSTEMS

CATEGORY: Basic Research

DESCRIPTION: Current procedures for acceptance testing mechanical systems in new Army construction are inadequate and do not insure that the systems are correctly installed and function in an energy efficient manner. The purpose of this work would be to investigate current measurement technology and develop a mechanical system acceptance test procedure using this technology and which could be used to insure that new Army mechanical systems operate properly. The acceptance test procedure would have to be usable within the normal Army construction process and should clearly indicate the energy efficiency of the new mechanical system. The initial acceptance test would be limited to building air distribution systems including controls, coils, and fans. Chillers and boilers and their related components would not be included.

A86-201 TITLE: PAVEMENT ICE DETECTOR SYSTEM

CATEGORY: Exploratory Development

DESCRIPTION: A device is needed to detect the presence of ice on a paved surface. This device should be sufficiently sensitive to determine whenever the paved surface has accumulated ice to the point of becoming a hazard; for instance on highways or on an airport runway. The device should be capable of detecting ice on the pavement itself; not a device that detects ice accumulation on itself and by inference is therefore detecting ice formation on the paved surface.

A86-202 TITLE: MINICOMPUTER VERSIONS OF TABS-2 PROGRAMS

CATEGORY: Exploratory Development

DESCRIPTION: The TABS-2 system of numerical flow and sediment transport models are widely used by the Corps of Engineers on mainframe computer. Some of the programs have been modified to run on mini-computer. There is a need to have the entire system of about 40 programs made operational and efficient on various mini-computer systems.

A86-203 TITLE: EROSION RESISTANT MATERIAL FOR DIKE PROTECTION

CATEGORY: Exploratory Development

DESCRIPTION: Training dikes in rivers and estuaries constrain flow so as to minimize navigation channel shoaling and cross currents. These dikes are subject to damage by erosion of the sediment at the instream end and erosion of the bank at the land end. There is a need for an inexpensive method/material that can be applied to the scour zone when traditional materials (e.g., rip-rap) is either too expensive or inadequate.

A86-204 TITLE: VECTORIZED VERSIONS OF TABS-3

CATEGORY: Advanced Development

DESCRIPTION: The TABS-3 system of numerical three-dimensional flow and sediment transport models are being used by the Corps of Engineers to solve sedimentation and water quality problems in waterways. The models use substantial amounts of processor time on super computers such as the CRAY 1 and the CYBER 205. Explicit vectorization of these programs to take full advantage of the super computer architecture will result in substantial cost savings to the Corps.

A86-205 TITLE: VIDEODISC TECHNOLOGY APPLICATIONS TO MASTER PLANNING AND BUILDING DESIGN

CATEGORY: Exploratory Development

DESCRIPTION: Videodisc technology offers attractive low cost mass storage medium for photographs, maps, and design drawings. Development of a prototype system is needed to demonstrate how this technology can assist Army master planners and building designers. Also, there is a need to develop video image manipulation techniques which facilitate end-user changes to video image data such as master plan data stored in Videodisc.

A86-206 TITLE: SYNCHRONOUS VIDEO RECORDER

CATEGORY: Exploratory Development

DESCRIPTION: Develop a video recorder capable of changing speed of recording with ability to synchronize with vehicle speed to maintain a constant number of frames for a given traveled distance.

A86-207 TITLE: DEVELOPMENT OF SPECIAL PURPOSE FINITE ELEMENT SYSTEM FOR MASS CONCRETE THERMAL ANALYSIS

CATEGORY: Exploratory Development

DESCRIPTION: Develop special purpose finite element method program(s) capable of 2- and 3- dimensional, non-linear, time-stepping analysis for computing temperature distributions and resulting thermal stresses and strains in mass concrete structures during and after construction. The program(s) must be capable of stimulating incremental (staged) construction and initiation and propagation of cracking. The program(s) also must be capable of handling internal heat generation; heat exchange by convection, conduction, and radiation; all practical boundary restraint conditions; and age and temperature dependent material properties. The program(s) must also account for creep of concrete.

A86-208 TITLE: DEVELOPMENT OF AN ULTRASONIC PULSE ECHO SYSTEM FOR EVALUATION OF CONCRETE

CATEGORY: Exploratory Development

DESCRIPTION: Billions of dollars are presently being considered as needed to repair the nation's infrastructure. Also, the repair of locks and dams will be expensive. No ultrasonic pulse echo system is commercially available for evaluating concrete like other materials. Eight years of research by Ohio State University, three years of research by the Army Corps of Engineers, and work by others have shown that a system is feasible. A non-destructive device is urgently needed to assess the condition of concrete in various structures.

A86-209 TITLE: SUBUNIT VACCINES FOR MILITARY-IMPORTANT DISEASES

CATEGORY: Exploratory to Advanced Development

DESCRIPTION: Subunit vaccines are those composed of key portions of killed microorganisms. The aim of this effort is to rid the killed microorganism of undesirable components by utilizing the techniques of microbial engineering and identifying just those parts of an organism that are able to produce immunity without side effects and to utilize genetic engineering to produce these purified antigens in large quantities.

A86-210 TITLE: DIAGNOSIS OF NATURAL AND INDUCED DISEASES OF MILITARY IMPORTANCE

CATEGORY: Exploratory to Advanced Development

DESCRIPTION: This effort is designed to provide state-of-the-art technology to develop a system for rapid identification and diagnosis of agents or diseases acquired naturally or by exposure to biological weapons. The system will provide for rapid identification of agent/s diseases through examination of clinical specimens such as blood, urine, spinal fluid, and throat washings. The system should be extremely sensitive using very specific reagents such as monoclonal antibodies prepared through hybridoma technology. Methods utilizing the latest in biotechnology techniques should be utilized, such as labeled molecular probes for the identification and analysis of microbes or their products.

A86-211 TITLE: IMMUNOASSAY FOR T-2 TETRAOL

CATEGORY: Exploratory Development

DESCRIPTION: T-2 tetraol is a principal urinary metabolite of T-2 in mammalian systems. An assay effective in sensitively measuring T-2 tetraol in urine is needed to screen for prior exposure to T-2. Production of a sensitive immunoassay is desired.

A86-212 TITLE: VACCINE DELIVERY SYSTEMS

CATEGORY: Exploratory Development

DESCRIPTION: A requirement exists for controlled-release systems, carriers, and/or adjuvants compatible with vaccines or subunit vaccines for high-hazard agents of specific interest to the Army. Additionally, a need also exists for new methods of immunization and/or mucosal immunity to these high-hazard agents.

A86-213 TITLE: NOVEL AGENTS FOR CHEMOTHERAPY AND PROPHYLAXIS OF MULTIDURG RESISTANT STRAINS OF PLASMODIUM FALCIPARUM

CATEGORY: Basic Research

DESCRIPTION: Stains of Plasmodium falciparum which have become resistant to standard antimalarial drugs are increasing in prevalence and threaten to compromise efforts to control this disease. Thus, a requirement exists to discover antimalarial agents which do not share structural similarities to drugs which are currently in use. Such novel compounds may possess biological mechanisms of action which are unique and thus limit the likelihood that cross-resistance to existing drugs will render them ineffective. Structural clauses other than the 4-aminoquinolines, and the amino alcohols should be emphasized.

A86-214 TITLE: PHYSIOLOGIC STABILIZATION AFTER TRAUMA

CATEGORY: Basic Research

DESCRIPTION: A general requirement exists to provide improved field care after traumatic injury when evacuation is delayed. The overall aim of this research and development is to provide treatment under adverse conditions that maximized salvageability and recovery once definite care becomes available. Contemplated efforts cover a wide technological spectrum from state-of-the-art applications designed to improve and simplify first aid and resuscitative methods on the field to basic scientific investigations design to explore unusual and innovative technical means for temporarily suspending or stabilizing pathophysiological processes after traumatic injury.

A86-215 TITLE: BLOOD BAGS

CATEGORY: Advanced Development/Non-Systems

DESCRIPTION: A requirement exists to develop rugged, plastic bags that can be stored with a preservative for ten years. The bags must be tolerant to wide temperature fluctuations within a 24-hour period.

A86-216 TITLE: BLOOD PRESERVATIVES

CATEGORY: Basic Research

DESCRIPTION: A requirement exists to develop a new blood preservative that allows red cells to be stored up to 56 days while maintaining at least 80 percent of their original 2, 3 diphosphoglycerate.

A86-217 TITLE: BLOOD SUBSTITUTE

CATEGORY: Basic Research

DESCRIPTION: A requirement exists for safe, efficacious emergency blood substitute for human use when whole blood is unavailable. Any proposed substitute should provide acceptable volume expansion as well as tissue oxygenation delivery capacity without requiring oxygen enriched breathing mixtures. Prolonged room temperature storage of the dehydrated material is desirable for logistic purposes.

A86-218 TITLE: LYOPHILIZED PROTEINS IN PLASTIC BAGS

CATEGORY: Basic Research

DESCRIPTION: A requirement exists to develop a technique to fill sterile plastic bags with a sterile protein solution followed by lyophilization of the protein for long-term storage.

A86-219 TITLE: HUMAN CORE TEMPERATURE MEASUREMENT DEVICE

CATEGORY: Exploratory Development – Advanced Development/Non-Systems

DESCRIPTION: A requirement exists for a human core temperature measuring device. The device must be non-invasive to the human body (i.e., anal probe) in its operation; however, a device which is ingested and subsequently eliminated from the body will be considered if it meets FDA approval. The device must be capable of transmitting data a minimum of one meter and must be able to meet U.S. Army precision criteria of + or – 0.2 degrees F and accuracy criteria of + or – 0.1 degrees F.

A86-220 TITLE: HYBRIDOMA PRODUCTION

CATEGORY: Advanced Development

DESCRIPTION: A requirement exists to acquire hybridomas secreting antibody to a spectrum of agents of military interest. The objective is to develop a library of monoclonal antibodies and nucleic acid probes against infectious agents of military interest. The monoclonal antibodies secreted by these hybridoma cells will be used in the development and eventual provisioning of the rapid identification/diagnostic system, and in-house laboratories.

A86-221 TITLE: ARTIFICIAL INTELLIGENCE FOR MAINTENANCE TRAINING

CATEGORY: Exploratory Development

DESCRIPTION: The complexity of some Army equipment has increased to the point that the probability of correct fault diagnosis is lower than desired. The training time and cost required to improve the situation using traditional training procedures is impractical. Progress in microcomputer design and artificial intelligence suggest that training devices may be possible which will aid school and on-the-job training (OJT). For instance, Derek Sleeman, Stanford University has developed procedures for discovering the specific errors made by algebra students and has developed programs for "Diagnosis and remediation by intelligent tutoring systems." John Seeley Brown has accomplished the same for arithmetic. Claire Weinstein at the University of Texas-Austin has developed techniques for modifying defective learning strategies. Application of these and other artificial intelligence techniques may increase school training effectiveness and allow more effective OJT.

The training devices for school environments might train learning strategies and generic skills which have application across many jobs and/or they might be reprogrammable to provide training on a number of specific devices. The OJT trainer and job aid would be easily reprogrammed to adapt to new procedures and modified equipment. The devices might also complete parts requisition forms and maintenance logs automatically, as well as maintain personnel performance records.

A86-222 TITLE: RESEARCH IN SIMULATOR/DEVICE MIX METHODOLOGIES

CATEGORY: Exploratory Development

DESCRIPTION: As technology expands in the area of simulation for training, the Army must determine the most effective and least costly methods of mixing devices to support training in operational units. A methodology for clustering critical tasks and sequencing the skill acquisition process across part and full task trainers would be extremely useful. Techniques are needed for examining existing and proposed simulators for their unique "niche" in the overall unit training program.

A86-223 TITLE: MEASUREMENT AND MODELS OF EMPLOYMENT DECISION MAKING

CATEGORY: Exploratory Development

DESCRIPTION: Each year the Army must enlist and reenlist thousands of soldiers. In order to recruit and retain high performing soldiers, it is important to be able to understand, measure, and model the variables considered by individuals in making their decisions to join the Army or reenlist. These variables are also important in terms of the decision to enroll and continue in ROTC and to make a career as an officer in the Army.

A86-224 TITLE: RESEARCH IN PROJECTING MANPOWER AND SKILL LEVEL REQUIREMENTS EARLY IN WEAPON SYSTEM DEVELOPMENT

CATEGORY: Exploratory Development

DESCRIPTION: Historically, the system acquisition process has been driven by cost, adherence to schedule, and hardware/software performance. Recently, increased emphasis has been given to early identification of the human resources needed to operate and maintain the new systems. Accurate estimates of the number of individuals and the skills they must possess provide a basis for (a) comparisons with estimated future supply; (b) identification of system changes to reduce operator and maintainer requirements; and (c) selection among competing systems. Innovative techniques which can be used to generate quantitative and qualitative estimates of operator and maintainer requirements on the basis of information available during concept development are needed. Procedures for estimating ability requirements are especially desired.

A86-225

TITLE: RESEARCHON COGNITIVE PROCESSES IN DECISIONMAKING UNDER
UNCERTAINTY TIME STRESS

CATEGORY: Exploratory Development

DESCRIPTION: Commanders, intelligence analysts, and others are often required to make decisions under conditions of uncertainty and severe time stress. Uncertainties may be associated with missing, incomplete or ambiguous information, or future outcomes that are unknown. Research is needed to (1) better understand the cognitive processes (e.g., memory, judgment, or problem-solving) of the decisionmaker under such conditions, and (2) suggest approaches for supporting the cognitive processes so that the overall quality and timeliness of the decisions made under uncertainty and time stress are enhanced.