U.S. ARMY

INTRODUCTION

The army has chosen the spring solicitation (May-July), as its primary vehicle for announcing new SBIR topics to the small business community. Consequently, this book contains only thirty topics, and we anticipate making about thirty awards next April.

We have experimented with the format of these topics by offering a few generalized topics along the lines of the Broad Agency Announcement. We continue to seek good ideas and are testing the waters of small firms with this format.

For this solicitation Phase I proposals should not exceed $50,000, so tailor your cost proposals accordingly.

Good luck and thank you for your interest in the Army SBIR Program.

J. PATRICK FORRY
Army SBIR Program Manager
(301) 394-4602

Submitting Proposals on Army Topics

Phase I proposal (5 copies) should be address to:

Belvoir Research, Development and Engineering Center

Topic A91-001
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U.S. Army Belvoir RD& E Center
ATTN: AMSTR-PBP, SBIR Program
Bldg. 314, Procurement Receptionist
Ft. Belvoir, VA 22060-56-6

Communication Electronics Command

Topics A91-002 through A91-006

Topic A91-002
CECOM Center for C3 Systems

Topic A91-003
CECOM Center for Electronic Warfare/Reconnaissance
Surveillance and Target Acquisition

Topic A91-004
CECOM Center for Software Engineering

Commander
U.S. Army Communications-Electronics Command
ATTN: AMSEL-PCCC-BID, SBIR Program
Tinton Avenue
Ft. Monmouth, NJ 07703-5000

Topic A91-005
Director
U.S. Army Center for Night Vision & Electro-Optics
ATTN: AMSEL-RD-NV-RM-FP, SBIR Program
Bldg. 305, Linda Kline
Ft. Belvoir, VA 22060-5606

Topic A91-006
Director
U.S. Army Center for Signals Warfare
ATTN: AMSEL-RD-SW-DTI, SBIR Program
Bldg. 260, Linda Monroe
Vint Hill Farms Station
Warrenton, VA 22186-5100

Chemical Research Development and Engineering Center

Topic A91-007
Commander
U.S. Army Chemical Research,
Development and Engineering Center

ATTN: AMSMC-PC-B(A)
Procurement Directorate
Bldg. 4455, SBIR Program
Edgewood Site
Aberdeen Proving Ground, MD 21010-5423

Tank-Automotive Command

Topic A91-008
Commander
U.S. Army Tank-Automotive Command
ATTN: AMSTA-IRSA
Bldg. 200A, SBIR Program
Warren, MI 48397-5000

Test and Evaluation Command

Topic A91-009
Commander
U.S. Army White Sands Missile Range
Directorate of Contracting
ATTN: STEWS-PR, SBIR Program
Bldg. 126
White Sands Missile Range, NM 88002-5201

Laboratory Command

Topics A91-010
Director
U.S. Army Armament, Munitions and Chemical Command
Procurement Directorate
ATTN: AMCMC-PCM(A), SBIR Program (BRL)
Edgewood Site, Bldg. E4455
Aberdeen Proving Ground, MD 21010-5423

Topic A91-011
Commander
U.S. Army Research Office
ATTN: SLCRO-RT, SBIR Program
PO Box 12211
4300 S. Miami Blvd.
Research Triangle Park, NC 27709-2211

Topic A91-012
Commander
U.S. Army White Sands Missile Range
Directorate of Contracting
ATTN: STEWS-PR, SBIR Program (ASL)
Build 126
White Sands Missile Range, NM 88002-5031

Topic A91-013
Director
U.S. Army Electronics Technology and Devices Laboratory
ATTN: SLCET-DT, SBIR Program
Ft. Monmouth, NJ 07703-5000

Topic A91-014

Director
U.S. Army Materials Technology Laboratory
ATTN: SLCMT-TMT-SBIR Program
405 Arsenal Street
Bldg. 131, Rm 144
Watertown, MA 02172-2719

Topic A91-015

Commander
U.S. Army Armament, Munitions and Chemical Command
Procurement Directorate
ATTN: AMCMC-PCA(A), SBIR Program (HEL)
Edgewood Site, Bldg. E4455
Aberdeen Proving Ground, MD 21010-5423

Topic A91-016

Director
Harry Diamond Laboratories
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2800 Powder Mill Rd.
Adelphi, MD 20783-1197

Topic A91-017

Director
U.S. Army White Sands Missile Range
Vulnerability Assessment Laboratory
Directorate of Contracting
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White Sands Missile Range, NM 88002-5031

Aviation Systems Command

Topic A91-018

Commander
U.S. Army Aviation Systems Command
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Building 102
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St. Louis, MO 63120-1798

Army Institute for Research in Management Information, Communications, and Computer Science

Topic A91-019

Director
U.S. Army Institute for Research in Management
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ATTN: ASQB-G
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Atlanta, GA 30332-0800

Army Corps of Engineers

Topic A91-020

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72 Lyme Road
Hanover, NH 03755-1290

Topic A91-021

Commander
U.S. Army Engineer Topographic Laboratories
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Building 2592, Leaf Road
Ft. Belvoir, VA 22060-5546

Army Materiel Command

Topic A91-022 – A91-026

Commander
Army Materiel Command
ATTN: AMCPD-BD (L.Garcia-Baco)
5001 Eisenhower Ave.
Alexandria, VA 22333-0001

Army Medical Research Acquisition Activity

TopicA91-027 – A91-030

Commander
U.S. Army Medical Research Acquisition Activity
ATTN: SGRD-RMA-RC, SBIR Program
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| A91-022 – A91-026 | AMC | L. GARCIA | 202-274-0815 |
| A91-027 – A91-030 | MEDICAL | A. WOLF | 301-663-7216 |

DEPARTMENT OF THE ARMY TOPICS FOR 91.1

| | |
|---|---|
| A91-001 | Combat Engineering Countermine Systems and Logistics Equipment Survivability |
| A91-002 | Survivable Adaptive Tactical Multimedia Communications |
| A91-003 | Target Classification in High Clutter Environment |
| A91-004 | Reusable and Adaptive Schedulers for Ada Rear-Time Applications |
| A91-005 | Night Vision and Electro-Optics |
| A91-006 | Tactical Intelligence Electronic Warfare (EW) and Data Fusion Techniques |
| A91-007 | Chemical/Biological Defense |
| A91-008 | Reducing The Size & Weight of Ground Combat Vehicles |
| A91-009 | Test Range Tracking Network Processors |
| A91-010 | Scientific Visualization |
| A91-011 | Power Generation: Electric Power Sources and Diesel and Gas Turbine Engines |
| A91-012 | Atmospheric Sciences |
| A91-013 | Millimeter Wave Amplification |
| A91-014 | Smart Materials for Army Structures |
| A91-015 | Automatic Target |
| A91-016 | Low Cost Conformal Electronically Scanned Antenna |
| A19-017 | Electronics Warfare Vulnerability |
| A19-018 | Army Rotocraft/Air-Vehicle Technology |
| A19-019 | Integrated Services Digital Network Applications in the Army Environment |
| A19-020 | Development of a Portable Ice-Thickness Measuring Instrument |
| A19-021 | Topography, Image Intelligence and Space Exploitation |
| A19-022 | Alternatives for Halon 1301 in Tactical Vehicle Firefighting Systems |
| A91-023 | Environmentally Acceptable Cleaning Processes |
| A91-024 | Environmentally Acceptable Pre-Treatment Process(es) |
| A91-025 | Environmentally Acceptable Organic Processes and/or Coatings |
| A91-026 | Environmentally Acceptable Inorganic Processes and/or Coatings |
| A91-027 | Military Disease Hazards |
| A91-028 | Combat Casualty Care |
| A91-029 | Army System Hazards |
| A91-030 | Medical Chemical Defense |

BELVOIR RESEARCH DEVELOPMENT AND ENGINEERING CENTER

A91-001 TITLE: Combat Engineering Countermine Systems and Logistics Equipment Survivability

DESCRIPTION: The Belvoir RD&E Center specializes in multiplying force effectiveness, neutralizing and countering the opposition's strengths, and sustaining forces. Mine Warfare is a typical force multiplier. Mines and booby traps are readily available for purchase by hostile organizations. The ability to detect and counter such devices gives the US force a deciding edge. The existing capability is limited to the detection of metallic mines. ARMY NEEDS INCLUDE handheld and vehicular detectors which can detect both metallic and nonmetallic mines. There are no constraints on the technologies used. Proposed research should focus on the detecting mechanism rather than on improved platforms, or auxiliary functions. Force effectiveness is also achieved by counter surveillance and deception. THE ARMY NEED Ultralight, multispectral camouflage screens, multispectral tarps and multispectral coatings. Research is required to better replicate the response of the natural environment. Battlefield deception must be affordable and a low logistics burden. IMPROVEMENTS ARE NEEDED in the design of large tactical equipment structures, and audio source synthesis and sampling techniques. Enhanced physical decoys, in both inflatable and frame/fabric versions, are required to maintain a realistic appearance to the unaided eye at distances as closes as 100 yards. Improved techniques for the synthesis of battlefield sounds and the conversion of audio sources from analog to digital with a reduction in storage memory are required. Force multiplication is further achieved by increased mobility. Use of composite and other advanced materials in bridge design will result in faster crossing with less support requirements. THE ARMY NEEDS adhesive bonding and field repair techniques. Advanced materials and automated, low-labor fabrication processes processes are required.

Sustainment of an army is crucial to its success. The soldier always needs water, fuel and ammunition; and his modern, high tech equipment depends on electric power and air conditioning compatible with Nuclear, Biological, Chemical (NBC) conditions. Advances in automation of material handling equipment will reduce the number of people required to move ammunition and fuels at front line and rear areas. ADVANCES IN ALL THESE AREAS ARE SOUGHT which can provide substantial improvements in performance, ease of handling and reliability of the equipment.

CECOM CENTER FOR COMMAND, CONTROL & COMMUNICATION ($C^3$) SYSTEMS

A91-002 TITLE: Survivable Adaptive Tactical Multimedia Communications

DESCRIPTION: The objective of this effort is to develop multimedia information transport technologies for improving the survivability of distributed C3 networks. The technologies should improve the capabilities of the tactical C3 System to exchange integrated voice, data, graphics, and video in an environment consisting of multimedia, multinetted, or internetted communication resources. The technology should improve the connectivity, security, survivability, responsive, or capacity of future tactical communications systems including High Frequency (HF) and Very High Frequency (VHF) Combat Net Radio, Mobil Subscriber Equipment (MSE), Enhanced Position Location & Reporting System (EPLRS). Extremely High Frequency (EHF) radio, Ultra Violet (UV), and other fiber optics.

High performance packet switching needs to be efficiently integrated into the Army's existing circuit switched system by utilizing a system of internetworked coaxial metal and fiber optic Local Area Network (LAN). Major advances in wireless LAN technology are needed to alleviate the need for coaxial metal and fiber cabling. Maturing Integrated Services Digital Network (ISDN) technology needs to be carefully integrated into the Army's evolving C3 capability. VHF and HF Combat Net Radio (CNR) must be available to extend this battlefield internetwork to tactical units operating in dense hostile electromagnetic environments. Networks will need to exploit Artificial intelligence and Expert System technology to be adaptive to counter the threat postulated for the 21st century. They will need to respond quickly and efficiently to rapid changes in connectivity and traffic loads.

The need to exchange data will always exceed the capacity of the available communications channel. Techniques are required to exploit data compression technology for the transmission of video sensor data in packet network applications, improve the robustness of the data being sent, and to further exploit the use of wide bandwidth technologies for extended tactical local area networks. Novel Antenna and processing technologies are required to maintain wireless, survivable LAN connectivity among dispersed command post elements and mobile antonymous fighting vehicles.

CECOM CENTER FOR ELECTRONIC WARFARE/RECONNAISSANCE SURVEILLANCE AND TARGET ACQUISITION

A91-003 TITLE: Target Classification in High Clutter Environment

CATEGORY: Radar Signal Processor

OBJECTIVE: Determine what modern advances in technology can do to improve radar signal processing in the classification/identification of targets in high clutter environment.

DESCRIPTION: Current U.S. Army radar systems have a problem identifying targets in high clutter environment. This effort will identify advances in technology that will have a significant impact on how well future Army radars will identify targets in high clutter environment.

Phase I: A study will be conducted to determine the impact of recent technological advances on target identification. This study will provide an outline of how technology has grown in the following Areas: System noise reduction, increase in receivers dynamic range, low radar cross section detection, improvement in Analog to Digital (A/D) converter, filter designs, and clutter suppression. In addition, techniques use to identify targets (e.g. helicopter vs. ground vehicle, track vs. wheel) will also be outlined. Candidate classification algorithms will be described.

Phase II: Algorithms will be applied to actual radar data to assess their performance.

CECOM CENTER FOR SOFTWARE ENGINEERING

A91-004 TITLE: Reusable and Adaptive Schedulers for Ada Real-Time Applications

DESCRIPTION: Software is a major component of most tactical Army systems currently in the field or in development. The Army's mandate for the use of the Ada programming language and the desire to reap cost benefits through the reuse of software has placed additional concerns on the development of embedded real-time software systems which already has inherent performance requirements. By distributing these types of software programs to increase performance, more complexity has been added to the already difficult processing of insuring that the program's tasks complete their work in their allotted time.

The Ada scheduler, contained in the runtime environment, controls and resolved task execution and intertask communication conflicts so that the real-time system con produce correct results within its time constraints. The Ada language provides a very limited ability, through the selection of eligible tasks according to priority, to explicitly control the runtime scheduling of tasks. Many scheduling algorithms now being developed require more scheduling control than that provided by the Ada tasking model. Also since scheduling algorithms are very complex or are application specific, it is unlikely that complier vendors will be able to support very many of them in the foreseeable future in the Ada runtimes that they provide.

Therefore, application specific scheduler components, implementing particular scheduling algorithms, that could be inserted into a Ada runtime are needed. These components would provide the scheduling that is appropriate for a particular application to guarantee its timing requirements. These components would be adaptable to some degree and be interchangeable to reusable in other applications. They would also be reusable with a variety of compilers.

Having them would provide a viable approach to meeting the time constraints and performance requirements of real-time systems.

This research will work toward developing a set of reusable scheduler components. It will also specify a flexible, efficient, and reusable interface to allow insertion of components into a runtime environment and to provide the ability to adapt and reuse them. In addition, this research will seek to develop the specification of a prototype tool that could aid in the adaptation of a particular scheduler component and facilitate its incorporation into the runtime environment for a particular software application

There are numerous emerging scheduling techniques that need to be examined, such as earliest deadline, prioritized with preemption, and priority inheritance. Variations of them and the ease of adapting them also needs to be addressed, such as modifying simple priority inheritance to full transitive priority inheritance for a particular application. There are algorithms that can support distributed processing implementations of Ada which also need to be addressed. Questions to be answered include: what is the necessary set of components that must be considered for the scheduler set? How could these components be made portable over various runtime implementations and reusable over different applications on the same runtime implementation; what are the runtime interface considerations that must be addressed? How can the performance of the components be specified so they are able to be reused with confidence in these specifications? What would be an approach to automate the incorporation of these components into an Ada runtime environment?

CECOM CENTER FOR NIGHT VISION AND ELECTRO-OPTICS

A91-005 TITLE: Night Vision and Electro-optics

DESCRIPTION: The CECOM Center for Night Vision and Electro-optics (C2NVEO) mission is to provide technology, devices, sensors and sensor/processor suites to enable the Army to acquire/engage the enemy at any time of the day or night under adverse battlefield environments.

In support of this mission, the Center seeks ideas in electro-optic materials, sensors, devices, system concepts, models and architectures in the following disciplines:

a. Infrared sensors and associated devices
b. Lasers, advanced optics and adaptive optics
c. Image intensifiers both direct and remote view
d. Visionics
e. Image and signal processing

New and innovative ideas to advance the state-of-art in technologies related to infrared and Laser materials; non-linear materials, materials processing; advanced algorithms, architectures and processors for aided target recognition; models of thermal and laser target signatures and system performance models; sensor/sensor suite concepts are areas of interest to the Center.

CECOM CERNTER FOR SIGNALS WARFARE

A91-006 TITLE: Tactical Intelligence Electronic Warfare (IEW) and Data Fusion Techniques

DESCRIPTION: The following three areas are of interest:

a. Communications Intercept and Location Technology Program provides improvements for the Army's tactical communications IEW capability. Topics that will be addressed over the next several years include: automated signal exploitation, on-board real-time sensor processing, extended frequency coverage, platform independent receivers and processors, high accuracy emitter location, interference cancellation and automated sensor tasking and control.

b. The Tactical Communicating Electronic Countermeasures Technology Program provides improvements for the Army's tactical communications jamming capability by reducing the effectiveness of the enemy's

command and control system. Topics that will be addressed over the next several years include: Electronic Warfare (EW) critical components (high power transistors, efficient antennas), new signals EW, smart jammer control, expendable jamming techniques and platform independent EW modules.

c. The Tactical Intelligence Fusion Technology Program develops new techniques, methods and approaches to critical IEW fusion problems by automating current manpower intensive correlation functions, integrating tactical intelligence data from multiple sensors, and automating IEW mission management functions. Topics that will be addressed over the next several year include: automated situation assessment, distributed processing and database management, automated terrain understanding, parallel processing and neural new technology for sensor fusion, and automated all sources processing and analysis.

CHEMICAL RESEARCH DEVELOPMENT AND ENGINEERING CENTER

A91-007 TITLE: Chemical/Biological (CB) Defense

DESCRIPTION: The proliferation of chemical warfare and increased biological capability among Third World countries necessitates that the US Armed Forces be provided with CB defense systems that are responsive to the changing threat: CB defense programs at the US Army Chemical Research, Development and Engineering Center (CRDEC) include Reconnaissance, Detection and Identification (RDI), decontamination, individual and collective protection, and flame, antimateriel and smoke/obscurant systems. Improvements in RDI will be affected by fielding new and more efficient microprocessor-based detectors with sensors utilizing spectrometry and biotechnology. Future detection systems must be capable of detecting both known and unknown CB agents. Currently under development are a hand-held mini-detector, a laser-based standoff detector and a field-hardened mass spectrometer. New decontamination systems must be able to decontaminate all CB agents from personal equipment, vehicles and sensitive equipment, i.e. electronics, with reduced logistics and operational burdens. New technologies are being sought to reduce the physiological burden of individual respiratory protective equipment. Future collective protection equipment must have lower power requirements, employ non-carbon filtration systems and be regenerable in-situ. Technologies, such as, energetic, combustible and incendiary materials and high energy oxidizers are being investigated for application to the development of combat flame systems to provide rapid disruption and degradation of area targets. Antimateriel systems are also under development to be used to degrade/defeat threat materiel and equipment. Technologies for payload development, dissemination and fuzing, and computer modeling are being considered. The emphasis in spoke/obscuration is the development of high performance, logistically acceptable, multispectral materials which will provide usual through microwave spectral screening for large area, projectile and vehicle self-protection systems.

TANK-AUTOMOTIVE COMMAND

A91-008 TITLE: Reducing the Size & Weight of Ground Combat Vehicles

CATEGORY: Exploratory Development

OBJECTIVE: Reduce the size and weight of future ground combat vehicles through the use of new and innovative design techniques and weight saving technologies.

DESCRIPTION: The increasing weight of the ground vehicle force has been primarily due to increased threat levels which have lead “conventional” designs to an overall increase in ballistic protection. This has had a direct impact on size and weight. A serious attempt to reduce the weight of the force must include lightening the structure of the vehicle allowing more weight and space claims for “dedicated” armor rather than conventional Rolled Homogeneous Armor (RHA) protection currently used in all combat vehicle hulls. Lightening the hull/structure will require new design approaches such as space frame, thick section composites, and Non-monolithic hull sections. Other design approaches would include: crew reduction and automation, Non-traditional survivability techniques/technologies and new lethality mechanisms.

The US Army TACOM Research, Development & Engineering (RDE) Center is planning the development of a High Energy Advanced Technology Transition Demonstrator (HRATTD) which will include input from Materials Technology Laboratory (MTL), Aviation Systems Command (AVSCOM), industry and universities to obtain a best technical approach for the lightest design alternative.

Phase I: The contractor(s) would identify all promising weight reduction technologies; both current and potential. This would include materials, structural design modifications, crew reduction, automation, non-traditional survivability methodology and new lethality mechanisms.

Phase II: Develop analytical assessments of all available and future technologies, and determine the best technical approach for an advanced demonstrator. Begin plans to design and develop a test bed demonstrator.

TEST AND EVALUATION COMMAND

A91-009 TITLE: Test Range Tracking Network Processors

CATEGORY: Exploratory Development

OBJECTIVE: The objective is to develop a board(s)-level processor for real-time applications, applicable in an integrated tracking network to combine the outputs of the tracking instruments currently available at the test range. Both single and multiple target tracking scenarios must be addressed.

DESCRIPTION: The research is directed toward the development of a real-time, reconfigurable microcomputer architecture and its processor hardware. The processor application in the integrated tracking network is multi-purpose, to serve as a signal processor, data processor, merge processor, or local/ global processor.

Phase I: This research effort is to accomplish the following: (1) identify the promising candidate tracking instruments for the make-up of the integrated tracking network from the currently available instruments at the test range, (2) develop preliminary design and specification for the reconfigurable microcomputer and its processor hardware suitable for an integrated tracking network and (3) identify currently available chip and board technologies and future near-term technologies applicable to (2) above.

Phase II: This research effort is the final design, fabrication and demonstration of the processor hardware based upon the reconfigurable architecture concept developed.

BALLISTIC RESEARCH LABORATORY

A91-010 TITLE: Scientific Visualization

DESCRIPTION: A new set of visualization tools needs to be developed to address the special needs of high performance computing. With the advent of the current crop of high performance workstations, three-dimensional manipulation of graphic objects has become routine. This development dovetails nicely with recent developments in mathematical modeling. Several laboratories are actively engaged in computing three-dimensional, time-accurate, dynamic simulations of complex phenomena in continuum mechanics. Typical calculations executed on supercomputers and minicomputers involve roughly a million spatial grid points (at each time step) which map to several variables such as pressure, vorticity, stress, etc. Many of these large-scale calculations demonstrate excellent correspondence to experimental data. However, the computation itself constitutes only half the story. Analyzing the voluminous results presents a staggering challenge and the likely source of help appears to reside in the realm of graphics. Some new tools need to be developed to effectively explore large 3D data sets (gigabyte regime). This should address data compression technology and the capabilities of graphics hardware. Advances of contouring algorithms need to be exploited to display very complex (non-convex) domain and range spaces. Surface plotting and level sets of 4D computations should be addressed. Animation will be essential to visualize time histories and stability analyses (such as bifurcation and catastrophe maps). New software tools are required in display of complicated gridding applications. This should include moving grids and depicting gridding with both 2D and 3D

components. And finally, there is a strong need to study techniques of matching data from physical models with computer simulations. In particular, visualization tools need to be developed which mirror the physical techniques of dye injection, laser Doppler velocimetry, and streaking. Unless one has a method of duplicating this with computed data sets, it is very tough to compare experiment with simulation.

ARMY RESEARCH OFFICE

A91-011 TITLE: POWER GENERATION: Electric Power Sources and Diesel and Gas Turbine Engines

DESCRIPTION: The Army has a need for new and improved electric power sources ranging upward in size from sources for personal equipment to systems for future vehicle drives and electric guns. Innovative research is needed to develop new power sources and conditioning which are compact, efficient, and can be scaled to the order of 1200 kw for tank electric drives. The new power sources must be able to meet Army needs for reliability, rapid start-up, and minimum signature. Approaches might include research on new electrochemical reactions, catalysts, membranes or fuels for electric density, higher output voltage, and efficiency and for fuel reforming to generate hydrogen from conventional fuels. New design concepts are sought for the utilization of waste heat and reaction products produced by electric power sources such as, in the case of fuel cells, recovery of potable water for troops and use of waste heat for fuel reforming.

Approaches are also sought which will lead to the prevention of soot formation in diesel and gas turbine engines. The approach should not decrease engine efficiency for power density (compared with AIPS-class engines) and should eliminate the initial formation of soot in engines fueled with DF-2 and/or JP-8. Novel engine designs, fuel management systems, and combustion control are some of the potential strategies which might be used to achieve this goal.

ATMOSPHERIC SCIENCE LABORATORY

A91-012 TITLE: Atmospheric Sciences

DESCRIPTION: Program focus in the atmospheric sciences is for the assessment of Army systems, tactics and materiel vulnerabilities and susceptibilities to adverse weather and battlefield environments. Research and application requirements involve five areas: 1) computer-based decisions aids including the application of artificial intelligence techniques, 2) electromagnetic and acoustic propagation, 3) mesoscale and microscale nowcast and forecast meteorological model development, 4) battlefield visualization, weather-related decision aids are prepared using graphic displays, map overlays, tables, matrices, and other methods to assist the battlefield commander in decision making, and 5) insitu and remote atmospheric characterization techniques. The focus of the propagation program is the assessment of Army sensor and system performance at all wavelengths. For the meteorological models, the focus is on models and applications strongly coupled to the terrain and land use. These programs range from basic research to applications specific to particular Army systems. Battlefield visualization is four-dimensional presentation of the battlefield as seen by various sensors. The characterization program involves the development of new meteorological sensing technology and the engineering of the technology into tactical hardware, to provide the meteorological data in the field needed to assess system performance.

ELECTRONICS TECHNOLOGY AND DEVICES LABORATORY

A91-013 TITLE: Millimeter Wave Amplification

DESCRIPTION: Millimeter waves are an integral part of satellite communications, electronic warfare and missile radar. Until recently, the prospects of amplifying significant levels of millimeter wave power using solid state devices have depended on IMPATT diodes. These devices operate at high junction temperatures making early burnout a significant risk element in any system application requiring millimeter wave power amplification.

The development of Field Effect Transistors (FETS), multiplier diodes, fine line geometric heterostructure growth breakthroughs in High Electron Mobility Transistor (HEMT) and Heterojunction Bipolar Transistor (HBT) technologies, make the promise of millimeter wave amplification with high efficiency and reliability a realistic possibility.

Since many present and proposed military systems are based on traveling wave tubes or IMPATT diodes, both of which have significant drawbacks involving circuit complexity, reliability and efficiency, there is a critical need to develop new highly reliable, efficient amplifiers which would employ new devices and circuit combinatorial techniques to develop millimeter wave amplifiers which would constitute a new generation of amplifiers for military systems applications. Specifically, millimeter wave unit amplifiers, combiners, matching networks, high efficiency solid state devices should be addressed with the goal of developing medium power amplifiers with high efficiency, reliability, producibility and maintainability at low cost.

MATERIALS TECHNOLOGY LABORATORY

A91-014 TITLE: Smart Materials for Army Structures

DESCRIPTION: Recently there has been intense activity in the development of "smart" or "intelligent" materials and functionally graded materials. This activity has been pursued enthusiastically in Japan and Europe. Some typical features of these so called smart materials are as follows:

- Embedded or bonded or intrinsic sensors which recognize and measure the intensity of environmental stimuli such as stress, strain, thermal, electric, magnetic, electromagnetic, chemical, biological or nuclear.
- Embedded or intrinsic actuators to respond in a prescribed or desired way to the stimulus.
- A control mechanism or selected response is available to respond to the stimulus in a predetermined way. The response occurs in a short or appropriated time and the material returns to its original state on removal of the stimulus.

Some clarifying examples of smart structures include: earthquake resistant structures wherein short loading and vibration resonances are dispersed via controlled/tuned force actuators, aircraft control flaps, use of electrorheological fluid filled structures to damp vibrations, embedded fiber optic sensors and shape memory alloy composites.

The purpose of this topic solicitation is to capitalize on such materials developments to enhance performance in applications to Army ground and aircraft vehicles, armor, large scale structures and machine components. Proposals are sought on the development of smart materials to:

- Reduce shock and vibration
- Defeat armor piercing weapons
- Enhance battle damage resistance
- In situ sensors, actuators and monitoring capability for a wide range of environmental conditions or more effective maintenance and life prediction of Army systems, components or equipment. Integrated packages containing, for example, electronics, coating, sheets and films, could lead to revolutionary developments.

HUMAN ENGINEERING LABORATORY

A91-015 TITLE: Automatic Target Acquisition Man-machine Interface

DESCRIPTION: A body of technology is evolving which provides the capability for assisting in detecting and identifying targets. These technologies involve the development of sensors and sensor suites, processors and displays. Target data is sensed then through software techniques and the machine is able to extract target characteristics which afford a probability of a target having been detected. These data must then be presented on a display medium for use by human operators. The development of these display presentations is critical to the effective utilization of target automation capabilities. There exist issues related to how much of the target probability data to present to the operator. In addition, operators need to have a high degree of confidence in the automated system in order to depend on it. There also exist issues on how to code the information so that the

operator can extract it in a ready to use fashion. Display resolution, field-of-view, effectiveness of each of several sensors need to be made available in a simple manner to the operator. This effort needs to identify the critical man-machine issues and identify approaches to addressing the issues and developing software specifications for their implementation in future target acquisition, recognition systems.

HARRY DIAMOND LABORATORIES

A91-016 TITLE: Low Cost Conformal Electronically Scanned Antenna

CATEGORY: Exploratory Development

OBJECTIVE: In order to improve the flexibility and performance of future Army ground surveillance radars, electronically scanned (e-scan) antennas will be required. The antenna will be used with a relatively low power pulse Doppler radar, and the concept selected must be adaptable to ground based as well as airborne platforms, be lightweight, low cost, and potentially meet all Army environmental requirements.

DESCRIPTION: Typically, conformal patch antenna arrays have been developed for low cost, lower performance applications, while active apertures with a large number if individually controlled elements have been used in high value, higher performance applications. An innovative antenna design is required which will retain the low cost and flexibility of conformal arrays, while meeting stringent performance requirements. Preliminary design features of the radar include: $> \pm 45°$ azimuthal beam scanning with a nominal 5° beamwidth, fixed $\csc^2$ elevation pattern with a nominal 30° beamwidth, and > 5% bandwidth. Minimization of sibelobes is a high priority. Consideration should also be given to circular or multiple polarizations, and adaptability to monopulse.

Phase I: To include a parametric analysis of the proposed design for various antenna shapes, beamwidths, and other parameters. The resulting antenna patterns will be used to iterate the design and optimize the theoretical performance of critical parameters. An estimate of the cost of the antenna in production for low and medium volume purchases will be prepared.

Phase II: Two implementations of the antenna concept will be fabricated. Electrical and mechanical interface definition will be provided prior to the start of the effort. Test data to include antenna patterns at various scan angles and frequencies will be taken. These antennas will be integrated into radar systems which will be field tested in order that the feasibility of the concept can be demonstrated.

VULNERABILITY ASSESSMENT LABORATORY

A91-017 TITLE: EW Vulnerability

DESCRIPTION: The US Army has an extensive program designed to stress developed and developmental weapon/C-E systems to electronic warfare (EW) environments. The objective is to establish or determine each systems' performance limitations or vulnerability when exposed to existing and/or postulated EW threat environments. The EW environments consist of active and passive countermeasures (ECM). A systems' EW vulnerability can be reduced by the incorporation of electronic counter-countermeasures (ECCM) into the system to harden it against hostile EW. Electronic support measures (ESM) are an integral part of the total EW picture. ESM are used to detect, locate and identify systems on a modern battlefield. The US Army vulnerability assessment (EWVA) program seeks technological advances in the ECM, ECCM, and ESM areas as well as innovative techniques and diagnostic tools that can be applied in the determination/assessment of system EW vulnerability.

The US Army's EWVA program requires applicable advances in the electromagnetic (EM) technology areas in the following portions of the EM spectrum: acoustic, visible, millimeter wave (MMW), radio frequency (RF), infrared (IR) and ultraviolet (UV). Multispectral systems operating in two or more of the above spectral bands are emerging on the modern battlefield. Technological advances in the development of broadband EMC, ECCM and ESM are required. Multispectral Sensor Technology needs to be developed to permit simultaneous operation across RD, MMW and IR-UV wavelengths. Unique, realistic and more efficient approaches in the establishment of the

systems' EW vulnerability are required for the theoretical, laboratory and field investigations. A multispectral simulator utilizing automatic target recognition technology is required to assess multi sensor systems. The simulator must have the capability to generate scenes with backgrounds, targets and countermeasures in multispectral regions to include MMW, far IR and television wavelengths.

There are requirements to address advanced multispectral passive ECM, low observables and smart munitions ECM techniques. For ECM purposes, "tailoring" of the multispectral signatures of military targets such as missiles, aircraft, ground vehicles, artillery and high value assets should be addressed. Smart munitions ECM techniques must be as broadband as possible to minimize the cost of applying them to a wide variety of munitions currently undergoing development. Electro-optical countermeasures (EOCM) advances are required in both decoy and jammer categories. Advances are required in spectrally tailored IR and UV sources that can provide higher output radiation power levels with reduced weight, physical size and input power requirements. Advances in jammer modulation techniques (to frequencies as high as 5 KHZ) that can provide programmable waveform shapes as well as CW waveforms from unmodulated constant level outputs are required. ECCM technology advances are required for electro-optical (EO) devices. These ECCM techniques will be used to counter the ECM effects of lasers and RF against EO devices. The importance of very fast optical switches that are responsive to frequency agile lasers should be stressed. Optical switches should respond to very low level intensities. Emphasis should be on IR, television (TV), nightsights, UV systems and the human eye. EO devises must also be hardened to protect them from performance degradation and/or damage from RF sources. ECCM technology to protect multispectral sensors is required to prevent RF penetration of sensitive electronics while minimizing the effects on the transmission of desired EO signals.

There is a trend in the development of new weapon systems based on directed energy technology: high power microwave (HPM), high energy laser, particle beams, kinetic energy weapons, etc. Advances are required in EW techniques to counter their effects, sensors and fire control systems. These sensors include both active and passive systems. The sensors are expected to operate in the microwave through the UV regions of the EM spectrum. Advances in EW techniques are required to defeat these sensors to include search acquisition, track, discrimination, fire control and kiss assessment. ECCM technology development for hardening against directed energy weapons (DEW) will be required. Near term ECCM technology for protection of US systems against high energy lasers and HPM should be addressed. Far term efforts are required to develop technology for hardening against particle beams.

An important area in assessing the EW vulnerability of systems is the ability to perform accurate EW signature measurements across the EM spectrum. Advances are needed in target signature measurement technology that will not only provide comprehensive accurate data, but also minimize the time and cost in making the measurements.

AVIATION SYSTEMS COMMAND

A91-018 TITLE: Army Rotocraft/Air-vehicle Technology

DESCRIPTION: Future Army rotorcraft/air-vehicle systems will feature advanced capabilities in the areas of survivability, lethality, operability and supportability. Survivability will include signature controls, vulnerability reduction, and the optimum mixture of passive/active countermeasure systems. Lethality will be balanced between an advanced air-to-air/air-to-ground capability and will feature significant improvements in platform maneuverability, agility, and speed, as well as advanced target acquisition and identification, integrated fir/flight control and advanced weapons. Operability will include extended ranges, mission times, self-deployability, and reduced control and advanced weapons. Operability will include extended ranges, mission times, self-deployability, and reduced manpower requirements, both operator and support. Supportability will be improved via advanced logistics, including use of knowledge based flight and maintenance data recorders for real time monitoring and diagnostic assessment of critical flight systems.

Enabling technology areas will include the following:

- Advanced lightweight structures and materials
- Advanced propulsion, transmission, rotors, thrust devices and flight controls
- Artificial Intelligence (AI) knowledge based information systems supporting man/machine integration, cognitive decision aiding

- Advanced pilotage/target acquisition sensors, weapons, command, control and communications
- Advanced modeling and simulation capability; to include Computational Fluid Dynamics (CFD) and man in the loop simulations respectively

Entirely new approaches to the system requirements contained in the above description are sought, as well as approaches that expand and improve present concepts and enabling technologies.

ARMY INSTITUTE FOR RESEARCH IN MANAGEMENT INFORMATION, COMMUNICATIONS, AND COMPUTER SCIENCE

A91-019 TITLE: ISDN Applications in the Army Environment

OBJECTIVE: To develop specific end user applications which solely depend upon the ISDN technologies for the Army

CATEGORY: Advanced Development

DESCRIPTION: The Army has identified the Integrated Services Digital Network (ISDN) as part of the communications architectures for the future. Extensive field trials of ISDN have been conducted within both commercial and government sectors to demonstrate the potential benefit of such technology. Unfortunately, the limited number of user applications has prevented the full realization of such services. Therefore, the Army needs to evaluate the impact of ISDN on its daily operations, identify applications which accurately match ISDN capabilities to it end user needs, and support the development of such Army ISDN application of such application requirements were not addressed by the industry.

Phase I: Phase I of the project would be (1) to identify high payoff application(s) that can be capitalize with the technical features of ISDN. (2) to demonstrate the usefulness of such application(s) in an ISDN laboratory environment.

Phase II: Phase II would require the transport and the demonstration of the applications(s) identified in Phase I in an Army installation ISDN environment.

COLD REGIONS RESEARCH AND ENGINEERING LABORATORY

A91-020 TITLE: DEVELOPMENT OF A PORTABLE ICE-THICKNESS MEASURING INSTRUMENT

CATEGORY: Exploratory Development

OBJECTIVE: To develop to a marketable degree a portable instrumentation system which can be manually placed in contact with the surface of an ice-covered body of water and non-obtrusively measure the ice thickness.

DESCRIPTION: Current ice-thickness measuring techniques include drilling small holes through the ice and manually measuring with a tape rule, or by using expensive radar equipment and consuming considerable time interpreting the data obtained. The goal of the work is to develop a system which can be backpacked by one person and used to measure ice thickness in several locations in a short time.

The instrument is to be capable of measuring ice thickness ranging from 2 inches to 24 inches with an accuracy of +/- ½ inch. The system must be usable on fresh-water ice containing entrained air bubbles, such as natural river or lake ice. Access to the interface between the ice and water is not permissible. Ice thickness should be displayed on a digital panel meter easily readable in conditions ranging from bright sunlight to darkness. The instrument should be capable of operating at temperatures down to –401F.

Phase I:

a. Determine feasibility of instrumentation to meet the above requirements.

b. Develop a working “breadboard model” which will meet the above requirements.
c. Conduct laboratory tests to verify proper performance of the “breadboard model.”

Phase II: Design and fabricate a prototype of the system evaluated in Phase I. The end product will be a calibrated prototype instrument which has been demonstrated to meet the requirements above.

ENGINEERING TOPOGRAPHIC LABORATORY

A91-021 TITLE: Topography, Image Intelligence and Space Exploitation

CATEGORY: Exploratory Development

OBJECTIVE: Develop innovative and unique approaches involving parallel computer architectures for a real time, knowledge engineering based tactical decision aids system which exploits terrain, weather and other environmental factors to produce information of relevance to command decisions on the battlefield.

DESCRIPTION: Current Tactical Decision Aids (TDA) systems are slow to produce results and require substantial expertise on the part of the user to produce decision aids which provide decision relevant knowledge to the battlefield commander. Expert personnel to man these systems are extremely rare and difficult to retain in the service. Time to analyze and produce a result is a commodity in short supply in tactical situations. The systems envisioned will combine “real world knowledge” derived from the field observations, remote sensor systems, and traditional terrain data sources placed into a geographic information system, with an interactive expert knowledge engine to produce interactive, near-real-time tactical decision aids with not only present to the commander specific knowledge required to make decisions but also permit interactive query to view alternatives, including estimates of the uncertainty of the result. Representative tactical decision corridors for main battle units and preparation of march orders; Integrated air defense planning; Integrated defensive fires for fire support; JSTARS patrolling patterns; Smart weapons deployment planning tool, etc..

Phase I: Identify candidate approaches for development of a system to meet the stated objective, reviewing technologies applicable to its implementation and information requirements to establish expert systems, and recommend a best system.

Phase II: Produce a brass board systems (this may include equipment owned by the Engineer Topographic Laboratories and be located within the laboratories) and develop expert shells to implement at least two of the representative TDAs indicated the objective. Demonstrate the application of the system solution in a military Command Post Exercise (CPX) or Field Training Exercise (FTX)

Phase III: The system should be optimize and refined as a Pre-Planned Produced Improvements (P3I) for the Digital Topographic Support System and/or insertion in other tactical command and control systems.

ARMY MATERIAL COMMAND

A91-022 TITLE: Alternatives for Halon 1301 in Tactical Vehicle Firefighting Systems

CATEGORY: Advanced Development

OBJECTIVE: To produce, in a cost effective manner, alternate firefighting agent(s) that are environmentally acceptable to replace HALON 1301 for use in tactical vehicles.

DESCRIPTION: The requirement exists to develop alternate firefighting agent(s) that are environmentally acceptable to replace HALON 1301 for use in tactical vehicles. HALON 1301 is identified as a controlled substance in the Montreal Protocol and the Department of Defense Directive 6050.9, Chlorofluorocarbons/HALONS. The firefighting systems in tactical vehicles are currently designed for total flooding against explosions (extinguishing rate: 250ms to fire out) and fires for normally occupied as well as unoccupied compartments. The alternative(s)

must be environmentally acceptable, non-toxic and effective against fuel, lube and oil explosions and fires. A list of agent parameters, with importance for each application, is available upon request.

Phase I: Conduct literature and laboratory research to determine technical and scientific merits and feasibility of alternate firefighting agents that are environmentally acceptable to replace HALON 1301 for use in tactical vehicles.

Phase II: Conduct laboratory research to demonstrate and substantiate technical and scientific findings resulting from Phase I. Determine and demonstrate potential for cost effective production of identified alternate firefighting agents to replace HALON 1301.

A91-023 TITLE: Environmentally Acceptable Cleaning Processes

CATEGORY: Advanced Development

OBJECTIVE: To produce, in a cost effective manner, environmentally acceptable cleaning processes to replace Chlorofluorocarbons (CFC) 113 and other ozone depleting chemical agents used for cleaning metals and composites.

DESCRIPTION: General – The requirement exists to develop environmentally acceptable cleaning processes that comply with the Montreal Protocol and Department of Defense Directive 6050.9, Chlorofluorocarbons/HALONS. The new processes will replace current processes used to clean metals and composites. Current processes use Chlorofluorocarbons (CFC) 113 and other ozone depleting chemical agents.

Phase I: Conduct literature and laboratory research to determine technical and scientific merits, and feasibility of new cleaning processes for metals and composites that are environmentally acceptable and comply with the Montreal Protocol and Department of Defense Directive 6050.9, Chlorofluorocarbons/HALONS.

Phase II: Conduct laboratory research to demonstrate and substantiate technical and scientific findings resulting from Phase I. Determine and demonstrate potential for cost effective production of identified new cleaning processes for metals and composites.

A91-024 TITLE: Environmentally Acceptable Pre-Treatment Process(es)

CATEGORY: Advanced Development

OBJECTIVE: To produce, in a cost effective manner, environmentally acceptable pre-treatment process(es) that replaces the hexavalent chromium used as a final rinse to remove unreacted phosphate salts.

DESCRIPTION: The requirement exists to develop environmentally acceptable pre-treatment processes that comply with Montreal Protocol and Department of Defense Directive 6050.9, Chlorofluorocarbons/HALONS. The new processes will replace the current hexavalent chromium, which is not environmentally acceptable, used as a final rinse to remove unreacted phosphate salts. The waste treatment systems used to remove and dispose of the hexavalent chrome from the process waste water has become increasingly expensive. The new process(es) will exhibit the same or better corrosion resistance capabilities than hexavalent chromium.

Phase I: Conduct literary and laboratory research to determine technical and scientific merits, and feasibility of the new process(es) to replace the hexavalent chromium used as a final rinse to remove unreacted phosphate salts, and that are environmentally acceptable and comply with the Montreal Protocol and Department of Defense Directive 6050.9, Chlorofluorocarbons/HALONS.

Phase II: Conduct laboratory research to demonstrate and substantiate technical and scientific findings resulting from Phase I. Determine and demonstrate potential for cost effective production of identified new pre-treatment process(es).

A01-025 TITLE: Environmentally Acceptable Organic Processes and/or Coatings

CATEGORY: Advanced Development

OBJECTIVE: To produce, in a cost effective manner, environmentally acceptable organic processes and/or coatings

DESCRIPTION: The requirement exists to develop environmentally acceptable organic processes and/or coatings that will eliminate the use of High Volatile Organic Compounds (VOCs), and mitigate air pollution, liquid and solid waste problems associated with high VOCs. Current processes use chemical agents that are not environmentally acceptable. The new processes will replace current organic processes and/or coatings used in the manufacturing processes involving metals and composites.

Phase I: Conduct literature and laboratory research to determine technical and scientific merits, and feasibility of new organic processes and/or coatings for metals and composites that are environmentally acceptable.

Phase II: Conduct laboratory research to demonstrate and substantiate technical and scientific findings resulting from Phase I. Determine and demonstrate potential for cost effective production of identified new organic processes and/or coatings for metals and composites.

A91-026 TITLE: Environmentally Acceptable Inorganic Processes and/or Coatings

CATEGORY: Advanced Development

DESCRIPTION: The requirement exists to develop environmentally acceptable inorganic processes and/or coatings that will eliminate the use of Cadmium and Chromium plating process, and mitigate air pollution, liquid and solid waster. Problems associated with these plating processes. Current processes use chemical agents that are not environmentally acceptable. The new processes will replace current inorganic processes and/or coatings used in the manufacturing processes involving metals and composites.

Phase I: Conduct literature and laboratory research to determine technical and scientific merits, and feasibility of new inorganic processes and/or coatings for metals and composites that are environmentally acceptable.

Phase II: Conduct laboratory research to demonstrate and substantiate technical and scientific findings resulting from coatings for metals and composites.

MEDICAL RESEARCH ACQUISITION ACTIVITY

A91-027 TITLE: Military Disease Hazards

DESCRIPTION: Research related to either medical defense against worldwide, naturally occurring infectious diseases or medical defense against potential biological warfare agents. Current research interests are medical countermeasures against “Toxic Agents of Biological Origin,” monoclonal antibodies against toxins, medicinal chemistry – synthesis of potential drugs effective against toxin agents of biological origin, detection, diagnosis and therapy for toxin exposure, preclinical testing of viral vaccines, and vector control systems.

A91-028 TITLE: Combat Casualty Care

DESCRIPTION: Improve the care and treatment of the injured soldier and to effect early return to duty where possible. Current research interests area high-speed parallel output solid state videocamera for maxillofacial injuries, blood and blood products, trauma injuries research, biologically compatible sustrate for cultured keratinocyte layers for burn wound coverage, and field medical, dental, and water treatment equipment and technologies.

A91-029 TITLE: Army System Hazards

DESCRIPTION: Identify and solve health problems posed by new combat material and new concepts for combat operations. Current research interests are high impedance neurophysiological sensors, miniaturization of angular motion sensors, environmental health monitoring equipment – sensor suite, vision and laser bioeffects, ocular protection from laser hazards, atmospheric and water related health hazards, and field sanitation methods.

A91-030 TITLE: Medical Chemical Defense

DESCRIPTION: Provide countermeasures to chemical warfare agents. Current research interests are vesicants or blister agents, nerve agents and neurotoxins, and blood agents.