U.S. ARMY NATICK SOLDIER RESEARCH DEVELOPMENT AND ENGINEERING CENTER

BROAD AGENCY ANNOUNCEMENT (BAA)

Solicitation Number "07 - 09 Natick BAA"
(Revised Version as of 15 May 2007 - Made changes to Section VI.F and deleted last paragraph under Section I - Introduction)

Effective from 1 April 2007 - 31 March 2009

NOTE:

This document is condensed from the full announcement, and contains only the 10 major subject areas of R&D interest, each categorized into more specific requirements.

SCIENTIFIC AND TECHNICAL AREAS OF INTEREST

A. COMBAT FEEDING EQUIPMENT AND SYSTEMS.

1. Combat Food Service Equipment for Individual and Group Feeding.

Ideas, concepts, and technologies applicable to sustaining troops on the battlefield are needed for four general mission areas: consolidated large groups (550 troops), companies (150 troops), squads (12 troops), and individual warfighters. Responsive proposals are directed towards minimizing the expenditure of energy, manpower, and other resources and materiel, and yet provide maximum flexibility and effectiveness in responding to the total food service requirements of troops operating under all battlefield threats, in all climatic and terrain conditions, and at all levels of commitment. Generally, the requirements are for systems that can be rapidly deployed/employed; are easily transported; offer quick response times; are highly efficient (i.e., require least manpower, fuel, water, etc.); support all types of rations and menus; and, can be readily adapted to any battlefield scenario. As such, equipment must be compact, lightweight, versatile (e.g., modular, multi-functional, multifuel capability, etc.), energy efficient, reliable, and easily operated and maintained. In addition, effective field sanitation and waste handling/disposal concepts are needed.

Field feeding equipment and systems can be classified according to the following specific interest areas:

(a) Individual

(1) Ration and beverage heating

(2) Ration and beverage chilling

(b) Group

(1) Heat and Serve

(2) Storage of perishable fresh and frozen foods

(3) Preparation of meals

(4) Transportation, distribution, and service

(5) Waste management, reduction, recycling, and conversion

(6) Sanitation

(7) Refrigeration

<u>Scientific and Technical Areas of Interest</u>:

A comparison of current and emerging capabilities versus known and projected requirements of the Military Services indicate an interest in the following technical areas:

a. Diesel/JP8 combustion technologies including vaporization, atomization, and gasification (catalytic or otherwise) that are efficient, clean, reliable, and maintainable.

b. Exothermic and endothermic chemical technologies and thermoelectric technologies for heating and chilling rations/beverages that are safe, efficient, compact and/or

reusable.

c. Heat transfer technologies that will safely utilize all forms of generated/cogenerated energy (e.g., chemical, electrical, fuel combustion, etc.) for cooking, heating and cooling rations and water.

d. Refrigeration technologies, or other methods for safely storing perishable foods, that operate with minimum expenditure of energy and limited weight/space demands for all modes of transport, storage, and distribution of perishable subsistence in the field.

e. Equipment technologies for safely thawing cases and pallets of frozen foods.

f. Methods and equipment to determine real-time biohazards in foods.

g. Material technologies for new structural and insulative materials appropriate for food service equipment that provide improved durability, strength, energy efficiency, and cost.

h. Equipment and systems technologies to reduce or recycle food service waste and/or to assist in efficient, safe waste handling and disposal in the field in an environmentally acceptable manner.

i. Food equipment sanitation technology that reduces the logistics of cleaning and sanitizing cookware by reducing water, reducing fuel required to heat water, treating and recycling the water, novel disinfectants and sanitizers, or other forms and processes for waterless sanitation.

j. Equipment technologies to ensure the sanitary protection of food and beverages during assembly, preparation, service, and distribution in the field, and systems concepts for efficient and effective cleaning and sanitation of field feeding equipment.

k. Novel power supplies for efficiently and effectively producing/storing, and/or providing electric power to operate field feeding equipment, including consideration of such factors as size, weight, cost, reliability, safety, maintainability, useful life, and environmental factors.

l. Equipment technologies, novel methods, and devices for heating food and chilling water on aircraft and in vehicles.

m. Equipment technologies that offer improvements in baking, roasting, steaming, boiling, simmering, and grilling.

n. Equipment and technologies to reduce cooking, cleaning, and maintenance labor in Navy ship galleys.

o. Automated Information Systems, Radio Frequency Identification, and sensors for food service equipment and systems to include wireless systems that support more efficient and effective food service operations.

Communication with the Technical POC prior to submission of a formal proposal is highly recommended.

Technical POC:

Mr. Don Pickard, TEL: 508-233-5036, don.pickard@natick.army.mil

All concept papers, proposals and administrative inquiries should be submitted to:

U.S. Army Soldier Systems Center
Natick Soldier Research, Development and Engineering Center
ATTN: AMSRD-NSC-CF-D/Anne Sowerbutts
Kansas Street
Natick MA 01760-5018
TEL: 508-233-5031, anne.sowcrbutts@us.annv.mil

2. Unit/Organization Equipment.

Unit/organizational and field service support equipment are required to sustain and increase the efficiency, survivability, and operational capability of the soldier in the battlefield while meeting individual needs. Equipment required to perform a variety of field functions must be efficient, reliable, compact, lightweight, easily operated /maintained, and logistically supportable. This equipment must also be rugged enough to withstand field transport, set-up under high stress conditions, repeated set-up and tear down, and drastically varying field conditions and climates. Future battlefield requirements dictate the need for more mobile, NBC survivable and multi-functional equipment in addition to the need to reduce the logistical burden of supplying water, fuel, and electrical power to the field.

Specific interest areas include:

a. Mobile Laundry Systems
b. Space Heaters for Tentage and Shelters
c. Water Heaters for Laundry, Showers, and General Purpose Hot Water (Including non-powered immersion type heaters)
d. Field Clothing and Textile Repair Equipment
e. Field Sanitation and Hygiene Equipment
f.. Non-Powered Field Lighting
g. Mortuary Affairs Equipment
h. Latrines and Incinerators for Human Waste Collection and Disposal in the Field
i. Lightweight portable shower systems
j. Field furniture
k. Portable Field Waste Water Treatment/Recycling Systems
l. Co/tri-generation technologies

Scientific and Technical Areas of Interest:

A comparison of current capabilities versus future combat service support requirements dictates interest in the following major areas of scientific knowledge and technological capabilities:

a. Advanced technology to allow the exploratory development of diesel/jet fuel-fired clothes dryers, microwave clothes dryers, and water heaters suitable for field use.

b. Advanced combustion technology to allow the exploratory development of clean-burning, efficient, and safe multi-fuel fired non-powered heaters for the field. This includes both space heaters and immersion heaters for water. ("Non-powered" means that no external electrical power is required for operation.)

c. Advanced technology to allow the exploratory development of photocopy equipment suitable for field use, with high reliability and low maintenance support requirements.

d. Environmentally safe dry-cleaning solvents which are compatible with Army clothing and finishes.

e. Advanced water treatment technologies to allow the safe re-use or disposal of waste water from field showers, laundries, and latrines.

f. Technology to produce low-cost, high efficiency, lightweight equipment for heating, ventilating, uniform heated/cooled air distribution, and conditioning for tentage applications (including collective protection).

g. Novel and exploratory concepts to effectively and reliably identify, process, and safely transport (including air transport) NBC contaminated human remains from the NBC battlefield.

h. Novel and exploratory concepts to provide non-powered field lighting using liquid fuels such as diesel and jet fuel.

i. Advanced small capacity multi-fuel combustion, heat transfer, and material technologies to allow development of lightweight highly portable general purpose hot water heaters for field use.

j. Advance technologies to permit the development of advancement of equipment identified in the functional areas above to better the quality of life for the soldier in the field.

k. Advanced laundry technologies for reducing the use of detergents and water over existing systems.

l. Advanced technology for the development of lightweight, modular, deployable field latrines and advanced methods of treatment and disposal for waste human from latrines in the field.

m. Advanced technology for developing a lightweight, portable incinerator that will provide a safe, economical, and environmentally sound means of disposing of waste products (including human wastes) generated during military operations.

n. Advanced technology to allow development of compact, portable, lightweight shower units for use by soldiers on initial entry into theaters of operation.

o. Novel means of power generation (thermoelectric, thermophotovoltaics, solar, etc)

to allow field service equipment such as heaters, showers and laundries, to be self-powered for operation in remote/isolated locations w/o need of tactical generators.

p. Novel concepts in field furniture that will reduce the logistics burden, be easily deployable and lightweight, rugged, and enhance utility/effectiveness in the field.

q. Novel waterless or low water cleansing technologies for field showers and personal hygiene.

Communication with the Technical POC prior to submission of a formal proposal is essential.

Technical POC:

Mr. Joseph Mackoul, TEL: 508-233-5592Joseph.mackoul@natick.army.mil

All concept papers, proposals and administrative inquiries should be submitted to:

U.S. Army Soldier Systems Center
Natick Soldier Research, Development and Engineering Center
ATTN: AMSSB-PM-RSS-F(N) (Mr. Joseph Mackoul)
Kansas Street
Natick, MA 01760-5057
TEL: 508-233-5592, joseph.mackoul@natick.army.mil

B. COMBAT RATION RESEARCH AND DEVELOPMENT.

Shelf-stable prepared combat rations are essential for enabling the individual Warfighter to perform assigned missions and to survive battlefield threats. The requirements for compactness, storage stability; protection; modularity; enhanced nutrition, acceptance, convenience; and producibility have become even more stringent in anticipation of supporting highly mobile, widely dispersed Warfighters in climatic extremes.

Combat ration functionality goals can be divided into the following specific interest areas:

- Storage stability with maximum quality and nutrient retention
- Production and distribution efficiency
- Consumption/acceptance enhancement
- Human performance maintenance/enhancement
- Improved and more effective protective packaging systems
- Collection and consolidation of quality assurance and environmental data
- Food safety and food defense

Scientific and Technical Areas of Interest:

A comparison of current capabilities versus future battlefield requirements indicates the need to explore certain new areas of scientific knowledge and technological capabilities. These Scientific and Technical (S&T) Areas of Interest are in direct support of several operational/capability requirements defining the needs of the Armed Services on the future battlefield (Future Force). The S&T Areas of Interest also support the Army Technology Objective: Nutritionally Optimized First Strike Ration, which has the following main thrusts: enhanced performance; energy and nutrient intake; nutrient stability; improved consumption rates; and reduced ration weight, source material, and waste. In addition, each S&T area is linked to Defense Strategic Goals, Force Transformation, the Joint Operational Concepts, and the Services visionary documents to provide the total spectrum of joint service support to sustain the Warfighter and his/her combat system on the battlefield of the future with focused logistics, improved responsiveness, deployability, agility, versatility, survivability, and sustainability. The spectrum of likely operations describes a need for land forces in joint, combined, and multinational formations for a variety of missions extending from humanitarian assistance and disaster relief to peacekeeping and peacemaking to major theater wars.

Advanced and efficient protective packaging systems are crucial to the preservation of Army material in any climatic and/or hazardous environment. Material requirements for protective packaging systems relate to both food and food service equipment. In order for the individual Warfighter to perform the assigned mission and/or survive battlefield threats, the mission essential item must arrive at the right time, at the right place and provide the expected functionality and utility. Technological advances in high barrier polymer films and coatings, and active packaging are needed to meet the increasingly stringent and sometimes conflicting requirements of compactness, storage, protection, modularity, durability, convenience, degradability, and producibility. Packaging functionality includes (as applicable) protection from the following concerns: temperature extremes, insect/rodents,

moisture permeation, oxygen permeation, light penetration, microbial penetration, tamper events and transportation hazards (including Air Drop). Advanced systems for tracking and monitoring quality of ration unit loads are required for flexible logistic systems for the future battlefield.

The key areas of science and technology include:

a. Scientific information and advanced processing technologies are needed to ensure that
nutrients required for optimum performance under stress are provided and are physiologically available for utilization.

b. Improved technology is needed to produce lightweight, low-volume, nutrient/calorie-rich
ration components that would be cost effective and producible by industry.

c. Innovative food processing technologies and systems are needed to provide for cost effective, high volume production of shelf stable fresh-like wet or intermediate moisture
foods with maximum retention of quality factors and nutrition.

d. Scientific information about the influence of food constituents and processing (traditional
and novel advanced methods), on the physical structure, chemical reactivity, nutrient preservation, package integrity, and microbiological safety of ration components is needed to ensure their stability under extreme storage conditions (with special interest in
dairy products, eggs and other high-protein foods).

e. Scientific information/innovative technologies on extending shelf-life/storage stability of
fresh fruits and vegetables and logistical support mechanisms suggested for viable technologies.

f. Programming and data base development for exploiting on soldier computers a ration
item optimization model to guide the selection of ration items or off-the-shelf items for
different missions based on energy requirements, nutritional content, battlefield climate/conditions, personal preferences, weight, volume, and cost of items or components.

g. Scientific information on the basis for and extent to which, specific food constituents incorporated into the food: 1) delay fatigue, 2) extend physical strength and endurance, 3)
hasten recovery from injury or 4) heighten alertness or enhance cognitive abilities of warfighters engaged in physically or mentally demanding tasks.

h. Scientific concepts and data are required for increasing the speed and sensitivity of detection technologies (sensors) for food safety determination, to include novel approaches in preparation of samples from complex food matrices, high throughput screening capabilities, improved transducer technologies and capture efficiencies. In

addition field portable objective and quantitative technologies are required for determination/estimation of ration quality status or presence of foodbome pathogens.

i. Packaging technology based on non-foil high barrier polymeric material is needed to ensure protection against oxygen, moisture vapor, microbial, and insect penetrants to maintain integrity throughout the military logistics system, and to provide rations with a minimum three year shelf life.

j. Technology is needed to develop smart packaging materials/films/coatings or adjuvants possessing inherent properties for absorbing or eliminating moisture, oxygen, off odors (e.g. aldehydes), carbon dioxide, and/or ethylene. Also, develop materials containing anti-microbial agents, physiological inhibitors for fresh produce and other methodologies to control or modify the atmosphere within the package for extension of shelf life.

k. Technology is needed to develop advanced materials/films/coatings for flexible and semi-rigid polymeric containers that provide physical and chemical protection comparable to traditional aluminum foil-based high barrier polymeric materials. Determine compatibility of non-foil high barrier polymeric material for both thermoprocessing and novel thermal/nonthermal processing.

1. Technology is needed to develop tamper evident features for incorporation into primary packaging, secondary packaging and unit loads to increase the security of the ration supply chain.

m. Technology is needed to develop a model that will predict the barrier performance of film structures incorporating multiple high barrier technologies, while taking into account environmental variables such as temperature and relative humidity, as well as the packaged product.

n. Technology is needed to improve packaging to make it more recoverable, recyclable, degradable and capable of being decontaminated.

o. Technology is needed to develop high-performance, manufacturable, compostable and recyclable fiberboard materials for incorporation into ration secondary packaging systems. Multi-functional coatings and/or additives may also enhance the utility of secondary packaging.

p. Technologies, including enhanced bar code labels and sensor enabled RFID tags, are needed to enhance secondary ration packaging systems to improve strategic handling, assembly, mobility, deployability, transportability, security, logistics tracking, and retrieval.

q. Technology is needed to automate and centralize manufacturing (traceability) data, inspection data, and environmental storage data to accurately predict the remaining shelf life of operational rations and to facilitate the efficient logistical management of rations through their entire lifecycle.

r. Technology is needed to develop cost effective, easy-to-open, or reclosable, functional packages for dispensing both conventional and unconventional solid and reconstituted liquid ration components.

s. Technology is needed to develop flexible or semi-rigid high barrier materials that are

compatible with Horizontal/Form/Fill/Seal machinery, capable of withstanding classical thermoprocessing or microwave, radio frequency or high pressure sterilization as well as aseptic packaging and capable of providing products with a three year shelf life.

Communication with the technical POC prior to submission of a formal proposal is essential.

Technical POC:

Dr. C. Patrick Dunne, TEL: 508-233-5514, patrick.dunne@natick.army.mil

All concept papers, proposals and administrative inquiries should be submitted to:

U.S. Army Soldier Systems Center
Natick Soldier Research, Development and Engineering Center
ATTN: AMSRD-NSC-CF-D/Anne Sowerbutts
Kansas Street
Natick MA 01760-5018
TEL: 508-233-5031, anne.sowerbutts(a!us.armv.mil

C. WARRIOR SYSTEMS TECHNOLOGIES.

1. Ballistic Protection for Individuals

Ballistic protection for the individual soldier involves protection of the body (head/neck, torso, extremities) against a variety of projectiles that differ widely in shape, size and impacting velocity. New materials and systems are required to meet these broad ballistic threats and to lighten the load carried by the Soldier.

Scientific and Technological Areas of Interest:

A comparison of current capabilities versus future battlefield requirements dictates interest in the following major areas of scientific knowledge and technological capabilities.

Technology is needed for:

a. New polymers that can provide increased tensile properties, increased ballistic protection and lighter weight.
b. Highly ordered polymers e.g. liquid crystals, for High Performance (HP) fibers.
c. Improvements to existing HP fibers (e.g., surface modification, processing and composition variations)

A need also exists for:

d. Novel concepts to identify the best technical approach to provide protection to the individual Soldier against multiple ballistic threats. Such concepts should identify ballistic defeat mechanisms for fragmentation and handgun threats. Upon identification of and understanding defeat mechanisms, further efforts should establish the feasibility of systematically combining those mechanisms into lightweight, flexible, minimum-bulk structures of 1 1b per square foot or less providing a high level of protection against the identified threats.

e. Unique and novel textile and composite structures which optimize the ballistic protection of currently available materials for soft body armor and helmet applications.

f. Studies of blast effects to include overpressure and behind armor effects on the individual and materials/systems to mitigate effects.

g. Novel concepts to identify the best technical approach to provide ballistic protection to the individual Soldier against multiple ballistic threats. Such concepts should identify ballistic defeat mechanisms for current ballistic threats including small arms threats and flechettes. The small arms threats range from 5.45mm to 7.62mm ball and armor piercing (AP) with limited interest in 12.7 mm AP. Upon identification of defeat mechanisms, further efforts should establish the feasibility of systematically combining those mechanisms into lightweight, minimum-bulk structures using unique and novel textile and/or composite systems.

h. Additional concepts may include transparent armor, smart materials for armor and other functionalities, and nanotechnology approaches to new materials.

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Communication with the Technical POC prior to submission of a formal proposal is essential.

Technical POC:

Ms. Janet Ward, TEL: 508-233-5462, janet.ward@natick.army.mil

All concept papers, proposals and administrative inquiries should be submitted to:

U.S. Army Soldier Systems Center
Natick Soldier Center
ATTN: AMSRD-NSC-SS-D/Ms. Gail Bernheart
Kansas Street
Natick, MA 01760-5019
508-233-4706, gail.bernheart@natick.army.mil

2. Integrated Protective Helmet.

Head borne protection for the individual combatant involves protection of the head (to include the eyes and neck) against fragmentation munitions, handgun projectiles and blunt trauma impact. New materials, designs and technologies are required to meet this broad range of threats while also providing the appropriate ergonomics, comfort, hearing and cooling necessary for the individual to be capable of wearing the head protection for extended periods of time.

Scientific and Technological Areas of Interest:

A comparison of current capabilities versus future battlefield requirements dictates interest in the following major areas of scientific knowledge and technological capabilities.

Technology is needed for:

a. New and improved polymers for fiber reinforced plastics and resins which can provide increased ballistic protection and lighter weight.

b. New fibers and materials for energy absorption and moisture vapor permeability/cooling management.

c. Transparent materials for enhanced eye protection without reductions in visibility.

d. Improved lightweight integrated communications devices.

e. Engineering designs which incorporate enhancements to combat helmets including area of coverage, field of view, modular attachment points, speech recognition, compatibility with existing equipment and improved hearing capabilities.

A need also exists for:

f. Novel modular designs and integration concepts to identify the best technical approach to provide head protection to the individual combatant against multiple ballistic and non-ballistic threats. Such concepts should identify ballistic protection capabilities for each component and area of the head to be protected. Upon identification of critical design elements further efforts should establish the feasibility of systematically combining those modular components into a lightweight head borne system of approximately 3.5 pounds providing a high level of protection against the identified threats and high level of user comfort.

g. Unique and novel design approaches, which utilize the currently fielded Marine Corps Lightweight Helmet as a base platform for incorporating modular components for improved ballistic/blast protection and would offer the user the ability to tailor the level of protection to the current threat by adding or removing modular integrated components (i.e. face shield, eye protection, neck protection).

h. Unique and novel design approaches for protective assemblies, which provide maximum area of coverage and ballistic resistance capabilities. These systems could weigh as much as 8 -12 pounds and encompass the entire head. This type of approach will require attachment designs and bio-mechanic studies to determine the best means for carrying the system weight on the shoulders or other parts of the body and be capable of allowing the user to tailor the level of protection to the anticipated threat by adding or removing modular integrated components.

i. Ergonomic and human factor studies to identify key parameters for user acceptability. The identified design(s) include studies, laboratory data and human evaluations for heat stress retention, stability, ability to fire weapon systems, maneuverability and general form, fit and function of proposed design.

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guidance.

Communication with the Technical POC prior to submission of a formal proposal is essential.

Technical POC:

Mr. James Mackiewicz, TEL: 508-233-5925,james.mackiewicz@natick.army.mil

All concept papers, proposals and administrative inquiries should be submitted to:

U.S. Army Soldier Systems Center
Natick Soldier Center
ATTN: AMSRD-NSC-IP-D/Ms. Heather Parker
Kansas Street
Natick, MA 01760-5019
508-233-4929, heather.parker@natick.army.mil

3. Modular Personnel Protection System (MPPS).

Personnel protection for the individual combatant involves protection of the torso (to include the arms, groin and legs) against fragmentation munitions, small arms and handgun projectiles. New materials, designs and technologies are required to meet these broad range of threats while also providing the appropriate ergonomics, comfort, weight and cooling necessary for the individual to be capable of wearing the body armor for extended periods of time.

The goal of this task is to develop a personnel protective system which can be tailored to defeat specific threats including fragmentation/blast munitions, hand-gun and small arms projectiles. The modular system will have the capability to achieve various levels of personnel protection to meet specific threats and to provide protection to specific and critical areas of the Soldier. The modular system will be designed to protect areas of the body not currently protected by the Interceptor Outer Tactical Vest (OTV) and Small Arms Protective Plates (SAPI). The primary challenge becomes one of designing an efficient and synergistic system that offers various level of protection while being operationally effective and meets form, fit and heat stress reduction requirements so that sustainability is increased.

Scientific and Technological Areas of Interest:

A comparison of current capabilities versus future battlefield requirements dictates interest in the following major areas of scientific knowledge and technological capabilities.

Technology is needed for:

a. New and improved polymers for fiber reinforced plastics and resins which can provide increased ballistic protection and lighter weight.

b. New fibers and materials for energy absorption and moisture vapor permeability/cooling management.

c. Improved ceramic materials capable of providing weight reductions and improved frangibility.

d. Improved lightweight integrated and flexible extremity protection.

e. Engineering designs which incorporate enhancements to personnel protection including area of coverage (soft and hard armors), modular attachment points, flexibility, compatibility with existing equipment and tailorability to increasing threat levels.

A need also exists for:

f. Novel modular designs and integration concepts to identify the best technical approach to provide body/extremity protection to the individual combatant against multiple ballistic and non- ballistic threats. Such concepts should identify ballistic protection capabilities for each component and area of the body to be protected. Upon identification of critical design elements further efforts should establish the feasibility of systematically combining those modular components into a lightweight personnel protection system of approximately 15-poundsproviding a high level of protection against the identified threats and high level of user comfort.

g. Unique and novel design approaches, which utilize the currently fielded Interceptor Body Armor as a base platform for incorporating modular components for improved ballistic/blast protection and would offer the user the ability to tailor the level of protection to the current threat by adding or removing modular integrated components (i.e. hard plates, soft panels, neck protection and extremity protection).

h. Unique and novel design approaches for protective assemblies, which provide maximum area of coverage and ballistic resistance capabilities. These systems could weigh as much as 12-20 pounds and encompass most of the body. This type of approach will require attachment designs and bio-mechanic studies to determine the best means for carrying the system weight on the shoulders or other parts of the body and be capable of allowing the user to tailor the level of protection to the anticipated threat by adding or removing modular integrated components.

i. Ergonomic and human factor studies to identify key parameters for user acceptability. The identified design(s) include studies, laboratory data and human evaluations for heat stress retention, stability, ability to fire weapon systems, maneuverability and general form, fit and function of proposed design.

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(DIS) Industrial Security representative or the Technical POC listed in the solicitation for guidance.

Communication with the Technical POC prior to submission of a formal proposal is essential.

Technical POC:

Mr. James Mackiewicz, TEL: 508-233-5925, james.mackiewicz@natick.army.mil

All concept papers, proposals and administrative inquiries should be submitted to:

U.S. Army Soldier Systems Center
Natick Soldier Research, Development and Engineering Center
ATOM: AMSRD-NSC-IP-D/Ms. Heather Parker
Kansas Street
Natick, MA 01760-5019
508-233-4929.heather.parker@natick.army.mil

4. Chemical/Biological Protection for Individuals.

The protection of the Soldier from exposure to hazardous chemicals, such as chemical warfare agents, is essential to mission accomplishment on today's battlefield and that of the future. This protection is currently accomplished through the use of an activated carbon system, the use of semi-permeable material systems, and the use of impermeable barrier materials. The activated carbon system is used in protective overgarments and affords protection by adsorbing hazardous chemicals. The impermeable barrier materials consist of rubber, coated, and multilayer laminate fabrics found in gloves, boots and special purpose (e.g. depot storage /demolition/explosive ordnance disposal ensembles), which afford protection by acting as a physical barrier to chemicals.

Future needs for chemical-protective uniforms require that they protect against multiple threats, including toxic aerosols and biological agents, be decontaminable and reusable. These uniforms must also be comfortable in all climates and not impair the mobility or performance of the Soldier. The materials for these uniforms should be lightweight, have improved protection for resistance to liquid, vapor, and aerosol CB agent penetration, lessen the propensity for heat stress, have increased durability and shelf life, and be reusable through the use of reactive and biocidal materials that will detoxify the chemical warfare (CW) agents without adverse reaction with the skin. There is a need for the development of methods for measuring adsorption of agents and agent surrogates within protective materials (particularly liquid challenge/liquid penetration) and for determining the reaction products (quantitative and qualitative) that originate from detoxification chemistry taking place in catalytic and reactive materials.

A need exists to alleviate the affects of extreme environmental loads through the use of microclimate conditioning. In particular, there is a need to mitigate the effects of heat stress

induced by personal protective clothing. Microclimate Cooling Systems (MCS) are effective in removing excess stored body heat, resulting in reduced body core temperature rise and reduced skin temperature. Operationally, MCS can significantly increase users' mission duration, improve mental acuity, reduce hydration needs and enhance thermal comfort. However, the size, weight, and power consumption of these systems have precluded their use for many users. Thus, there is a need to minimize these parameters to improve the acceptance of MCS for the military and First Responder communities.

Scientific and Technical Areas of Interest:

A comparison of current capabilities versus future battlefield requirements dictates interest in the following major areas of scientific knowledge and technological capabilities:

a. Novel materials and concepts that could provide protection against highly toxic compounds, including toxic industrial chemicals (TIC) and military offensive chemical agents (blister, nerve, etc.) in gross contamination amounts for extended periods (greater than four hours), and biological agents. We are also interested in related exploratory development proposals such that feasibility can be established for the development of improved CB agent/TIC protective and biological agent protective suits, garments, gloves and socks. Proposals which emphasize lighter weight, improved protection, improved decontamination (through the use of self-decontaminating or biocidal materials or materials that can be regenerated in the field), improved durability and launderability, reduced heat stress, and other human factor concerns are of particular interest. For gloves, novel technologies that improve tactility, durability and moisture vapor transport are desired.

b. Proposals for a low cost service life indicator that can be worn or stored inside a chemical protective garment package to visibly display or provide some reading as to the degree of protection remaining in the garment are of interest as are applications of novel polymers and smart materials.

c. Research proposals to reduce/minimize the need for live agent testing to verify the chemical protection of current carbon based sorptive systems.

d. A research proposal on advanced semipermeable or selectively permeable membrane technology that allows selective permeation of moisture while preventing penetration of chemical and biological warfare agents in the forms of liquid, vapor, and aerosol.

e. Garment design and novel closure systems for CB protective clothing system. We are interested in elastic/stretchable polymeric materials such as thermoplastic elastomers for development of closure systems that provide and maintain chemical/biological agent protection in normal and in stretched states.

f. Proposals to investigate mechanisms and garment treatments that capture and possibly react with aerosolized (<5micron) threat particles. Key to this work would be to demonstrate that such treatments could remain effective during the normal use and service life of the protective garment.

g. A research proposal for improved outer shell materials for CB protective garments. We are interested in materials with novel surface modification to either its fibers or the fabric, resulting in an air permeable water repellent material for the life of the garment.

h. Proposal for improved protection against radiation threats. An example would be concern for the potential risk of collateral "E" bomb exposure. The high frequency pulse emitted by these devices might overwhelm traditional shielding methods, thus we have an interest for unique nanotechnologies, or other approaches, that offer some protection against X-ray and low-energy Gamma emissions that could be modified to offer supplemental lightweight shielding for high value electronic equipment worn or carried by the warfighter.

i. A research proposal for waterproof and solvent resistant slide fasteners as well as slide fastener test apparatus for CB agent resistance.

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Communication with the Technical POC prior to submission of a formal proposal is essential.

Technical POCs:
Elizabeth McCoy, TEL: 508-233-5434, elizabeth.mccoy@us.army.mil
Dr. Eugene Wilusz TEL: 508-233-5486,
eugene.wilusz@natick.army.mil Mr. Brad Laprise (for Micro Climate Cooling Systems) TEL: 508-233-5440, brad.laprise@natick.army.mil

All concept papers, proposals and administrative inquiries (other than for Micro Climate Cooling Systems) should be submitted to:

U.S. Army Soldier Systems Center
Natick Soldier Research, Development and Engineering Center
ATTN: AMSRD-NSC-SS-D (Ms. Gail Bemheart)
Kansas Street
Natick, MA 01760-5020
TEL: 508-233-4706. gail.bemheart@us.armv.mil

All concept papers, proposals and administrative inquiries (for Micro Climate Cooling Systems) should be submitted to:

U.S. Army Soldier Systems Center
Natick Soldier Research, Development and Engineering Center
ATTN: AMSRD-NSC-IP-D (Ms. Heather Parker)
Kansas Street

Natick, MA 01760-5019
TEL: 508-233-4929.heathcr.Parkcr@natick.armv.mil

5. *Flame and Thermal Protection for the Individual Soldier.*

Flame and thermal protection for the individual Soldier involves protection of the body against a variety of fire hazards that occur in combat (rural and urban warfare), operations other than war, and standard operational duty. New, low cost materials are required to protect against these threat and hazards to reduce burn injuries.

Science and Technology Areas of Interest:

A comparison of current capabilities versus battlefield requirements dictates interest in the following major areas of scientific knowledge and technological capabilities.

Technology is needed for:

a. New, low cost fibers for clothing applications (woven, nonwoven, knit, and batting fabric structures) which provide flame and thermal resistance without melt drip characteristics.

b. Improvements to existing fibers (e.g. incorporate novel flame retardant chemicals, flams suppressors or char formers into conventional low cost fibers).

c. Novel concepts and approaches to integrate multiple protection capabilities into materials and clothing systems. Such concepts should integrate flame and thermal protection with other protective capabilities such as environmental protection, signature management, and electrostatic dissipation without significantly increasing weight.

d. Novel developmental flame resistant treatments, coatings, and films that are moisture vapor permeable, lightweight, and chemically compatible with a wide variety of substrate materials.

e. Test methodology and supporting instrumentation to characterize and evaluate the melt burn potential of thermoplastic fiber-based fabric in layered configurations at either the bench scale or full instrumented manikin system.

POCs:
Maurice Larrivee, TEL: 508-233-4921, maurice.larrivee@us.army.mil
Ms. Carole Winterhalter, TEL: 508-233-5460, carole.winterhalter@us.army.mil

f. Novel commercial environmentally friendly flame retardant chemical treatments and processes for cotton and other fibers.

POC:
Ms. Amy Johnson, TEL: 508-233-4625, amy.l.johnson2@us.army.mil

All concept papers, proposals and administrative inquiries should be submitted to:

U.S. Army Soldier Systems Center
Natick Soldier Research, Development and Engineering Center
ATTN: AMSRD-NSC-SS-D (Ms. Gail Bernheart)
Kansas Street
Natick, MA 01760-5020
TEL: 508-233-4706, gail.bernheart@us.army.mil

6. Countersurveillance.

Survivability is fundamental to the conduct of warfare. The countersurveillance mission is to enhance the survivability of the warfighter on the battlefield by providing textiles for uniforms, individual equipment and paints and textiles for exposed skin that reduce detectabiliry by various sensors. These sensor threats include the eye, near-infrared image intensifiers, short-wave infrared devices, thermal imagers, radar and multi-spectral sensors. Signature suppression with textile and skin camouflage materials usually take the form of dyes/pigments, additives and coatings, although novel and innovative solutions are encouraged. Thermal countermeasures must not degrade existing countermeasures for visual and near-infrared (NIR) protection. They should be passive, hypo-allergenic and not increase the bulk or heat stress over levels currently imposed by existing clothing systems.

Scientific and Technical Areas of Interest:

Analysis of user requirements and current capabilities indicate the need for:

a. Near and far term research proposals related to novel concepts and materials that:

(1) Defeat the threat of short-wave infrared devices.
(2) Defeat the threat of thermal sensor detection.
(3) Defeat the threat of radar detection.
(4) Defeat multispectral threat sensors.
(5) Provide novel camouflage solutions to current and future sensor threats by exploring the applicability of a wide variety of technical approaches without compromising visual and NIR.
(6) Provide protection to exposed hands and facial areas to defeat multispectral sensor detection.

b. Exploratory development proposals related to the above areas under which the feasibility of such proposals may be demonstrated.

NOTE: Some of the technical approaches for topics within this solicitation may be subject to export control restrictions under existing export control laws, and or required to be conducted as classified projects as outlined in the National Industrial Security Program Operating Manual (NISPOM) and its supplements. Contractors who would like to submit proposals pertaining to such technologies are encouraged to contact their local Defense

Investigative Service (DIS) Industrial Security representative or the Technical POC listed in the solicitation for guidance.

Communication with the Technical POC prior to submission of a formal proposal is essential.

Technical POCs:

Ms. Lisa Hepfinger, TEL: 508-233-5146, lisa.hepfmger@us.army.mil Ms. Anabela Dugas, TEL: 508-233-5470, anabela.dugas@us.army.mil

All concept papers, proposals and administrative inquiries should be submitted to:

U.S. Army Soldier Systems Center
Natick Soldier Research, Development and Engineering Center
ATTN: AMSRD-NSC-IP-D (Ms. Heather Parker)
Kansas Street
Natick, MA 01760-5020
TEL: 508-233-4929, heather.parker@us.army.mil

7. Body Worn Interactive Materials.

Electronic subsystems, devices, and sensors are being miniaturized for personal use. Novel materials, technologies, and manufacturing methods are needed to integrate these electronics into textiles, protective clothing, or combat field equipment. There is an interest in the development of textile-based conductive materials and integration of these materials and electronics into textile clothing and individual equipment to provide multiple performance enhancements. Desired materials and products shall be safe to wear, lightweight, flexible, launderable, resistant to corrosion and water contamination, and durable to wear and tear. In addition, novel materials providing sense and respond, or actuation capabilities, power generation, or radio frequency tagging are of interest.

Scientific and Technological Areas of Interest:

A comparison of current capabilities versus future battlefield requirements dictates interest in the following major areas of scientific knowledge and technological capabilities.

Technology is needed for:

a. New fiber forming polymers that provide conductive, radiative or optical performance. Conductivities of conductive fibers should approach that of metals for power/data transmission applications.
b. Responsive fibers and fabrics that can sense and respond to a particular stimulus.
c. Novel manufacturing processes to integrate electro-optic fibers, yarns, films, and materials into fabrics. These processes should be capable of large-scale production of the materials.
d. Techniques to integrate or mount battery powered wireless or wired sensors or other miniature electronic devices into or onto fabrics or other individual equipment.

e. Development of ergonomic connector technologies to attach/detach electronics, sensors to/from network.
f. Methods to translate standard cabling such as USB 2.0, Firewire (IEEE 1394), and Coaxial cables into flat, lightweight, flexible, wearable textile-based conductors.
g. Integration methods of textile based body worn antennas into protective clothing and equipment.
h. Novel wearable power generation technologies to provide minute battery charging capabilities or to provide for direct power of low consumption miniature electronic devices.
i. Lightweight Electromagnetic Interference/Radio Frequency (EMI/RF) shielding capabilities for wearable electronic components and conductive networks.
j. Radio Frequency tagging for technical applications such as local positioning within a building and for inconspicuous data storage and collection.
k. Development of ergonomic computer input devices for handware of other clothing items.

Communication with the technical POC prior to submission of a formal proposal is essential.

Technical POCs:

Ms. Carole Winterhalter, TEL: 508-233-5460
carole.winterhalter@us.army.mil Mr. James Fairneny, TEL: 508-233-5209
james.fairneny@us.army.mil

All concept papers, proposals and administrative inquiries should be submitted to:

U.S. Army Soldier Systems Center
Natick Soldier Research, Development and Engineering Center
ATTN: AMSRD-NSC-SS-D (Ms. Gail Bernheart)
Kansas Street
Natick, MA 01760-5020
TEL: 508-233-4706, gail.bemheart@us.army.mil

8. Body-Worn Systems, Hand Held Devices, and Smart-Lightweight Electronic Components/Modules for Soldier Protection, Knowledge Management and Cognitive Improvement.

The advanced tactical helmet and body worn electronic systems, components and smart sensors for future individual and small combat unit Soldier systems will integrate communications, NBC protection, tactile/visual/audible information displays, micro display integration, weapon sighting/fire control functions, and directed energy weapons (DEW) protection on the warfighter. These will maximize the individual Soldier's survivability and situational understanding on the battlefield. Advanced technology for the Soldier is needed for the miniaturization of lightweight, durable, reliable, low-power displays, sensors, optics, remote threat detectors, and personal area network cabling systems. This includes wearable

smart electronic components/modules/materials that might be integrated into textiles or on the Soldier for disseminating knowledge in a manner in which the human and small combat unit can process and use the knowledge.

Scientific and Technical Areas of Interest:
A comparison of human integration efforts, current technology, research activities, and the future needs of the user, has revealed the following areas of interest:

a. Research proposals related to advancing the human integration and current technology for lightweight integrated wearable systems, head and body mounted displays, large area displays and body-worn systems that may lead to enhancing the individual Soldier's survivability and situational awareness on the battlefield; special interest areas include human systems integration, miniaturization, increased durability and reliability, and components having low power as well as new power solutions that meet man-portable system requirements for Soldier's survivability and situational understanding. Specific examples of body worn system capabilities include: computers, integrated electronic modules, inter- connections in fabrics, wearable battery technologies, combat identification, tactical engagement simulation capability, system voice control, haptics, neuro- physiological and physiological/medical sensors and data management, integration of individual/team weapon system sensors and controls.

b. Research proposals for various lightweight low power, body mounted displays, large area displays, threat detecting sensors, indirect weapon sighting systems, communication and information management capabilities and devices to enhance performance and protect individual Soldier's biosensors against the varied threats expected in the intense battlefield environment of the future, such as, (e.g., chemical/biological toxins, unexploded ordnance, RF, seismic, acoustic) and smart electronic modules that think, sense and communicate to the warfighter, interfaces that allow Soldiers to manipulate miniature robotics and robotically controlled sensors, to enhance visualization and situational and cognitive awareness.

c. Research proposals for low weight, low power, high efficiency man portable/wearable systems and components (e.g., antennae, power and/or data bus, sensors, displays) that can be integrated into textiles and other protective structures.

d. Research proposals that integrate with Tech Base areas such as nonportable IR and daylight readable display technologies using minimal energy output levels as well as a potential for deicing and defogging capable of meeting performance requirements across all environments.

e. Research proposals for displays and body-worn components, sensors and systems and system components using innovative display and sensor technologies capable of innovative human mounted integration. Critical areas of interest include some or all of the following display attributes:

- active matrix displays and backplanes
- flexible displays

- reduced bulk and weight
- increased field of view
- multifunctional displays, modules and sensors
- reduced power requirements
- bistability and increased bandwidth displays and sensors
- increased pixel resolution/monochrome/color
- incorporate see-through/ reflective/diffractive/scanning/mems/nanotechnology
- technology/occluded/see around/handheld/body-wom
- electronic components that may be integrated into textiles
- components that think, sense and communicate to the warfighter
- Cognition enhancement capabilities

Communication with the Technical POC prior to submission of a formal proposal is essential.

Technical POC:

Mr. Andrew Taylor, TEL: 508-233-4968 andrew.taylor@natick.army.mil

Contract Data Rqmts POC:

Mr. Michael Short, TEL: 508-233-6951 michael.shortl@natick.army.mil

All concept papers, proposals and administrative inquiries should be submitted to:

U.S. Army Soldier Systems Center
Natick Soldier Research, Development and Engineering Center
ATTN: AMSRD-NSC-IP-D (Ms. Heather Parker)
Kansas Street
Natick, MA 01760-5019
TEL: 508-233-4929, heather.parker@natick.army.mil

9. Biomechanics.

Biomechanical tools and data are currently being developed to inform the design of boots, individual body armor, and load carriage gear that reduce injuries, delay fatigue and enhance dismounted Soldier mobility. There is a need for detailed information on the forces acting on the Soldier's musculoskeletal system as well as how their gait, range of motion, rates of movement, energy expenditure, and stamina are affected by their load, its distribution on the body, the terrain and grade of the environment, and obstacles presented by the environment, such as in urban terrain.

Scientific and Technical Areas of Interest:

A review of the existing data and models has revealed the following areas of continuing scientific and technical interest:

a. Development of light weight, low powered prototypical devices that improve the

mobility of individual dismounted (non-vehicular riding) Soldiers in complex terrain and enhances their ability to carry heavy loads with reduced stress on the body and less fatigue.

b. Development of a suite of biomechanical tools that may be used to assess the physical performance characteristics of Soldier systems of dismounted Soldiers in a broad range of environments.

c. Determine to what degree the biomechanical measures of fatigue may be used to predict performance failure of critical Soldier tasks.

d. Develop predictive fatigue algorithms and integrate them with physiological monitoring systems to provide commanders with real time information on the performance capabilities of their Soldiers.

e. Investigate the effects of acute and chronic head borne weight on Soldier performance, fatigue and the incidence of injuries.

f. Develop physics based data and analytic models/virtual prototyping tools of human locomotion and combat environment individual movement techniques (IMTs) to provide design guidance for individual Soldier equipment.

g. Determine the biomechanical effects of placing loads of varying mass, volume and location on the extremities during typical soldier tasks.

Communication with the Technical POC prior to submission of a formal proposal is essential.

Technical POC:

Dr. Jeffrey Schiffman, TEL: 508-233-4967, Jeffrev.SchiflmaiKaius.armv.mil

All concept papers, proposals and administrative inquiries should be submitted to:

U.S. Army Soldier Systems Center
Natick Soldier Research, Development and Engineering Center
ATTN: AMSRD-NSC-SS-D (Ms. Gail Bernheart)
Kansas Street
Natick, MA 01760-5020
TEL: 508-233-4706, gail.bemheart@us.army.mil

10. Materials Nanotechnology.

Nanotechnology, the understanding and manipulation of matter at the nanometer scale, offers opportunities to create materials with new or significantly improved properties, relative to known materials. Examples include the numerous reports of small amounts of nanoparticle additives (such as montmorillonite clays or carbon nanotubes) giving rise to mechanical or electrical properties in polymer composites that typically require much

higher loadings of conventional additives to achieve. In some cases, properties are observed in materials with controlled nanometer-scale structures that have not been realized in more conventional material structures. One example is the extraordinary diffusion barrier properties of some nanoclay-filled polymers. Periodic structures with nano-scale features are known to interact strongly with electromagnetic radiation having wavelengths on the order of the feature size. These effects can be used to create new types of resonant structures for enhanced optical performance, for instance the photonic crystal behavior exhibited by materials with controlled structural features on the nanometer scale. Nano-scale periodic structures are also used to create non-conventional optical components such as filters, polarizers and waveplates that can be tuned to operate in specific wavelength regions.

Scientific and Technological Areas of Interest:

There is a need for research and development of materials incorporating nanometer-size architectures, and demonstrating enhanced or novel properties relative to existing materials in the area of physical properties, including mechanical properties, thermal properties, diffusion barrier properties, electromagnetic properties, novel or enhanced chemical functionality and unanticipated combinations of properties. Composites of polymers with nanometer-scale reinforcements of various forms may offer enhanced mechanical properties allowing equipment to be fabricated with less weight and bulk than current designs and possibly at lower cost. The creation of interpenetrating networks of various compositions, with domain sizes on the nanometer scale, may offer access to unprecedented material properties. Fiber or textiles with controlled nanometer-scale architectures may have application to the development of high strength, high durability or multifunctional textiles.

Particular areas of application for the materials of interest include personnel armor, clothing, airdrop systems, shelters and load carriage systems, packaging materials, textile-integrated electronic systems, chemical and biological reactive materials, permselective materials and tactical optics.

In addition to the discovery and development of new materials, research efforts may be needed to understand the nano-scale origins of bulk properties observed in nanocomposite or nano-structured materials that could aid in the design optimization of material structures for particular applications.

New techniques that will enable the creation of periodic structures with decreased feature size are of interest and the ability to control the geometry of nano-scale elements and their periodic configuration is also of interest.

Research to develop economically viable processes for the creation of nano-structured materials on a commercial scale may be of interest.

Communication with the Technical POCs prior to submission of a formal proposal is essential.

Technical POCs:

Dr. Michael Sennett, TEL: 508-233-5516,

michael.sennettl@us.army.mil Dr. Heidi Gibson, TEL: 508-233-5487, heidi.gibson@us.army.mil Mr. Brian Kimball, TEL: 508-233-4375, brian.kimball@us.army.mil

All concept papers, proposals and administrative inquiries should be submitted to:

U.S. Army Soldier Systems Center
Natick Soldier Research, Development and Engineering Center
ATTN: AMSRD-NSC-SS (Ms. Gail Bernheart)
Kansas Street
Natick, MA 01760-5020
TEL: 508-233-4706, gail.bernheart@us.army.mil

11. Lightweight Conformal Solar Cells.

The power incident from the sun, at the earth's surface, is on the order of $1 kW/m^2$. Conversion of this power, even at moderate efficiencies could be a major renewable, clean and inexpensive energy source, there for the taking. The operation of solar cells is based on the photovoltaic effect, which is the generation of a voltage and/or current by absorption of light in certain materials or combinations of materials. To date, the primary materials that have found commercial application are a variety of inorganic materials including silicon (crystalline, multicrystalline and amorphous), copper indium diselenide, indium phosphide and gallium arsenide, with cell efficiencies averaging around 18-20%. These materials however remain limited because of high cost and inability to process them into lightweight, conformal devices. Therefore, much research has been devoted to the development of new materials that can address these limitations and further improve device efficiencies. It is well known that organic materials can offer lower cost, lower weight, facile processability and tailorability of the photoelectric response. However, the efficiencies of organic based devices are currently too low for practical use. Recently, it has been demonstrated that cells composed of both organic "light-harvesting" materials and inorganic "nanocrystalline" (high surface area) materials can provide sufficient conversion efficiencies and current densities to make practical applications feasible (Grstzel). This is a relatively new realization in photovoltaic research and it is anticipated that improvements in these unique "hybrid" (organic/inorganic) materials, along with ongoing developments in nanostructured materials, will provide exciting advances for wearable solar cell devices.

Scientific and Technological Areas of Interest:

There is a need for research to develop new materials and new methodologies to effectively integrate promising organic and inorganic materials into hybrid devices for wearable solar cells with maximum energy conversion efficiencies. Towards this, new light-absorbing materials that are more stable and more efficient light absorbers are needed. Also, new processing approaches are needed that can increase the surface roughness to improve energy collection and maximize interfacial interactions such that charge separation occurs before recombination. Devices that are portable, rugged, lightweight, flexible and conformal to a variety of materials, in particular fabrics, are desired. Organic light-harvesting dyes or

polymers coupled with inorganic semiconductor materials into interpenetrating nanofibrous or nanocomposite structured networks may offer a low cost, viable approach to meet these needs. Particular areas of application include wearable solar batteries for the soldier (garments, helmets, backpacks and removable patches) to provide modular energy units and tentage materials for shelters. In addition to the development of these photovoltaic devices, coupling with appropriate capacitors for energy storage as well should also be considered.

Materials of interest include new nanofibrous or nanocomposite structured organic/inorganic hybrid systems. Specific materials may include light harvesting and charge-transfer dyes or polymers, conducting polymers, inorganic semiconductor materials and nanoparticles, flexible and transparent electrodes, and conducting fabrics.

A major barrier to the fabrication of wearable solar cells will be effective integration of the components in the device such that energy collection is maximized and charge recombination is minimized. This will be necessary to reach conversion efficiencies high enough for practical application.

Communication with the Technical POC prior to submission of a formal proposal is essential.

Technical POC:
Mr. Barry DeCristofano, TEL: 508-233-4255, barrv.decristofano(«>us.armv.mil

All concept papers submitted to:
U.S. Army Soldier Systems Center
Natick Soldier Research, Development and Engineering Center
ATTN: AMSRD-NSC-SS-NS (Mr. Barry DeCristofano)
Kansas Street
Natick, MA 01760-5020

All proposals and administrative inquiries should be submitted to:

U.S. Army Soldier Systems Center
Natick Soldier Research, Development and Engineering Center
ATTN: AMSRD-NSC-SS-D (Ms. Gail Bernheart)
Kansas Street
Natick, MA 01760-5020
TEL: 508-233-4706. gail.bernheaii@us.ai-mv.inil

12. Anthropometry

The NSRDEChas traditionally maintained an extensive anthropometric database on U.S. Army and other military personnel. Anthropometric data are needed on Active Duty, National Guard, and Army Reserve personnel in order to facilitate the design and sizing of personal protective clothing and equipment systems. These data are also required for the design and layout of general-purpose workstations and combat vehicle crewstations. Virtually all military system development requires access to accurate body size data at some

point in the design process. U.S. Army anthropometric data are also used by military contractors, other government agencies, and industry. The most recent anthropometric survey of U.S. Army personnel was conducted in 1988, and a need currently exists to update this information.

Scientific and Technical Areas of Interest

Obtain traditional anthropometric measurement information on Active Duty, National Guard, and Army Reserve personnel in accordance with data collection standards established during the 1988 survey of U.S. Army Personnel.

Develop and implement quality control measures to include data editing and other means that serve to ensure the accuracy of anthropometric data collected during the course of the survey.

Develop data collection methods and procedures as required to support the acquisition of a well-defined set of body measurements that permit the assessment of anthropometric changes over time and also permit the comparison of U.S. Army personnel data with other U.S. and foreign military populations.

Traditional anthropometric data collection as well as three-dimensional whole body and body segment scanning of survey participants will be performed by the offeror. Close coordination between the government and offeror on such matters as the final dimension list, body landmarking requirements, quality control implementation, and data cleaning shall be required throughout the duration of this large scale data collection effort. It is anticipated that a cost sharing contract will be used to execute this anthropometric data collection effort.

Communication with the Technical POC prior to submission of a formal proposal is essential.

Technical POC: Mr. Steven Paauette. TEL: 508-233-5430.
steven.paquette@.us.army.mil

All concept papers, proposals, and administrative inquiries should be submitted to:

U.S. Army Soldier Systems Center
Natick Soldier Research, Development and Engineering Center
ATTN: AMSRD-NSC-SS-D (Ms. Gail Bernheart)
Kansas Street
Natick, MA 01760-5020
TEL: 508-233-4706, gail.bemheart@us.army.mil

13. Advanced Protection and Integration Technologies and Systems.

As protective and structural technologies get more advanced, opportunities emerge to integrate multiple functions into fewer layers and components. As the Army transforms over the next decade to a lighter, more agile and lethal force, the individual warrior's set of protective clothing and individual equipment must also transform. The Army is seeking a

revolutionary approach to system design and integration using emerging technologies and technology trends. New and emerging technologies and design concepts must be explored to provide the warrior with combat overmatch through significant advances in survivability, mobility, and cognitive/physical warrior performance. An advanced integrated combat uniform system will emerge as the foundational centerpiece for the human interface, load bearing, protection, and electronics hardware linkages for the future warrior systems. System weight and bulk reduction are key goals of this effort. Significant mission benefits to the soldier include: longer mission time (endurance) in hot/cold, and/or chemical/biological environments; improved warrior performance, both physical and cognitive in all mission environments; reduced heat stress casualties; reduced water intake requirements; enhanced cold weather protection; and enhanced mobility due to reduced bulk and protrusion of electronic devices and interfaces.

Scientific and Technical Areas of Interest:

Research proposals to develop combat uniform and integration system design concepts and breadboard prototypes, to include integration of multiple technologies into fewer textile-based structures and/or system components. Examples include, but are not limited to, integration of ballistic protection and load bearing functions, integration of chemical/biological agent protection with environmental protection and signature management, integration of novel closure and interfaces for advanced protection and electronic networking capabilities, integration of power/data bus, sensors and connectors into textiles and other protective structures.

Research proposals for novel design approaches and technologies to provide enhanced passive physiological management, active ventilation, and/or heating and cooling concepts suited for dismounted soldier applications.

Research proposals to develop and implement measures, assessment tools, and analysis of cognitive and physical warrior performance, especially as it relates to the soldier's body worn system.

Communication with the Technical POC prior to submission of a formal proposal is essential.

Technical POC:

Ms. Cheryl Stewardson, TEL: 508-233-5427, cheryl.stewardson@us.army.mil

All concept papers should be submitted to:

U.S. Army Soldier Systems Center
Natick Soldier Center
ATTN: AMSRD-NSC-W, (Ms. Cheryl Stewardson)
Kansas Street
Natick, MA 01760-5056

All proposals and administrative inquiries should be submitted to:

U.S. Army Soldier Systems Center
Natick Soldier center
ATTN: AMSRD-NSC-IP-D/Ms. Heather Parker
Kansas Street
Natick, MA 01760
TEL: 508-233-4929, heather.parker@us.army.mil

14. Warrior Performance

Warrior Performance is the degree to which a warfighter's skills and abilities are implemented for a particular task or set of tasks. It is specific to the military operational environment. There are on-going efforts to generate data in the area of human factors as it relates to Warrior Performance, however, most of these efforts relate to the physical aspects of performance. Though significant work is being done through these efforts more work remains in order to gain a complete picture of the relationship of the warrior to his/her environment. Concentration on the cognitive aspects of individual warrior performance is lagging. Significant work still remains to be done in this area as well. The objective of this area of study is to generate methodologies as well as relevant data that can be applied directly to the development of emerging warrior systems with equal emphasis on physical and cognitive performance and can be utilized by emerging behavioral models for the same purpose. The warrior performance target audience includes male and female: Dismounted Infantry, Mounted Infantry, Engineers, SOF, Medics, Army Aircrew and Military Police.

Scientific and Technical Areas of Interest:

Development and validation of quantitative measures and criteria as well as methodologies for evaluating these areas is a key element of any proposed effort.

a. Research to determine the performance of individuals and small units with respect to their Situation Awareness. Influencing factors for investigation should include, but not be limited to, maturity, skill, experience, motivation, risk acceptance, training and learned versus inherent propensity for situation awareness. Studies may also include the impact of mission (e.g., complexity, type, intensity), mission environment (e.g., MOUT, Jungle) training proficiency and unit dispersion on the SA of individuals and small units. Studies on the impact of different technology types on situation awareness, and situation awareness and the 'small unit dynamic' are also of interest.

b. Studies on the effect of fatigue on warriors to include, but not be limited to, the influence of mission on physical and cognitive fatigue, quantification of the physical/cognitive relationship of fatigue, quantification of different types of fatigue (e.g., muscle, cognitive, systemic) and their impact on warrior performance, determining mitigating factors of fatigue related to training and determining whether levels/degrees of fatigue be can predicted based on personal characteristics.

c. Research to determine differences in warrior performance due to varying missions (e.g., attack, raid, SASO) and mission environments (e.g., Desert, Artie). This research should highlight the impact on physical and cognitive warrior performance.

d. Taxonomy - Develop taxonomy of measures and associated criteria of physical and cognitive warrior performance.

Communication with the Technical POC prior to submission of a formal proposal is essential.

Technical POC:
Ms. Cynthia L. Blackwell, TEL: 508-233-5210, cynthia.blackwell@us.army.mil

All concept papers should be submitted to:

U.S. Army Soldier Systems Center
Natick Soldier Center
ATTN: AMSRD-NSC-W (Ms. Cynthia L. Blackwell)
Kansas Street
Natick, MA 01760-5056

All proposals and administrative inquires should be submitted to:

U.S. Army Soldier Systems Center
Natick Soldier center
ATTN: AMSRD-NSC-IP-D/Ms. Heather Parker
Kansas Street
Natick, MA 01760
TEL: 508-233-4929, heather.parker@us.army.mil

15. Soldier-borne Power Sources

In the future, dismounted Soldiers capabilities will continually be modernized with advanced sensors, networking and processing technologies all of which require man portable power sources. While many of these technologies will possess advanced low power electronics and power management features the need for innovative power source solutions for the small combat unit will remain an essential aspect of the Army's Soldier modernization program. Emerging operational concepts dictate the need for technology to support extended missions without the benefit of re-supply for 72 hours or longer.

Scientific and Technical Areas of Interest:

Power source solutions that can demonstrate through objective analysis substantial reductions in life cycle cost and logistics burden are of primary interest to the Army. Technologies and concepts that provide improvements in energy density, ergonomics, "ease of use" and safety to facilitate human factors and Soldier-centric integration will also be given special attention.

An example of a specific area of interest is solid oxide fuel cell on a silicon chip (MEMS SOFC). Power levels of 20 to 30 watts are the range of interest. The complete SOFC system, including fuel, must be less than 0.8 liter and no more than 0.6 kg. Research proposals are sought to develop demonstration prototype products that meet the above

criteria.

Communication with the Technical POC prior to submission of a formal proposal is essential. Technical POC: Scott Feldman; (508) 233-5214; Scott.Feldman@us.army.mil All concept papers, proposals and administrative inquiries should be submitted to:

U.S. Army Soldier Systems Center
Natick Soldier Center
ATTN: Mr. Scott Feldman
Kansas Street
Natick, MA 01760-5056

D. TENTAGE, FABRIC STRUCTURES AND RIGID WALL SHELTERS

The objective is to enhance the protection and capability provided to warfighters and warfighter systems that use soft, rigid wall, and hybrid shelters. Threats include combat and the environment, and capabilities include mobility, transportability, durability and producibility. Research and development enhancements are grouped into seven primary thrusts areas. These are:

1) Ballistic Protection

2) Chemical/Biological Protection

3) Electromagnetic Interference/Electromagnetic Pulse Protection

4) Environmental Protection

5) Detection Avoidance

6) Deployment/Durability

7) Functional Integration of Multiple Technologies.

Scientific and Technical Areas of Interest:

The following examples (though not inclusive) represent areas of science and technology that are relevant to the objectives of the Tentage and Rigid Wall Shelters area and may be of interest to the Army.

1) Ballistic Protection

a. Lightweight rigid shelter panels and/or structures effective against ballistic threats including ceramic/epoxy/fiberglass composite panels with capability of localized/variable protection; applying protection only where critically needed and to the level needed.

b. High strength, lightweight, flexible, and affordable ballistic resistant fibers, fabrics, or fabric composites for tentage (flexible, thin, abrasion resistant).

2) Chemical/Biological Protection

c. Technologies related to collective protection shelters including barrier and reactive materials, hermetic structural closures and entry/exit systems.

d. Gasket materials which have similar mechanical and environmental performance characteristics as the current silicone gaskets, but provide increased protection against chemical/biological threats without a significant cost increase.

3) Electromagnetic Interference/Electromagnetic Pulse (EMI/EMP) Protection

e. High permeability and high conductivity structural composites that provide EMI/EMP shielding.

f. EMI/EMP gasket with improved mechanical properties and performance in field environment. The gasket should not be subject to compression set and should require minimal to no cleaning.

4) Environmental Protection

g. Insulative rigid shelter panel shielding technologies that minimize the acoustic and thermal signatures associated with on-board power generators.

h. Superinsulative panels for rigid wall shelters.

i. Low bulk and low cube insulative liners for tentage that may utilize active methods of membrane dispersion to produce dead air space and high insulation.

j. Functional treatments of tentage fabrics that produce reduced effects from solar loading, the capability to accept camouflage printing, and the capability to accept insecticides, etc.

5) Detection Avoidance

k. Lightweight, low-cost, rigid and flexible shelter treatments that reduce visual, IR and radar signatures.

6) Deployment/Durability

1. Flame retardant fibers and fabrics that maintain mechanical strength, wear, and weather resistance for materials used for tentage applications.

m. Bonding techniques that guarantee long-lasting shielding continuity and integrity at seams and cutouts of rigid wall shelters.

n. Novel stitching and joining techniques for leak-free seams in tents through the possible use of durable, composite threads that permanently expand with application of a stimulus (e.g. heat) to eliminate the possibility of tent seam leakage due to needle holes, as well as increase seam strength.

o. Net-shape manufacturing processes for fabric structures utilizing tubular materials with integral end close-outs that form the final shape of a fabric structure without seams except for doors and windows.

p. Technologies related to the maturation of inflatable structures that carry high loads, are reliable and affordable. Related topics include the development of rapid airbeam inflation systems; and technologies for long term deployment of airbeam structures, such as alternative inflation substances, and rigidifying.

q. Self-erecting tents and rigid shelters utilizing novel technologies such as shape memory materials and phase change materials.

r. Technologies that improve shelter soil/structural interfaces in world-wide environments to include soil stabilization and improved anchoring techniques.

s. Soft wall shelters that become rigid with application of external stimulus, using reversible rigidizing polymers.

t. Lightweight, high strength, low-cost, rigid panels for expandable rigid wall shelters

u. Highly expandable rigid wall structures with expansion ratio of 12 or higher.

v. Improved expandable rigid shelter design for expandable shelters which reduce the number of personnel needed, and/or reduce the amount of time required to set up and tear down.

7) Functional Integration of Multiple Technologies

w. Integration of multiple shelter technologies (ballistic/detection avoidance/EMI/EMP/CB) to demonstrate a highly-protected "operate-on-the-move" command post.

x. Integration of multiple shelter technologies to demonstrate a shelter complex that provides multiple survivability capability integral with the system's components, along with rapid deployment through low weight, high expansion, and airbeam support.

y. Integration of multiple information and automation technologies to enhance the utility of rigid shelters

8) Miscellaneous

z. The development of alternative applications for new inflatable pressurized composite structures technology such as breakwaters, fendering systems, rapid port enhancement, water/fuel containers, munitions barricades and high pressure hoses.

aa. Modeling of nonlinear fabric structures, fabric/yarn mechanics, constitutive relation, wind structure interactive modeling, and failure criteria.

bb. Applications of electrotextiles to rigid and soft-walled shelters.

cc. New technologies that will benefit shelter electrical systems such as high efficiency lighting and field photovoltaic systems.

Some of the technical approaches for topics within this solicitation may be subject to export control restrictions under existing export control laws, and/or required to be conducted as classified projects as outlined in the National Industrial Security Program Operating Manual (NISPOM) and its supplements. Contractors who would like to submit proposals pertaining to such technologies are encouraged to contact their local Defense Investigative Service (DIS) Industrial Security representative or have the Technical POC listed in the solicitation for guidance.

Communication with a Technical POC's prior to submission of a formal proposal is

essential.

Technical POC's:

Ms. Jean Hampel, TEL: 508-233-4692, jean.hampel@natick.army.mil
Mr. Melvin Jee, TEL: 508-233-5245, melvin.iee(q),us.armv.mi1

Contract Data Rqmts POC:

Ms. Arlene Garwood, TEL: 508-233-5338, arlene.garwood@natick.army.mil

All concept papers, proposals and administrative inquiries should be submitted to:

U.S. Army Soldier Systems Center
Natick Soldier Center
ATOM: AMSRD-NSC-CP-D (Ms. Arlene Garwood)
Kansas Street
Natick, MA 01760-5018

E. AIRDROP - ADVANCED PERSONNEL AND CARGO AIRDROP SYSTEMS

Airborne force projection and aerial delivery methods are critical operational capabilities of the military's strategic shift toward a CONUS-based force. Increasing mission responsibilities now include humanitarian missions. Airdrop science and technology is focused on:

1) increasing aircraft/airborne force survivability in a threat environment by expanding the airdrop operational envelope

2) improving airdrop accuracy through the introduction of standoff (of various levels) precision guided aerial delivery platforms and low level airdrop systems

3) reducing personnel injuries/casualties by improving system functional reliability while reducing ground impact velocity, oscillation, and exposure time to threats

4) reducing the cost and time required for parachute development and production by new manufacturing techniques and using novel new parachute designs developed by computational analytical methods to reduce manufacturing and testing requirements.

Scientific and Technical Areas of Interest:

An assessment of current personnel and cargo airdrop capabilities and ongoing research and development efforts versus future requirements has led to the following areas of interest:

a. Cargo airdrop technologies should focus on precision aerial delivery for all cargo weights (l-30Klbs) and varying ranges off-set distances, including high glide and extended off set powered systems. Affordable high altitude precision delivery systems and low cost guidance, navigation and control (GN&C) systems to include sensors, avionics, and software. In addition, technologies for compatible mission planning systems at various levels of integration with delivery platforms and aircraft to support all types of airdrops from all types of aircraft. Complimentary weather sensors and forecasting technologies for integration and/or use with mission planning or precision aerial delivery systems.

b. The M-l and M-2 parachute releases used for heavy cargo have limitations and do not always perform optimally under severe conditions. New more reliable, lower maintenance, lower weight and lower cost parachute releases are needed to replace the M-l and M-2 parachute releases for heavy cargo capable of automatically releasing parachutes from the cargo upon ground impact regardless of ground wind conditions and payload orientation. New parachute releases are also required lighter cargo.

c. Concepts and development of extraction systems for light through heavy payloads from transport aircraft.

d. New personnel parachute systems are needed to provide accurate delivery as well as low velocity landings coupled with ground wind attenuation to minimize body injuries. High glide and high off-set distance canopy designs, along with high tech communication, video, and global positioning systems are needed for steerable personnel parachute systems. In-flight communication systems for high altitude deployed paratroopers and HALO/HAHO navigation aid systems for SOF units. In addition, lightweight oxygen systems for high altitude deployed paratroopers.

e. Advanced construction methods for low cost manufacture of ram-air gliding wings, round, cross and other parachute systems.

f. Development of interactive/electronic textiles for parachutes to monitor and improve parachute and airdrop system performance, such as canopy fabric structural behavior during inflation, variable porosity canopy fabric and glide ratio, fabric structural integrity indicator, and environmental-adjustable fabric.

g. Modeling and experimental investigation of the inflation and steady descent of parachutes, including modified round canopies, single-skin and ram-air parafoils, and new parachute design for high altitude and off-set precision aerial delivery of military payloads.

h. Advanced sensors, instrumentation and measurement methods to measure and investigate parachute aerodynamics and structural dynamics during opening and descent, including canopy spatial position, motion and geometry, fabric strain, opening force, air velocity, air pressure, and overall flow field.

i. Modeling and experimental research on the biomechanics of paratroopers during parachute deployment and landings, body protective devices to minimize body injuries, and avoidance measures for towed jumpers.

Communication with a Technical POC prior to submission of a formal proposal is essential.

Technical POC:

Mr. Richard Benney, TEL: 508-233-5835,
richard.benney@natick.army.mil Dr. Calvin Lee, TEL: 508-233-4267,
calvin.lee@natick.army.mil

All concept papers, proposals and administrative inquiries should be submitted to:

U.S. Army Soldier Systems Center
Natick Soldier Center
ATTN:AMSRD-NSC-AD-BAA (Ms. Kimberley Mahon)
Kansas Street
Natick, MA 01760-5017
TEL: 508-233-4345, kimberley.mahon@natick.army.mil

Request all concept papers and proposals submitted be copy furnished to:

U.S. Army Soldier Systems Center
Natick Soldier Center
ATTN: AMSRD-NSC-AD-J /Mr. Richard Benney
Kansas Street
Natick, MA 01760-5017

F. TEXTILE TECHNOLOGIES.

1. Multi-Functional Materials.

Textile technology programs relate to protection of the individual Soldier against battlefield threats such as ballistic, Soldier detection, chemical, biological, fire, thermal and directed energy, while ensuring survival under extremes of environmental (temperature and humidity) conditions by involving comprehensive research and engineering. In addition to threat survivability, there is a strong interest in the new and growing field of "wearables." The wearables field is of interest insofar as it relates to the integration of electronic capabilities in to textile materials, combat clothing and combat field equipment worn by Warfighters. The following is a summary list of textile technologies of interest to the Natick Soldier Center:

a. Polymer synthesis and characterization
b. Fiber morphology and mechanical property characterization
c. High-strength fibers, i.e., fibers from liquid crystal polymers
d. Yarn and fabric manufacturing and fabric preparation and finishing processes
e. Photochemistry and photophysics of dyes and dyed textiles
f. Methods for sorbing/reacting chemical warfare agents in lightweight, low-heat stress textile systems.
g. Producibility of unique fibers and fabrics
h. Thermally resistant insulating textile systems
i. New technologies for the characterization of textile systems properties (e.g. electrostatic, electromagnetic, durability; and flame, thermal and ballistic resistance).
j. Consideration of comfort and physiological implications of protective clothing
k. Polymer batteries and lightweight sources of power.
l. Power junctures and connections integrated in to textiles for access and supply of power to electronic components.
m. Connections for power and data wires to electronic components and sensors.

Communication with the Technical POC prior to submission of a formal proposal is essential.

Technical POC:

Mr. Maurice Larrivee, TEL: 508-233-4921, maurice.larrivee@natick.army.mil

All concept papers, proposals and administrative inquiries should be submitted to:

U.S. Army Soldier Systems Center
Natick Soldier Center
ATTN: AMSRD-NSC-IP-D/Ms. Heather Parker
Kansas Street
Natick, MA 01760-5019
TEL: 508-233-4929, heather.parker@natick.army.mil

2. High Performance Bi/Tri-component Fibers.

Bi/tri-component fibers can be defined as "individual fibers composed of two/three polymers of different chemical and/or physical properties extruded from the same spinneret, with various cross sectional geometries." Bi/tri-component fiber cross sectional geometries which include side-by-side, sheath/core, islands in the sea and segmented pie morphologies can be utilized to develop lighter, reactive/responsive fabrics that will make the wearer safer, more comfortable and higher performing. Bi/tri-component fibers can also be used in applications besides clothing, including soft shelters, parachutes, vehicles and numerous other textile applications. Most commercial bi/tri-component fibers are used in commodity applications such as carpeting, automobile interior fabrics and filters. There has been very little work done in high performance or multi-functional fibers where specialty polymers (conducting, transparent, high strength, etc.) are co-extruded with metals, nanoparticles, optically active materials, etc., to make novel fibers and textiles with combinations of physical, chemical, optical, and/or electronic properties never seen before. The Natick Soldier Research, Development & Engineering Center (NSRDEC) has acquired a bi/tri-component fiber extruder for processing thermoplastic materials that will be available for novel fiber research and development projects.

Scientific and Technological Areas of Interest:

There is a need for research and development of novel fibers to create woven and nonwoven textiles for warfighter and first responder protection and sustainment. Specifically, novel optical, high strength, electronic, flame resistant and reactive (chemical, biological) fibers are of interest. Novel optical fiber research and development could involve efforts related to the creation of fibers for friend vs. foe identification, optical communication systems, and optical sensing. High strength fiber R&D should relate to the creation of melt processable fibers for soft and rigid armor, transparent fiber reinforced composites for transparent armor or structural composites for load carriage, shelters, or other Soldier System applications. Investigation of nanofibers produced through islands-in-the-sea technology for high strength, impact resistant composites is of interest. Electronic fibers for use in, for example, electrotextiles should be melt processable, conducting, shielded and durable. There is specific interest in developing a flame resistant elastomeric fiber that can be woven into an undergarment and wicks away moisture. Reactive fibers could change chemically or physically to perform certain functions. An example of a physical change would be a fiber that coils or stretches in response to temperature changes. Chemically or biologically reactive fibers could sense and/or decontaminate chemical or biological hazards. It is conceivable to make fibers that combine several of the desired characteristics. For instance, a transparent fiber with the appropriate additives could sense and react to a chemical or physical change by sending an electronic message to the heads up display of the user,

advising the user of a hazardous situation. In addition to the fabrication of new bi/tri-component fibers, research efforts are needed to explore more fundamental issues such as delamination of the different polymers that could be used in the fiber, the use of compatibilizing additives and polymers, the dispersion of additives in the various polymers of the fiber, and the use of "migrating" additives to modify desired areas of the fiber. In addition, there is interest in devising new cross-sectional geometries that will enable or improve the performance of bi/tri-component fibers for specific applications.

Communication with the Technical POCs prior to submission of a formal proposal is essential.

Technical POCs:

Ms. Jean Herbert, TEL: 508-233-4405, jean.herbert@natick.army.mil
Dr. Michael Sennett, TEL: 508-233-5516, michael.sennett@natick.army.mil
Ms. Betty Ann Welsh, TEL: 508-233-4662, elizabeth.welsh(o).natick.armv.mil

All concept papers, proposals and administrative inquiries should be submitted to:

U.S. Army Soldier Systems Center
Natick Soldier Research, Development & Engineering Center
Kansas Street
Natick, MA 01760-5020
Attn: Gail Bernheart
TEL: 508-233-4706, gail.bernheart@natick.army.mil

G. MODELING AND SIMULATION.

1. Individual and Small Unit Performance and Survivability.

Ballistic, chemical, and environmental casualty assessment models plus unit performance models have been used to show the relative benefit of one proposed technology versus another. Initial work has been accomplished to support the integrated analytic simulation of individuals and small units to assess their potential survival and performance when equipped with current or proposed individual combatant clothing and equipment ensembles. Work has been accomplished to link this integrated analytic environment to other analytic and training simulations using both Distributed Interactive Simulation (DIS) protocols (IEEE Standard 1278.1) and DoD High Level Architecture (HLA) approaches. The resulting integrated analytic simulation environment is the Infantry Warrior Simulation (IWARS). The IWARS currently provides simulation of various casualty mechanisms such as ballistic and environmental hazards as well as providing simulation of operations at the individual and small unitlevel and their equipment.

Scientific and Technical Areas of Interest:

A review of the existing models and simulations has revealed the following areas of continuing scientific and technical interest:

a. Development of a methodology and model to simulate the effects of battlefield stresses, such as physical exertion, sleep deprivation and heat stress on infantry task performance.

b. Development of a methodology and model to simulate the target detection, recognition, identification and acquisition process under various lighting and operational conditions.

c. Support the linkage of live, virtual, and constructive simulations. Develop capabilities to link IWARS with other models and simulations. Extend IWARS to allow for human-in-the-loop operations..

d. Development of a capability to simulate communications and information transfer and the resulting impacts on individual situational awareness and small unit operations within the IWARS; including a wide range of modes of information transfer, information elements, sensors, information technologies and network systems..

e. Enhancement of the IWARS and associated supporting models to support automated communications with other standard U. S. Army and NATO analytic simulations and war games such as COMBAT XXI, OneSAF, and CAEn.

f. Enhancement of the IWARS and associated supporting models to allow user to parametrically analyze capability.

g. Technological assets which would result in a full Soldier Systems Integration Laboratory capability, that would allow full assessment of fightability under controlled laboratory situations.

h. Tools and capabilities, especially in the studies and analysis area, that allow simulation of the full spectrum of missions ranging from peacekeeping to combat.

i. Enhancement of Human Behavior and Human System Representation within constructive combat simulations primarily used for assessment of equipment capabilities to provide improved battle command, situational awareness and situational understanding to support data fusion and decision-making, plus the effects of encumbrances and equipment characteristics on performance.

j. Compilation, synthesis, and analysis of empirical data collected during field experiments and training exercises that quantitatively and qualitatively describe how Soldiers move, shoot, communicate, sense and perceive, and decide during close combat and military operations in urban terrain (MOUT). These data can be used for IWARS algorithm development and the data table population.

k. Enhancement and generation of terrain databases that support the modeling of IWARS infantry behaviors and support linkages with other models such as Combat XXI and OneSAF

1. Application of the IWARS to support the application of Simulation and Modeling for Acquisition, Requirements and Training (SMART) and Simulation-Based Acquisition (SBA) to reduce the overall acquisition time, avoid program costs, reduce program risk, support development of better equipment, and to provide needed feedback to the NSRDEC personnel involved in tool development.

m. Development of methodologies and models to represent the effects of behavior and equipment on lethality, survivability, sustainability, mobility, and Command and Control.

Communication with the Technical POC prior to submission of a formal proposal is essential.

Technical POC:
Mr. Roger A. Schleper, TEL: 508-233-6265 roger.schleper@natick.army.mil

All concept papers, proposals and administrative inquiries should be submitted to:

U.S. Army Soldier Systems Center
Natick Soldier Research, Development and Engineering Center
ATTN: AMSRD-NSC-IP-D (Ms. Heather Parker)
Kansas Street
Natick, MA 01760-5019

TEL: 508-233-4929, heather.parker@natick.army.mil

2. Wargaming Concept and Tool Development.

The execution of wargames through the use of models and simulations enables the validation and assessment of the combat worth of warfighter systems and subsystems. These exercises permit the conduct of integrated, multi-domain analyses that allow the complex relationships between warfighters, their equipment, and the battlefield environment to be explored. The implementation of network-centric warfare can provide a distinct warfighting advantage through the development of a common operating picture and an increased level of situational awareness and cognitive understanding of tactical and operational situations. The combination of emerging tactics, techniques, and procedures that a networked joint force can employ allow the full exploitation of the highly path-dependent nature of information warfare from the battalion to small unit level. The cooperative use of models in wargaming, such as the Joint Effects Model (JEM), and the Infantry Warrior Simulation (IWARS), allows for the assessment of survival and performance as they apply to fixed-sites and maneuver units within a simulated environment.

Scientific and Technical Areas of Interest:

A review of the existing models and simulations related to wargaming has revealed the following areas of continuing scientific and technical interest:

a. Analyses of operational concepts, military strategy and doctrine as they pertain to wargaming and wargaming objectives.

b. Integration of simulation models for use in wargaming exercises.

c. Development of wargame scenarios for the assessment of battlefield operations and equipment.

d. Enhancement of the IWARS to permit integration of input/output with live, virtual, and constructive training events in order to optimize readiness levels and evaluate training.

Communication with the Technical POC prior to submission of a formal proposal is essential.

Technical POC:
Mr. Roger A. Schleper, TEL: 508-233-6265 roger.schleper@natick.army.mil

All concept papers, proposals and administrative inquiries should be submitted to:

U.S. Army Soldier Systems Center
Natick Soldier Research, Development and Engineering Center
ATTN: AMSRD-NSC-IP-D (Ms. Heather Parker)
Kansas Street
Natick, MA 01760-5019
TEL: 508-233-4929, heather.parker@natick.army.mil

H. NEUROEPIDEMIOLOGY.

Epidemiological field research methodology and improvements in the assessment and early detection of adverse neurological health and performance risks are critical for protection of Soldiers' health. The primary goal of the research program is to apply epidemiological field study methodologies to identify and better understand the adverse neurological health and performance risks associated with deployment operations and military service in general. Areas of study to be addressed include: feasible biomarker(s) of acute, chronic, and cumulative exposures to neurotoxicants present in the military occupational environment, field-tested techniques for the assessment of exposure to neurotoxicants (particularly chronic exposures), neurocognitive outcomes assessment, neurophysiologic markers of early effect, and long-term neurological health consequences of deployment and military service.

Communication with the Technical POC prior to submission of a formal proposal is essential.

Technical POC:

Dr. Susan Proctor, TEL: 508-233-4465, susan.proctor@us.army.mil

All concept papers, proposals, and administrative inquiries should be submitted to:

U.S. Army Research Institute of Environmental Medicine
ATTN: MCMR-EMR-BP (Mr. Jeff Evans)
Kansas Street, Bldg 42
Natick, MA 01760-5007
TEL 508-233-5135, jeffrey.c.evans@us.army.mil

I. NATIONAL PROTECTION CENTER

The National Protection Center (NPC) is the Natick Soldier Research, Development and Engineering Center's (NSRDEC) focal point for Homeland Defense and Homeland Security related dual-use RDT&E coordination, inter-agency collaboration, and project management/oversight. Through the NPC, the NSRDEC is responsive to DOD requirements to support the RDT&E needs of homeland defense and emergency responders, consistent with PL 107-314, section 1401 and a number of other inter-governmental RDT&E agreements. Because Homeland Defense and Security professionals share a significant number of research and development interests and needs, NSRDEC promotes dual-use RDT&E activities that offer alternative human protection and operational support, sustainment, and survivability for Homeland Security Operations against conventional and emerging threats. The NSRDEC's focus on Human-Centered Integrated Protection, integrated systems, and field sustainment programs attract high interest from users and operators from a wide range of disciplines and agencies nationwide. While fostering dual-use and interagency collaboration, there is a concurrent need to further understand how military-driven concepts and technologies apply to the broader context of homeland defense and homeland security operations. NSRDEC's NPC is focused on understanding the similarities and differences between operators, and evaluating the operational environment in order to effect proper coordination, oversight and implementation of DOD Homeland Defense and Homeland Security (HLD/S) and Technology Transfer directives through its numerous activities.

The establishment of the Department of Homeland Security and transformation of military doctrine and tactics to support multiple theater operations and environments (disaster relief, homeland focused national security, international conflict in urban environments, peace keeping operations, etc.), and high public awareness of these activities, further increases the interest on dual-use applications of concepts, doctrine and technology. Through the NPC, the NSRDEC, in alliance with the National Institute of Justice, Office of Science and Technology, National Aeronautics and Space Agency (NASA), the Department of Homeland Security, the National Institute for Standards and Technology/Office of Law Enforcement Standards and other agencies, fund and foster inter -agency projects. Capitalizing on NSRDEC's and its allied partners core competencies, program activities include a number of RDT&E and technology transfer activities: gaps analysis; technology prioritization and planning; development of cross-cutting requirements; development of concepts of operation and use; sharing of intellectual and physical resources; evaluation of multi-user requirements and interagency operating procedures; equipment standardization/standards analysis; doctrine analysis; technology vetting; Commercial and Government Off-the-Shelf (CoT/GoTs) assessment; implementation of best business practices; and RDT&E program execution where gaps have been identified.

The NPC oversees vetting practices, serves as multi-agency Senior Advisor, and provides Subject Matter Expertise supporting technology transfer of advanced protective technologies, integrated systems, collective protection, austere environment life support systems (shelter, feeding, command post, etc.), and personal sustainment (water, food, and feeding technology) for HLD/S operations. This is accomplished by a multitude of activities that include but are not limited to:

a. Technology Transfer. Facilitate the assessment, vetting and transfer of technology - government to government, government to industry, industry to government, academia to industry, and so forth. This goal will be achieved through multiple vehicles, partnership/leveraging and other mechanisms.

b. Prioritizing, Managing and Funding Research, Development, Test and Evaluation (RDT&E) of individual or integrated personal protective materials or systems, as Activities support multi-agency/team project management and execution on behalf of the funding agency or organization. This includes cross-cutting requirement and gaps analysis

c. Human Systems Integration. Augment NSRDEC's ability to maintain a capability and expertise in systems integration, as it would pertain to treating the Homeland Defender and/or other human operational platforms as a system under conventional and non- conventional HLD/S Operations..

d. Conduct Technology Assessments: Analysis in subject areas (e.g. ballistic protection) from the standpoint of deficiencies in standards, requirements, doctrine and technology and/or equipment both in the military and commercial sector, and make recommendations to overcome these deficiencies. These assessments can then be used as the input for R&D of dual-use Homeland Defense/Security personal protective clothing, equipment and integrated system proposals or projects.

e. Market Analysis. Prior to conducting R&D on a technology or product development, conduct dual-use market analysis to determine the potential for the development to meet the customer's needs and/or to become a commercial success and to identify potential industry and academia participants.

f. Product Test and Evaluation. Participate in standards analysis and development. Products may be tested and evaluated under specific user operational scenarios to assure the capabilities are consistent with the needs of the user, to provide the requisite levels of protection and operational effectiveness, and to evaluate them in non-conventional applications, perhaps revealing new commercial applications/markets. This will include the analysis of applicable standards that have an impact on national homeland security operations funded procurements, and providing recommendations where gaps exist.

g. Network Services. The NPC serves as a network agent to match capabilities and sources from government, industry an academia. Activities will support this function, consistent with statutory guidelines, and will enhance NSRDEC's ability to understand market demands and trends.

h. Customer Support. Provide assistance in maintaining a capability to respond to customer's needs in terms of field problems encountered with protective equipment.

i. Conferences. The Center will sponsor and conduct conferences and symposia on subject matters fitting into the scope of the NSRDEC as outlined above,

within the context of statutory guidelines.

Specific Areas of Interest:

a. Proposals that address the process of improving public-private partnerships.

b. Proposals that provide approaches to identifying and addressing gaps and needs of the HLD/S operator. Where applicable and feasible, proposals should include data that supports how the need was identified and what the market niche/field issue to be solved would be.

c. Proposals that address potential areas of study, technology vetting procedures, interagency business practices, end item analysis, and development based on integrated concepts with high dual-use applicability.

d. Proposals that address product or process improvement.

e. Proposals that address market analysis, manufacturability, lifecycle management, etc. relevant to the transfer, adoption, implementation and use of the given technology or system of interest.

(These projects must be unique in nature (not proposed under other project areas), of high dual use value with the ability to span a multi-user base and that encourage/maximize public-private partnerships and academia participation. A path to transition the proposed work to commercialization must be part of the proposal. Affordability of end items or cost effectiveness of basic studies should be inherent in the proposals.)

Communications with the U.S. Army Natick Soldier Research, Development and Engineering Center NPC Team prior to submission of formal proposal is essential.

TECHNICAL POC:

Mr. David Carney, National Protection Center Program Office/Operations, Tel. (508) 233-5831, david.carney@natick.army.mil

All proposals and administrative inquiries should be submitted to:

U.S. Army Soldier Center
Natick Soldier Center
ATTN: AMSRD-IP-D/Ms. Heather Parker
Kansas Street
Natick, MA 01760-5019
508-233-4929, heather.parker@natick.army.mil

J. ROBOTICS AND ADVANCED TECHNOLOGY.

1. Small Unmanned System Technology.

Unmanned aerial vehicle (UAV) technology has had a dramatic impact on the battlefield in recent years, permitting commanders and individual warfighters to understand and develop a situation before making contact, maneuver largely out of contact, and only then, initiate decisive action, bringing all inherent capabilities to bear with accuracy and lethality. The ability to collect and disseminate real-time battlespace information is a critical need. Uncertainty about hostile and friendly conditions on the battlefield dictates cautious movement and a requirement for response options to any number of contingencies, with resulting expenditure of time and resources. This is often followed by initiation of action at times and places not of the commander's choosing.

Likewise, the technological advances of Unmanned Ground Vehicle Systems (UGVS) have matured significantly during the Global War on Terror. As UGVS technical maturity has risen, so has acceptance of these technologies by the Warfighter.

Effort is underway to develop and integrate technologies addressing the following:

- A more efficient and effective use of available bandwidth appropriate to a 2-10 pound Small Unmanned Aerial System (SUAS) or man portable UGVS.
- A greatly improved ability to detect and identify potential battlefield threats.
- The ability to engage those threats with organic and precision indirect fires.
- The ability to conduct SUAS and/or UGVSS missions with higher reliability, minimized size/weight, and/or maximized range/endurance.
- The tools to train effectively, maintain proficiency, and evolve tactics, techniques and procedures.

Scientific and Technical Areas of Interest:

Concept papers and proposals are requested in the following areas and are not necessarily limited to the specific areas of interest indicated:

a. Payloads for integration: imaging, image processing, acoustic, targeting, chemical, etc.

b. Targeting: image processing, differential GPS, etc.

c. Command, control and communications (C3): digital links, communications networks/protocols, relays, encryption, non-line of sight reliability, etc.

d. Platform technology: miniaturized avionics, improved propulsion, pocket sized platforms, improved power sources, fuel engines, improved Soldier portability, etc.

e. Simulation and training: battlespace simulation, hardware in-the-loop trainer, etc.

Additionally, technology candidates must exhibit the following characteristics:

a. Technical readiness level of 5-7.

b. Stand-alone system requiring no large residuals such as HMMWVs or other vehicle/infrastructure for support.

c. Minimized weight, volume, manpower requirements, and power consumption for either subcomponents suitable for integration into existing platforms or newly proposed systems/platforms.

The development timeframe for this effort is January 2007 through September 2010.

Communication with the technical POC prior to submission of a formal proposal is essential.

TECHNICAL POC:

Andrew J. Mawn III, TEL: 508-233-4262, andrew.mawn@natick.army.mil

All concept papers should be submitted to:

U.S. Army Soldier Systems Center
Natick Soldier Research, Development and Engineering Center
Attn: AMSRD-NSC-TP-A (A. Rocco Olean)
Kansas Street
Natick, MA 01760-5060
508-233-6466, adam.rocco.olean@natick.army.mil

All proposals and administrative inquiries should be submitted to:

U.S. Army Soldier Center
Natick Soldier Research, Development and Engineering Center
ATTN: AMSRD-NSC-D (Ma. Heather Parker)
Kansas Street
Natick, MA 01760-5019
508-233-4929, heather.parker@natick.army.mil

2. Individual Warrior Technology

Operational capability gap analysis has indicated that the following technical areas warrant research and development efforts.

a. Individual cultural integration/interaction to include:

- language translation
- Medical Support
- Interrogation / Information collection/dissemination aids in coalition efforts
- Individual collaborative tools for coalition efforts

b. Internal tactical communications and control for teams, for both close-in and distributed teams to include internal collaborative tools, displays, etc.

c. Maintain situational awareness to both blue force and red force status (location, intent, capabilities, etc.) internal and external to team/squad/platoon.

d. Ability to locate, mark, illuminate and designate targets from extended ranges without detection.

e. Move, dismounted, over open terrain, natural and man-made obstacles, with large loads (100-300 lbs), without leaving a visible signature behind.

f. Individual power providing high energy density, and high current density.

g. Navigate to and from objectives in high threat areas without being detected, in all conditions of visibility.

h. Protect against improvised explosive devices, kinetic weapons, and fragmentation devices.

Communication with the technical POC prior to submission of a formal proposal is essential.

TECHNICAL POC:

Andrew J. Mawn III, TEL: 508-233-4262, andrew.mawn@natick.army.mil

All concept papers should be submitted to:

U.S. Army Soldier Systems Center
Natick Soldier Research, Development and Engineering Center
Arm: AMSRD-NSC-TP-A (A. Rocco Olean)
Kansas Street
Natick, MA 01760-5056
508-233-6466, adam.rocco.olean@natick.army.mil

All proposals and administrative inquiries should be submitted to:

U.S. Army Soldier Center
Natick Soldier Research, Development and Engineering Center
ATTN: AMSRD-NSC-IP-D (Ms. Heather Parker)
Kansas Street
Natick, MA 01760-5019
508-233-4929, heather.parker@natick.army.mil