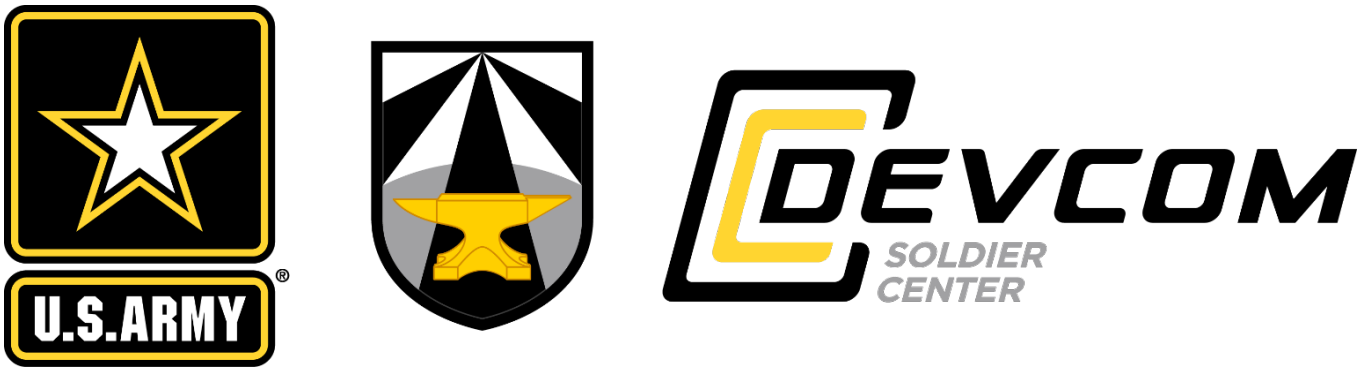
U.S. ARMY COMBAT CAPABILITIES DEVELOPMENT COMMAND SOLDIER CENTER



BROAD AGENCY ANNOUNCEMENT (BAA) FOR BASIC AND APPLIED RESEARCH

Solicitation Number W911QY-20-R-0022

Effective from 29 February 2020 - 28 February 2025

"THE LEADER IN EMPOWERING THE WORLD'S MOST CAPABLE SOLDIERS"

TABLE OF CONTENTS

Contents

SECTION I - INTRODUCTION

The mission of the U.S. Army Combat Capabilities Development Command Soldier Center (CCDC Soldier Center) is to "Maximize the Warfighter's Survivability, Sustainability, Mobility, Combat Effectiveness and Field Quality of Life by Treating the Warfighter as a System".

Our focus is to deliver world class research, development, systems engineering, and services with a unique human-centric focus by:

- cultivating a highly motivated, expert, and agile workforce;
- exceeding customer and stakeholder expectations;
- delivering what we promise at an unprecedented pace and honoring our commitments;
- fostering long term strategic partnerships and collaborations with key customers, other Government agencies, industry, and academia.

By treating the Soldier as a system, we strive to EMPOWER, UNBURDEN, and PROTECT the Soldier to be comparable to other decisive weapon systems. The Soldier operates primarily within a small unit. Therefore, we focus on both the individual and his/her tactical environment including his/her unit.

Our goal is to provide the American Warfighter the best equipment for the best price through research, development and engineering in the areas of:

- Combat Feeding Equipment and Systems;
- Combat Ration Research and Development (R&D);
- Warfighter Systems Technologies;
- Shelters and Life Support technologies for Contingency Basing;
- Airdrop - Advanced Personnel and Cargo Airdrop Systems;
- Textile Technologies;
- Modeling and Simulation;
- Neuroepidemiology;
- Warfighter Advanced Technologies.
- Technology Enabled Capability Demonstrations

We are deeply committed to making all our service members the best clothed, equipped, sheltered, and fed in the world.

This Broad Agency Announcement (BAA) is intended to fulfill requirements for scientific study and experimentation directed toward advancing state-of-the-art technologies and/or increasing knowledge and understanding as a means of eliminating current technology barriers. This BAA DOES NOT focus on specific systems or hardware solutions. *This BAA identifies CCDC SOLDIER CENTER research/exploratory development areas of*

interest and provides prospective offerors information on the preparation of proposals along with proposal evaluation factors. The Government may award purchase orders, contracts, grants, cooperative agreements, or other transactions against this BAA.

Please note that, typically, research resulting from work executed under this BAA leads to an additional requirement for services being provided by the applicable contractor in support of operational experiments to evaluate the measures of merit and performance enhancement capability to the Warfighters. However, it is not possible at the time of release of this announcement, or at the time of contract award, to accurately anticipate if these services will be required nor is it possible to anticipate the level of effort required. In addition, the technology explored under this BAA typically has application across the various branches of the Department of Defense (DoD). In order to satisfy the unique needs of these different branches and to ensure a proper job is done in the evaluation of the applicable technology, contract modifications which add new Contract Line Item Numbers (CLINs) and/or expand on current CLINs for services providing flexibility in technology assessment (with technology transition as the ultimate goal) may be executed. In the event that this is required, it shall be considered to be within the scope of this BAA and the resulting contract, and, therefore, will have met the requirements of the Federal Acquisition Regulation (FAR), DoD FAR Supplement (DFARS), and the Competition in Contracting Act. The benefit of this flexibility to the Government and ultimately the taxpayer is a significant increase in the R&D return on investment. The flexibility to have multiple users (branches of the military) in the technology evaluation cycle is absolutely critical and allows systems and technologies to be developed in a manner that has broader DoD market applications. These can then be modularly reconfigured to meet goals and objectives for all DoDservices.

SECTION II – CONCEPT PAPERS AND PROPOSALS

WHO MAY SUBMIT

The CCDC Soldier Center will consider concept papers and proposals based on this BAA from the following organizations and firms interested in conducting scientific research:

- degree-granting colleges and universities,
- nonprofit research institutes,
- foreign organizations, and
- commercial firms (including Large Businesses, Small Businesses, Small Disadvantaged Businesses, Women-Owned Small Businesses, Historically Underutilized Business Zone Small Businesses, Veteran-Owned Small Businesses, and Service-Disabled Veteran-Owned Small Businesses.

Proposals from government facilities and organizations WILL NOT be considered under this program announcement. Offerors are cautioned that only a duly appointed Contracting Officer or Grants Officer acting within the scope and limits of his/her authority may obligate the Government to the expenditure of funds.

Small Businesses (SB), Small Disadvantaged Businesses (SDB), Women-Owned Small Businesses (WOSB), Historically Underutilized Business Zone (HUBZone) Small Businesses, Veteran-Owned Small Businesses (VOSB), Service-Disabled Veteran-Owned Small Businesses (SDVOSB), Historically Black Colleges and Universities (HBCUs) and Minority Institutions (MIs): Although no portion of this BAA has been set aside for SBs, SDBs, SDVOSBs, HUBZones, HBCUs, or MIs, their participation is highly encouraged. For any topic areas (see Section VI) where sufficient quality proposals are received that demonstrate that a set-aside would be appropriate, CCDC Soldier Center will consider doing so and modifying this BAA accordingly. Therefore, all above named business types are encouraged to submit proposals under any topic that they feel they are highly qualified to perform.

The applicable North American Industry Classification System (NAICS) code for the majority of work submitted under this BAA will be either 541713 (Research and Development in Nanotechnology); 541714 (Research and Development in Biotechnology (Except Nanobiotechnology); 541715 (Research and Development in the Physical, Engineering, and Life Sciences (Except Nanotechnology and Biotechnology)) or 541720 (Research and Development in the Social Sciences and Humanities). NAICS 541713, 541714 and 541715 have a small business size standard of 1,000 employees while 541720 has a size standard of $20,500,000 in annual receipts.

To be eligible for award, a prospective recipient must be able to demonstrate sufficient financial and technical resources and must meet certain minimum standards pertaining to

financial resources, ability to comply with the performance schedule, prior record of performance, integrity, organization, experience, operational controls, technical skills, facilities and equipment. (See FAR9.405)

WHEN TO SUBMIT

This BAA shall remain in effect until 28 February 2025 unless superseded, extended or canceled. Concept papers will be accepted until the close of business on 28 February 2025. Proposals may be submitted at any time after the concept paper has been approved and until the BAA closing date of 28 February 2025. Awards against this BAA may be made until 30 June 2025.

The Offeror agrees that if its offer is accepted by the Government, it shall, as specified in the proposal and within ninety (90) calendar days from the date of the proposal, agree to furnish any or all items upon which prices are offered at the price set opposite each item, delivered at the designated point(s), and within the time specified in the proposal schedule. At times, the Government may contact an Offeror after the ninety (90) day period about a proposal it would like to bring to award. This will occur when a shortage of funds exists during the initial ninety (90) day period. If this does occur, the Offeror reserves the right to accept or decline the offer and may also submit a revised proposal with any necessary price/schedule changes, though the technical merit must remain the same.

WHERE TO SUBMIT

Concept papers, proposals and inquires shall be submitted to the electronic or physical mail address indicated under each scientific and technical area of interest cited in Section VI herein. Electronic mail submissions may provide a standard electronic signature or a written signature on the cover page of the submission. Facsimile submission is normally not an authorized means for the delivery of such documents. The contractor MUST receive prior approval from the applicable point of contact (POC) for facsimile submissions.

BAA PROCESS

In an effort to minimize proposal preparation costs, this BAA will utilize a two-step process. Step one will be the offeror's submission of a concept paper. This step will preclude unwarranted effort on the part of an offeror whose proposed technology/capability or product is not of interest to the Government. Those offerors whose concept papers are found to be consistent with the intent of the BAA and which are of interest to the Government will be invited to submit a proposal (step two).

Communication with the technical points of contact (POCs) identified in Section VI "Scientific and Technical Areas of Interest" (as well as the POCs listed in Section V – Safety and Human Systems Integration Requirements) is essential in tailoring responses to the specific needs of CCDC Soldier Center. This preliminary communication is especially important because once

the formal proposal is submitted as instructed in the specific Scientific and Technical Area of Interest listed in Section VI, no further communication between the proposed contractor and the Government technical POC is allowed.

Requests for or offers of conference or symposium support, consultant services, engineering and/or marketing services, and/or training support will not be considered under this announcement. **Only concepts for research/exploratory development will be considered.**

Offerors should not submit a proposal until selected Government personnel have reviewed the concept paper and the contractor has been invited to submit a formal proposal by Government personnel.

a. Concept Paper Submission: If the Offeror has a novel research approach within an area of interest covered by this BAA, the Offeror should prepare a BAA concept paper. Concept papers should be submitted electronically to the technical POC listed in each area of interest in Section VI. Concept papers may not exceed 5 single-sided 8 ½ x 11 inch typed pages (including charts, graphs, photographs, etc.) and shall include the following:

   (1) A brief technical explanation of the proposed effort that addresses the major research thrust, the research goals and deliverables, a proposed approach to achieve these goals and deliverables, and military relevancy.

   (2) A brief "management" description outlining key personnel and experience.

   (3) Any past performance the contractor has with similar research efforts.

   (4) An estimated cost/price and performance schedule for the work.

Concept papers will be evaluated by the Government within ninety (90) days of receipt.

Once an Offeror has been invited to submit a formal proposal by the specified technical POC, the following process MUST be adhered to by the Offeror.

b. Proposal Submission: Informal exchanges should be held with the technical POC listed under each topical area noted in Section VI herein on any proposed research **BEFORE** the submission of a formal proposal since the BAA is written in such broad terms to cover a wide variety of technical areas.

   The Offeror's technical, management, cost/price, past performance, subcontracting (if applicable)/small business participation, and company certification sections of the proposal shall be submitted in severable sections as set forth below. The proposal package must be valid for at least 90 days from the date of submission. All information pertaining to each section shall be confined to the appropriate part. The sections shall be as brief as possible, consistent with complete submission. Pages should not exceed

8-1/2 inches in width and 11 inches in length; however, fold-out pages depicting such items as sketches, etc., may be used. The proposal will be evaluated in accordance with the process described in Section IV herein. The offeror's proposal package must include the CCDC Soldier Center BAA Proposal Cover Sheet which can be found at the beta.SAM link for W911QY20R0022.

PART I - Technical Section - automated and/or one (1) original
PART II - Management Section - automated and/or one (1) original
PART III - Cost/Price Section - automated and/or one (1) original
PART IV - Past Performance Section - automated and/or one (1) original
PART V - Subcontracting (if applicable) & Small Business Participation automated and/or one (1) original
PART VI - Contractor Representations and Certifications - automated and/or one original
PART VII – Contractor Statement of Work –Word Document File

(1) Part I - Technical Section:

The Offeror is responsible for including sufficient details, without reference to cost/price, to permit a complete and accurate evaluation of the proposal from a strictly technical standpoint. The technical proposal shall be formatted as follows to allow for inclusion of all required/applicable information:

(a) A summary of the objective/purpose of proposed research - what scientific "problem" you intend to resolve, advance the state-of-the-art with respect to, or increase the understanding of.

(b) Identification of product(s) or process(es) which you anticipate will result from this effort. Product(s) may simply be technical data, reports on the feasibility of novel concepts, product samples, etc. Also, address any Human Systems Integration (HSI) formerly MANPRINT, and/or safety requirements or state that no such requirements exist. For specific details and guidance on HSI and safety requirements see Section V herein.

(c) Identification of any potential military and/or civilian applications of the product(s) which may be developed if the work performed under the proposed BAA contract is continued following completion of the proposed contract.

(d) An assessment of the probability for project success.

(e) An explanation of the planned approach, techniques, and/or processes To be used in this effort.

(f) Rationale for the proposed methodology. What, if any, innovative ideas/techniques will be tried? Identify the technical risks in completing this project and the approach taken to overcome these risks. For studies involving human subjects, describe recruitment plan and access to populations. The proposal/application should describe a plan for data access. (Access to subjects and data is the sole responsibility of the investigator.) As relevant, describe plans for addressing issues unique to working with military populations. If human and/or animal subjects are included in the research, proposals/ applications may be submitted without human and/or animal use protocols and institutional approvals. However, protocols with required institutional approvals must be submitted no later than 60 days after award to demonstrate continued progress and ensure continuation of payment. The Contracting or Grants Officer may make exceptions in situations where human and/or animal use is not expected to begin until after the first year of the research project. In such cases, a timeframe for submission of the appropriate protocols and institutional approvals will be established prior to award. PIs and collaborating

organizations may not use, employ, or subcontract for the use of any human participants, including the use of human anatomical substances, human data, and/or human cadavers, or laboratory animals until applicable regulatory documents are approved by the Army Human Research Protections Office (AHRPO) to ensure that DoD regulations have been met. Allow at least 2 to 3 months for regulatory review and approval.

(g) Any planned interactions with CCDC Soldier Center (to include a request for a post award conference if the contractor so desires) required during the performance of proposed contract.

(h) Any planned collaborative arrangements with other parties (including subcontractors and/or consultants) for the effort. Identify the responsibilities and contributions of these parties in completing the intended deliverables. If the Offeror is an academic institution, provide details of planned interactions with industry (if applicable) and letters from the industries in which they commit themselves to support the effort.

(i) A detailed list and description of all deliverables including data the Offeror proposes to provide to the Government, the schedule for delivery, and acceptance criteria. Proposals must include a severable, self-standing, detailed list and description of all deliverables without any proprietary restrictions which can be used to make award.

(j) A schedule containing milestones for the performance of the proposed effort.

(k) Detailed Risk Mitigation Plan: Discuss in detail the technical, cost and schedule risks involved with the project and how each risk will be mitigated by the Offeror.

(2) Part II - Management Section:

The management section of the proposal shall include the following for the Offeror and any collaborators identified in Part I:

(a) Resumes (or some portion of such) of technical personnel detailing education, experience, and technical expertise proposed for this effort and the percentage of time expected to be devoted to this project.
Note: Resumes should reflect and emphasize the qualifications and experience as related to the execution of the proposed tasks.

(b) Organization of the Offeror's firm.

(c) Facilities and equipment available for the proposed effort.

(d) Project management systems and controls to be utilized by the Offeror. Include tools, systems and procedures that will be used during execution of the proposed tasks. (i .e. task tracking, management tools, etc.)

(3) Part III - Cost/Price Section:

The Cost Proposal Spreadsheet can be found by following beta.SAM Solicitation link at W911QY20R0022.the Click on the "proposal spreadsheet" link and save a copy of the spreadsheet. Instructions for completion have been embedded into the spreadsheet. Any proposed options that are identified in the Technical Proposal but are not fully priced out in the Cost Proposal Spreadsheet will not be included in any resulting contract or other transaction. If proposing options, they **must** be separately priced and separate spreadsheets should be provided for the base period and each option period. In addition to providing summary by period of performance (base and any options), the Contractor is also responsible for providing a breakdown of cost for each task identified in the Statement of Work. The sum of all costs by task worksheets MUST equal the total cost summary.

For proposed subcontracts over $250,000, Offerors must provide a separate fully completed Cost Proposal Spreadsheet in support of the proposed costs. This spreadsheet, along with supporting documentation, must be provided either in a sealed envelope with the prime's proposal or via email directly CCDC Soldier Center as instructed in the specific Scientific and Technical Area of Interest listed in Section VI at the same time the prime proposal is submitted. The e-mail shall identify the proposal title, the prime Offeror and that the attached proposal is a subcontract, and should include a description of the effort to be performed by the subcontractor.

Offers should also familiarize themselves with the new subcontract reporting requirements set forth in Federal Acquisition Regulations (FAR) clause 52.204-10, Reporting Executive Compensation and First-Tier Subcontract Awards. The pertinent requirements can be found in Section III, Additional Information about Proposal Submissions.

The secure pdf-compatible format is intended to prevent unauthorized editing of the proposal prior to any award. A password should not be required for opening the proposal document, but the government must have the ability to print and copy text, images, and other content.

The electronic submission of the Excel spreadsheet should be in a "useable condition" to aid the Government with its evaluation. The term "useable condition" indicates that the spreadsheet should visibly include and separately identify within each appropriate cell any and all inputs, formulas, calculations, etc. The Offeror should not provide "value only spreadsheets" similar to a hard copy.

(4) Part IV - Past Performance Section:

(a) Information should be submitted for all proposed first-tier subcontractors with whom the Offeror is teaming, as well as for the Offeror itself.

(b) The Offeror should submit past performance information on any contracts (as a prime or subcontractor) it worked on during the previous three (3) years which are relevant to the efforts required by this solicitation. In addition, any and all contracts terminated in whole or part during the previous five (5) years, including those currently in the process of such termination, are considered relevant and the Offeror shall provide past performance information for those contracts. The following information should be included:

- Role as prime or subcontractor
- If from past Government contract, the contracting activity name; address; and the contracting officer's name, telephone number and email address
- Contract type
- Awarded cost/price
- Final, or projected final, cost/price
- Original delivery schedule
- Final, or projected final, delivery schedule

(c) For each of the contracts described in the past performance section of the Offeror's proposal, a description of the objectives achieved, detailing how the effort is similar to the requirements of this solicitation, shall be included. For any contracts that did not/do not meet the original requirements with regard to original cost/price, schedule, or technical performance, the Offeror should provide a brief explanation of the reason(s) for such shortcomings and any demonstrated corrective actions taken to avoid recurrence. For any terminated contracts, the Offeror shall indicate the termination type and reasons.

(5) Part V – Subcontracting & Small Business Participation

(a) Subcontracting Plans (if applicable)

The US Army CCDC Soldier Center is strongly committed to providing meaningful subcontracting opportunities for Small Businesses (SB), Small Disadvantaged Businesses (SDB), Women-Owned Small Businesses (WOSB), Historically Underutilized Business Zone (HUBZone) Small Businesses, Veteran-Owned Small Businesses (VOSB), Service Disabled Veteran-Owned Small Businesses (SDVOSB), Historically Black Colleges and Universities/Minority Institutions (HBCU/MI), and other socioeconomic considerations through its awards.

Pursuant to Section 8(d) of the Small Business Act (15 U.S.C. 631(a)), it is the policy of the Government to enable SB, SDB, WOSB, HUBZone, VOSB, and SDVOSB concerns to be considered fairly as subcontractors to contractors performing work under Government contracts and to ensure that prime contractors and subcontractors carry out this policy. Offerors, other than small businesses, seeking an award of greater than $700,000, are required to submit a subcontracting plan IAW FAR 19.702, 19.703, and 19.704 as part of their proposal. The plan format is outlined in FAR 19.704. A sample Small Business Subcontracting Plan template is provided at the beta.SAM link for W911QY20R0022.

Subcontracting plans will be reviewed for adherence to applicable public laws and regulations cited in FAR Part 19 and its supplements. An offeror's refusal to submit an acceptable subcontracting plan is grounds for the Government to not negotiate award of that offeror's BAA proposal.

(b) Small Business Participation Plan

Separate from the Subcontracting Plan, ALL prime offerors, regardless of size, shall submit a Small Business Participation Plan in accordance with DFARS 215.304. All offerors shall provide a statement of the extent of the offeror's commitment to small business participation through its awards and must agree that SB, SDB, WOSB, HUBZone, VOSB, and SDVOSB concerns will have the maximum practicable opportunity to participate in contract performance consistent with its efficient performance. A Small Business Participation Plan template is provided at the beta.SAM link for W911QY20R0022.

NOTE: Small Business offerors may meet the requirement using work they perform themselves. This assertion will be reviewed to ensure that it supports this policy by providing meaningful subcontracting opportunities.

(6) Part VI - Contractor Representations and Certifications:

Offeror's are required to complete the annual representations and certificates in the System for Award Management (SAM) at: https://www.sam.gov/portal/public/SAM and should note in part VI of their proposal what their Dun and Bradstreet Data Universal Numbering System (DUNS) number is and the fact that they are in SAM.

Note: The applicable North American Industry Classification System (NAICS) code for the majority of work submitted under this BAA will be either 541713 (Research and Development in Nanotechnology); 541714 (Research and Development in Biotechnology (Except Nanobiotechnology); 541715 (Research and Development in the Physical, Engineering, and Life Sciences (Except Nanotechnology and Biotechnology)) or 541720 (Research and Development in the Social Sciences and Humanities). NAICS 541713, 541714 and 541715 have a small business size standard of 1,000 employees while 541720 has a size standard of $20,500,000 in annual receipts. DFARS Representations and Certifications and Certifications for Grants and Agreements are provided at the beta.SAM link for W911QY20R0022.

(7) Part VII - Contractor Statement of Work

The offeror shall provide a stand-alone Statement of Work (SOW) that outlines the specific work to be performed that is supported by the other parts of the offeror's proposal and which will become the contractually binding SOW in the resulting contract. The SOW shall begin with the following language:

"Independently, and not as an agent of the Government, the Contractor shall furnish all necessary services; qualified professional, technical and administrative personnel; material, equipment and facilities not otherwise explicitly described as provided by the Government under the terms of this contract as set forth below."

The SOW should follow the format described below, although the format described herein is only meant to be a guide and is not necessarily all-inclusive. As such, contents should be tailored to the specific requirement being proposed. As applicable, the various SOW sections should address the following:

(a) **Background:** Identified as the "Introduction," this section provides information needed to acquaint the reader with the basic acquisition situation. The background information may:

- Identify the requirement in very general terms;
- Describe why the project is being pursued and how it relates to other projects;
- Summarize any statutory authority or regulations affecting the overall requirement; and

- Identify any background materials attached to the SOW.

(b) **Objectives:** This section should provide a concise overview of:
- The contract effort goals and objectives; and
- How the results or end products will be used.

(c) **Scope:** Provide a brief statement of what the Government expects to accomplish under the contract-the breadth and limitations of the contract effort. It should not include specific work tasks or a description of deliverable products.

(d) **Tasks:** Sometimes identified as "Requirements" or "Work Requirements," this section defines the SPECIFIC TASKS that the Contractor must complete during contract performance, and should describe requirements in terms of results required rather than the methods for completing the work. The specific tasks must provide the specific performance attributes that define success, such as minimum performance thresholds, form/fit/function characteristics, quality control requirements and/or other OBJECTIVE measurements defining successful task performance. Other items to consider include but are not limited to:

- Specify requirements clearly so that all readers can understand them.
- Reference only the absolute minimum applicable specifications and standards needed.
- Tailor specifications and other documents.
- Separate general information from direction.
- Include specific titles and task descriptions for all tasks for required performance
- Use a Work Breakdown Structure (WBS) format and WBS Dictionary
- Include milestones that are to be accomplished as applicable and as identified on the milestone schedule. Milestones can include such things as preliminary reports or data submittals, attendance at meetings, etc.

(e) **Period of Performance**: Provide period of performance in either months or years; if applicable, include options and spell out what is optional vs. what is not; provide any restrictions (e.g., NTE 100 hours a month, etc.)

(f) **Place of Performance**: Insert the place of performance for this work (e.g., CCDC Soldier Center, contractor's facility (include location), etc.

(g) **Delivery:** This section should clearly state:
- What the Contractor must deliver including specific quantities for each deliverable. If different tasks have different delivery requirements, they must be clearly identified.

- When the Contractor must deliver. This may be stated using actual dates, days after contract award, or using some other method that clearly marks the required delivery date.
- Delivery address/location. This may be stated as a location, an organization, a person identified by position (e.g., Contracting Officer's Representative, a person identified by name or using some other description.)
- What documentation (if any) the Contractor must obtain from the Government to verify Government receipt of the delivery.
- Other items to consider: Deliverables are different than task completion milestones. Milestones may not require a specific deliverable or data submittal. Include a schedule for when final products such as data, reports or other items are required to be furnished to the Government.

(h) **Government-Furnished Property, Material, Equipment, or Information (GFP, GFM, GFE, or GFI):** This section should identify any Government-furnished property required to be provided by the Government to the Contractor. This includes all Government-furnished property, such as Government-furnished material, equipment, or information. If the list of property is extensive, this section should identify where that list can be found.

(i) **Security:** This section should identify any unique security requirements associated with contract performance, such as secure facilities, DD-254 requirements, etc.

(j) **Travel:** Describe any travel requirements that are to be encountered in the performance of the service(s).

(k) **Special Material Requirements:** Describe requirements for any special materials that are to be encountered in the performance of the service(s).

(l) **Other Unique Requirements:** Discuss any other unique requirements or considerations required for successful contract performance.

THIS ANNOUNCMENT <u>IS NOT</u> FOR THE ACQUISITION OF TECHNICAL, ENGINEERING AND OTHER TYPES OF SUPPORT SERVICES.

SECTION III – ADDITIONAL INFORMATION ABOUT PROPOSAL SUBMISSIONS

1. CONTRACTOR MANPOWER REPORTING

All contracts awarded under this BAA will include the following: ACCOUNTING FOR CONTRACT SERVICES REQUIREMENT (Jun 2010)

The Office of the Assistant Secretary of the Army (Manpower & Reserve Affairs) operates and maintains a secure Army data collection site where the contractor shall report ALL contractor manpower (including subcontractor manpower) required for performance of this contract.

Detailed instructions can be found on the Enterprise Contractor Manpower Reporting Application (ECMRA) website in the ECMRA "Contractor User Guide" or "Subcontractor User Guide". The contractor must create an account upon entering the site and is required to completely fill in the required information at the ECMRA website: https://www.ecmra.mil/Default.aspx

The required information includes:

(a) Unit Identification Code (UIC) of the Army Requiring Activity that would be performing the mission if not for the contractor:_____*(Enter the Army Requiring Activity's UIC here).*

(b) Command of the Requiring Activity that would be performing the mission if not for the contractor:_____*(Enter Command of the Requiring Activity here).*

(c) Contracting Officer (KO) and contact information:_____*(Enter KO's name, phone number, and email address)*.

(d) Contracting Officer's Representative (COR) and contact information: _____*(Enter COR's name, phone number, and email address)*.

(e) Federal Service Code (FSC) reflecting services provided by contractor (and separate FSC for each subcontractor if different). If there are multiple FSCs for an Order number, enter a separate data record for each FSC.

(f) Location where contractor and subcontractor(s) perform the service, including the city, state, Zip code, and country. When service is performed at an overseas location, state only the city and country. If there are multiple locations for an Order number, enter a separate data record for each location. (*Note: If there are many location records that need to be entered, the Bulk Loader function is available which allows the transfer of information from a contractor's system to the secure web site. The Bulk Loader Template and Bulk Loader Instructions*

may be downloaded from the web site.)

(g) Contractor Type (prime or subcontractor).

(h) Direct labor hours (including subcontractors) for each FSC.

(i) Direct labor dollars paid this reporting period (including subcontractors) for each FSC.

(j) Weapons system support indication:_____*(Enter yes or no)*.

If subcontractors are used in the performance of this contract, several factors must be considered. The contractor shall include, and require inclusion of, this clause in all subcontracts at any tier under the contract in which services are being procured. The contractor shall also enter its data in a timely manner as subcontractors cannot input any information into the ECMRA system until the Prime Contractor has entered its data. The Prime Contractor has overall responsibility for ensuring subcontractors enter their respective data. Subcontractors are only responsible for entering Location Data.

The reporting period will be the period of performance not to exceed 12 months ending 30 September of each Government fiscal year and must be reported by 31 October of each calendar year.

2. EXECUTIVE COMPENSATION AND FIRST-TIER SUBCONTRACT REPORTING (APPLIES ONLY TO CONTRACTS)

Section 2(d) of the Federal Funding Accountability and Transparency Act of 2006 (Pub.L. No. 109-282), as amended by section 6202 of the Government Funding Transparency Act of 2008 (Pub. L. 110-252), requires the Contractor to report information on subcontract awards. The law requires all reported information be made public; therefore, the Contractor is responsible for notifying its subcontractors that the required information will be made public.

Unless otherwise directed by the Contracting Officer, by the end of the month following the month of award of a first-tier subcontract with a value of $25,000 or more (and any modifications to these subcontracts that change previously reported data) the Contractor shall report the following information at https://www.fsrs.gov/ for each first-tier subcontract:

(a) Unique identifier (DUNS Number) for the subcontractor receiving the award and for the subcontractor's parent company, if the subcontractor has one.

(b) Name of the subcontractor.

(c) Amount of the subcontract award.

(d) Date of the subcontract award.

(e) A description of the products or services (including construction) being provided under the subcontract including the overall purpose and expected outcomes or results of the subcontract.

(f) Subcontract number (the subcontract number assigned by the Contractor).

(g) Subcontractor's physical address including street address, city, state, and country. Also include the nine-digit ZIP code and congressional district.

(h) Subcontractor's primary performance location including street address, city, state, and country. Also include the nine-digit ZIP code and congressional district.

(i) The prime contract number (and order number if applicable).

(j) Awarding agency name and code.

(k) Funding agency name and code.

(l) Government contracting office code.

(m) Treasury Account Symbol (TAS) as reported in FPDS.

(n) The applicable North American Industry Classification System (NAICS) code.

By the end of the month following the month of a contract award, and annually thereafter, the Contractor shall report the names and total compensation of each of the five most highly compensated executives for the Contractor's preceding completed fiscal year at https://www.fsrs.gov/ if :

(a) In the Contractor's preceding fiscal year, the Contractor received:

(i) 80 percent or more of its annual gross revenues from Federal contracts (and subcontracts), loans, grants (and sub-grants)and cooperative agreements; and

(ii) $25,000,000 or more in annual gross revenues from Federal contracts (and subcontracts), loans, grants (and sub-grants) and cooperative agreements; and

(b) The public does not have access to information about the compensation of the executives through periodic reports filed under section 13(a) or 15(d) of the Securities Exchange Act of 1934 (15 U.S.C. 78m(a), 78o(d)) or section 6104 of

the Internal Revenue Code of 1986. (To determine if the public has access to the compensation information, see the U.S. Security and Exchange Commission total compensation filings at http://www.sec.gov/answers/execomp.htm).

Unless otherwise directed by the Contracting Officer, by the end of the month following the month of a first-tier subcontract with a value of $25,000 or more, and annually thereafter, the Contractor shall report the names and total compensation of each of the five most highly compensated executives for each first-tier subcontractor for the subcontractor's preceding completed fiscal year at https://www.fsrs.gov/if:

(a) In the subcontractor's preceding fiscal year, the subcontractor received:

(i) 80 percent or more of its annual gross revenues from Federal contracts (and subcontracts), loans, grants (and sub-grants), and cooperative agreements; and

(ii) $25,000,000 or more in annual gross revenues from Federal contracts (and subcontracts), loans, grants (and sub-grants), and cooperative agreements; and

(b) The public does not have access to information about the compensation of the executives through periodic reports filed under section 13(a) or 15(d) of the Securities Exchange Act of 1934 (15 U.S.C. 78m(a), 78o(d)) or section 6104 of the Internal Revenue Code of 1986. (To determine if the public has access to the compensation information, see the U.S. Security and Exchange Commission total compensation filings athttp://www.sec.gov/answers/execomp.htm).

If the Contractor in the previous tax year had gross income from all sources under $300,000, the Contractor is exempt from the requirement to report subcontractor awards. Likewise, if a subcontractor in the previous tax year had gross income from all sources under $300,000, the Contractor does not need to report awards to that subcontractor.

3. GOVERNMENT FURNISHED PROPERTY (GFP)

Government Furnished Property, as defined in FAR Part 45, may be available for contractor use during the performance of a given contract awarded against this BAA.

The offeror should clearly request in its proposal what, if anything, it desires as GFP for the given project. It is recommended that a section in the technical or management proposal be set aside to summarize the GFP requirements.

The offeror may request for incorporation in the contract a GFP delivery schedule NOT based specifically on the date of contract award.

Any property furnished to and accepted by the Government under a resultant contract and subsequently returned to the contractor for any reason shall be regarded as Government Furnished Property.

Any facilities, including rooms, desks, etc., to be provided to a contractor by the Government for the performance of any portion of a contract, is considered to be GFP, and if needed should be specifically requested for the applicable time frames in the offeror's proposal.

4. TYPE OF INSTRUMENT

The Combat Capabilities Development Command (CCDC), Natick Contracting Division has the authority to award procurement contracts, cooperative agreements, and grants, and reserves the right to use the type of instrument most appropriate for the effort proposed. Offerors should familiarize themselves with these instruments and the applicable regulations before submitting a proposal. Following are brief descriptions of the possible award instruments. Offerors shall provide rationale to support their suggested award instrument. Further information may be found in FAR Part 16.

Procurement Contract - A legal instrument which, consistent with 31 U.S.C. 6303, reflects a relationship between the Federal Government and a State, a local government, or other recipient when the principal purpose of the instrument is to acquire property or services for the direct benefit or use of the Federal Government. Procurement contracts resulting from this BAA will generally fall into two broad categories:

(a) Firm Fixed Price (FFP) contracts (see FAR 16.2.) FFP contracts are generally utilized when performance risks are low, and the delivery requirements are very well defined and can be readily priced and scheduled. However, a FFP contract may be necessary for business entities that do not possess a DCAA approved accounting system (which is a requirement for award of a cost reimbursement contract). FFP contracts are structured in one of two methods that dictate how contractor is reimbursed for work performed, and offerors proposing a FFP contract are strongly encouraged to carefully consider their cash flow requirements when formulating their proposals:

(i) FFP contracts may be structured to reimburse the contractor upon delivery of the work. Contract Line Item Numbers (CLINs) specify a particular piece of work and the delivery terms, and the contractor invoices the Government upon delivery.

(ii) An alternative structure is a milestone payment structure based on discrete incremental milestones that are achieved as progress is being made against a longer term contract deliverable. The use of milestone payments will only be considered by the Government when the milestones are clearly defined in

terms of specific activity based events AND performance measurement attributes that define milestone achievement, AND a discrete price for the milestone.

(b) Cost Reimbursement contracts (See FAR 16.3). Cost reimbursement contracts are generally utilized when there is technical risk that may impede successful performance such that it is difficult to accurately predict cost the final cost. In order to receive a cost reimbursement contract, the contractor must possess a DCAA approved accounting system.

The contract type may vary according to the degree and timing of the risk responsibility assumed by the contractor for the cost of performance and the amount and nature of the profit incentive offered to the contractor for achieving or exceeding specific standards and goals. See FAR Subpart 16.101(a). Offerors shall identify the type(s) of contract (FAR Part 16) they feel is (are) best suited to the proposed effort. The offeror shall note that, in accordance with FAR Subpart 16.301-3, in order to receive a COST type contract, its accounting system must be adequate for determining costs on a Government contract. This is determined by the Defense Contract Audit Agency (DCAA) office assigned to the offeror's business location and may take thirty (30) to forty (40) days for completion. An Offeror's suggestion regarding suitable contract type does not obligate the Government to employ the suggested contract type.

Offerors may propose profit or fee to both FFP and cost reimbursement type contracts. The Government will employ a weighted guidelines approach to establishing profit or fee, and offerors are strongly encouraged to use this method when establishing their proposed profit or fee. The weighted guidelines method is described in DFARS 215.404-71 and a weighted guidelines calculation template is at DD Form 1547.

The selection of the contract type and any fee or profit is subject to negotiation.

Grant - A legal instrument that, typically utilized with academic institutions, consistent with 31 U.S.C. 6304, is used to enter into a relationship:

a. The principal purpose of which is to transfer a thing of value to the recipient to carry out a public purpose of support or stimulation authorized by a law of the United States, rather than to acquire property or services for the DOD's direct benefit or use.
b. In which substantial involvement is not expected between the DOD and the recipient when carrying out the activity contemplated by the grant.
c. In which no fee or profit is allowed.

Cooperative Agreement - A legal instrument, also typically utilized with academic institutions, which, consistent with 31 U.S.C. 6305, is used to enter into the same kind of relationship as a grant (see definition "grant"), except that substantial involvement is expected between the DOD

and the recipient when carrying out the activity contemplated by the cooperative agreement. The term does not include "cooperative research and development agreements" as defined in 15 U.S.C. 3710a. No fee or profit is allowed.

Grants and cooperative agreements are governed by the following regulations:

a. OMB Circular A-21, "Cost Principles for Educational Institutions"

b. OMB Circular A-87, "Cost Principles for State, Local and Indian Tribal Governments"

c. OMB Circular A-102, "Grants and Cooperative Agreements with State and Local Governments"

d. OMB Circular A-110, "Uniform Administrative Requirements for Grants and Agreements with Institutions of Higher Education, Hospitals, and Other Non-Profit Organizations"

e. OMB Circular A-122, "Cost Principles for Non-Profit Organizations"

f. OMB Circular A-133, "Audits of States, Local Governments, and Non- Profit Organizations"

g. DOD Grant and Agreement Regulations (DODGARs), DOD 3210.6-R http://www.dtic.mil/whs/directives/corres/html/321006r.html

Copies of OMB regulations may be obtained from:

Executive Office of the President
Telephone: (202) 395-7332
Publications Service
FAX Requests: (202) 395-9068
New Executive Office Building
http://www.whitehouse.gov/OMB/
725 17th Street, N.W., Room 2200
Washington, DC 20503

http://www.whitehouse.gov/omb/circulars_a021_2004/

NOTE: In accordance with DoD Directive 3210.6, http://www.dtic.mil/whs/directives/corres/html/321006r.html, the DODGARs may include rules that apply to other non-procurement instruments, when specifically required in order to implement a statute, Executive Order, or Government-wide rule that applies to other non- procurement instruments, as well as to grants and cooperative agreements.

5. PREPARATION COSTS

It must be clearly understood that the receipt and review of concept papers and proposals as described in this BAA by the Government is entirely for the purpose of technical evaluation and in no way constitutes an agreement to enter into contractual or other relationships. It must be further understood that the submission of such documents is voluntary and must be done solely at the offeror's expense. The Government will in no way be held liable for, nor reimburse, an offeror for any expenses (direct or indirect) incurred in the process of formulating or submitting such documents.

6. AVAILABILITY OF FUNDS

It must be clearly understood that as of the date of release of this BAA there are no funds committed for any project. Until such time as funds are released to the Contracting Officer, no contract can, or will, be made for an otherwise acceptable proposal.

7. FAR INFORMATION/REFERENCES

All FAR information/references plus other related acquisition information may be found on the Internet at either of the following addresses: https://www.acquisition.gov/

8. SYSTEM FOR AWARD MANAGEMENT (SAM) REGISTRATION

By submission of an offer, the Offeror acknowledges the requirement that prospective awardees MUST be registered in the System for Award Management (SAM) database in order to be eligible to receive an award, and subsequently prior to submitting an invoice and through final payment of any contract resulting from this BAA Solicitation.

Offerors that are not registered should consider applying for registration immediately upon receipt of this solicitation. To remain registered in the SAM database after the initial registration, the Offeror is required to review and update on an annual basis from the date of initial registration (or subsequent updates) its information in the SAM database to ensure it is current, accurate and complete.

9. INVOICING AND PAYMENTS

All payments by the Government under contracts awarded from this BAA shall be made by electronic funds transfer (EFT) or the Government purchase card. If not paid by purchase card, then invoices shall be submitted electronically in accordance with DFARS 252.232-7003, which will be included in any resulting contract from this BAA. The automated

method being used at CCDC Soldier Center is the Wide Area Workflow (WAWF) system found at https://wawf.eb.mil/.

Contractors are encouraged to view this website and familiarize themselves with the invoicing process. More specific instructions on WAWF will be provided in any BAA award document.

10. REPORTING AND TECHNICAL DATA/SOFTWARE DELIVERABLES

The following are samples of data deliverables that are typically required under a research effort:

> Monthly Progress Reports; Test Results, data, and analyses; Technical data covering technology; Source and object code for software; Presentation materials; Final Technical Report; Safety Assessment Report

Separate Contract Data Requirement Line items (CDRLs) are included in a contract to cover each of the above items. Each CDRL includes a data item description and possible a military standard to provide, e.g. guidance in the format of the data delivered.

The following minimum data deliverables will be required under traditional procurement contracts awarded under this BAA:

Monthly Progress Report: These reports must describe the previous calendar month's activity, technical progress achieved against goals, difficulties encountered, recovery plans (if needed), explicit plans for the next calendar month, and financial expenditures (including expenditures during the past calendar month period plus cumulative expenditures and projected expenditures for the coming calendar month.)

Final Technical Report: For a final report, each selected Offeror must provide a final technical report of work performed during the period of performance delivered no later than the prescribed time. The final report must be a cumulative, stand-alone document that describes the work of the entire research effort. It must include any technical data gathered. The final technical report must include a summary of all performance goals versus performance achieved during the program (either measured or otherwise substantiated). The final technical report must discuss all variances from the performance goals including reasons or theories for variances. If applicable, provide a discussion of how the Offeror might meet any unmet performance goals under a future effort. This final technical report must also include "lessons

learned" from the effort as well as recommendations for future research, development, or testing that would lead to success in meeting the performance goals. The final report must provide a comprehensive and detailed account of all funds expended.

11. RESTRICTED DATA ON PROPOSALS

As stated in FAR 52.215-1(c) "Instructions to Offerors - Competitive Acquisition", the following guidance is provided for contractors desiring to restrict any information in their concept papers or proposals:

Offerors that include in their proposals data that they do not want disclosed to the public for any purpose, or used by the Government except for evaluation purposes, shall –

(1) Mark the title page with the following legend:

"This proposal includes data that shall not be disclosed outside the Government and shall not be duplicated, used, or disclosed -- in whole or in part -- for any purpose other than to evaluate this proposal. If, however, a contract is awarded to this offeror as a result of – or in connection with -- the submission of this data, the Government shall have the right to duplicate, use, or disclose the data to the extent provided in the resulting contract. This restriction does not limit the Government's right to use information contained in this data if it is obtained from another source without restriction. The data subject to this restriction are contained in sheets [*insert numbers or other identification of sheets*];" and

(2) Mark each sheet of data it wishes to restrict with the following legend:

"Use or disclosure of data contained on this sheet is subject to the restriction on the title page of this proposal."

12. INTELLECTUAL PROPERTY

a. Noncommercial Items (Technical Data and Computer Software)

Offerors responding to this BAA requesting a procurement contract, grant, or cooperative agreement to be issued under the FAR/DFARS shall identify all noncommercial technical data and noncommercial computer software that they plan to deliver under any proposed award instrument in which the Government will acquire less than unlimited rights, and to assert specific restrictions on those deliverables on a

list. Offerors shall follow the format for the list under DFARS 252.227-7017 for this stated purpose. In the event that Offerors do not submit the list, the Government will assume that it automatically has "unlimited rights" to all noncommercial technical data and noncommercial computer software delivered under any award instrument, unless it is substantiated that development of the noncommercial technical data and noncommercial computer software occurred with private or mixed funding. If private or mixed funding occurred in the development of noncommercial technical data and noncommercial computer software delivered under any award instrument, then Offerors should identify the data and software in question as subject to Limited Rights, Restricted Rights or Government Purpose Rights. In accordance with DFARS 252.227-7013 "Rights in Technical Data-Noncommercial Items", and DFARS 252.227-7014 "Rights in Noncommercial Computer Software and Noncommercial Computer Software Documentation", the Government will automatically assume that any such Government Purpose Rights restriction is limited to a period of five (5) years in accordance with the applicable DFARS clauses, after which time the Government will acquire "unlimited rights" unless the parties agree otherwise. Offerors are admonished that the Government will use the list during the source selection evaluation process to evaluate the impact of any identified restrictions and may request additional information from the Offeror, as maybe necessary, to evaluate the Offeror's assertions. Once an Offeror's assertions are confirmed and a contract is to be awarded, a clause confirming the scope of these identified restrictions may be prepared for incorporation into the contract. If no restrictions are intended, then the Offeror should state "NONE" on the list. A sample list for complying with this request is as follows:

NONCOMMERCIAL			
Technical Data or Computer Software to be Furnished with Restrictions	Basis for Assertions	Asserted Rights Category	Name of Person Asserting Restrictions
(LIST)	(LIST)	(LIST)	(LIST)

b. Commercial Items (Technical Data and Computer Software)

Offerors responding to this BAA requesting a procurement contract grant, or cooperative agreement to be issued under the FAR/DFARS, shall identify all commercial technical data, and commercial computer software that may be embedded in any noncommercial deliverable technical data and/or computer software contemplated under the research effort on the list. The Government may use the list during the source selection evaluation process to evaluate the impact of any identified commercial data/software restrictions, and may request additional information from the Offeror, as may be necessary, to evaluate the Offeror's assertions. If no deliverable commercial technical data/software is intended, then the Offeror should

state “NONE” on the list.

A sample list for complying with this request is as follows:

COMMERCIAL	
Technical Data or Computer Software to be Furnished with Restrictions	Basis for Assertions
(LIST)	(LIST)

c. All Proposers – Patents

Offerors responding to this BAA shall include documentation proving ownership of inventions or possession of appropriate licensing rights to all inventions (including patented or those inventions for which a patent application has been filed) that will be utilized under the proposal being submitted. If a patent application, provisional or non- provisional, has been filed for an invention that the proposal utilizes, but the application has not yet been made publicly available, the serial number, inventor name(s), assignee names (if any), filing date, and a summary of the invention title, may be provided together with either: 1) a representation of ownership of the invention, or 2) proof of possession of appropriate licensing rights in the invention.

d. All Offerors – Intellectual Property Representations

Offerors shall provide a good faith representation that they either own or possess appropriate licensing rights to all other intellectual property (IP) that will be utilized under the proposal being submitted. Additionally Offerors shall provide a short summary for each such IP in which an Offeror asserts the Government will be restricted that describes the nature of the restriction and the intended use of the intellectual property in the conduct of the proposed research.

13. PROTECTION OF HUMAN SUBJECTS

The CCDC Soldier Center Human Research Protections Office ensures that research conducted, contracted, sponsored, supported, or managed by the CCDC Soldier Center and involving human subjects, human anatomical substances, human data, human cadavers, and animals is conducted in accordance with federal, DoD, Army, CCDC , and international regulatory requirements.

Principal Investigators (PIs) and applicant organizations **may not commence performance** of research involving the above, **or expend funding** on such efforts, until and unless regulatory documents are submitted to and approved by the Army Human Research Protection Office (AHRPO) to ensure that DoD regulations are met. All expectations described below are consistent with DoDI 3216.02, “Protection of Human Subjects and Adherence to Ethical Standards in DoD-Supported Research,” as issued on November 8, 2011, and available at http://www.dtic.mil/whs/directives/corres/pdf/321602p.pdf.

AHRPO is responsible for administrative review, approval, and oversight of research involving human subjects, human anatomical substances or human subjects' data. ***Research involving use of human data and/or specimens that is anticipated to be exempt from human subjects' protections regulations requires a determination from the PI's institution as well as the AHRPO.*** A timeframe for submission of the appropriate protocols and required approvals will be established during negotiations.

Specific requirements for research involving human subjects or human anatomical substances include but may not be limited to:

a. **Assurance of Compliance:** Each institution engaged in non-exempt human subjects' research must have a current Department of Health and Human Services Office for Human Research Protection (OHRP) Federal wide Assurance (FWA) or DoD Assurance. The Institution's IRB office or the HRPO can assist in determining if engaged institutions have active assurances and obtaining an assurance is required.

b. **Training:** Personnel involved in human subjects' research must have appropriate instruction in the protection of human subjects. Documentation confirming completion of appropriate instruction may be required during the regulatory review process.

c. **Informed Consent Form:** The following must appear in the consent form:
   - A statement that the Department of Defense (DoD) is providing funding for the study.
   - A statement that representatives of the DoD are authorized to review research records. In the event that a Health Insurance Portability and Accountability Act (HIPAA) authorization is required, the DoD must be listed as one of the parties to whom private health information may be disclosed.

d. **Intent to Benefit:** The requirements of Title 10 United States Code Section 980 (10 USC 980), which are applicable to DoD-sponsored research, must be considered. 10 USC 980 requires that "Funds appropriated to the Department of Defense may not be used for research involving a human being as an *experimental subject* unless (1) the informed consent of the subject is obtained ***in advance***; or (2) in the case of research intended to be beneficial to the subject, the informed consent may be obtained from a legal representative of the subject."

   An individual not legally competent to provide informed consent (e.g., incapacitated individuals, cognitively impaired, minors) may not be enrolled as an ***experimental subject*** in a DoD-supported study unless the research is intended to benefit each subject enrolled in the study, to include subjects enrolled in study placebo arms. Studies designed in a manner that permits all subjects to potentially benefit directly from medical treatment or enhanced surveillance beyond the standard of care can meet the 10 USC 980 requirements. Note that the definition of ***experimental subject*** as defined in the DoDI 3216.02 has a much narrower definition than ***human subject***. Research with experimental subjects must involve an intervention or interaction where the primary

purpose of the research is to collect data regarding the effects of the intervention or interaction.

10 USC 980 is only applicable to certain intervention studies. It does not apply to retrospective studies, observational studies, studies that involve only blood draws, and tissue collections. Contact the CCDC Soldier Center HRPO at (usarmy.natick.nsrdec.mbx.nati-human-protection-administrator@mail.mil) ***if further clarification regarding applicability of 10 USC 980 to the proposed research project is required.***

Research Monitor Requirement: ***For research determined to be greater than minimal risk, DoDI 3216.02 requires that the IRB approve, by name, an independent research monitor with expertise consonant with the nature of risk(s) identified within the research protocol.*** The IRB must approve a written summary of the monitor's duties, authorities, and responsibilities.

The research monitor's duties should be based on specific risks or concerns about the research. The research monitor may perform oversight functions and report his/her observations and findings to the IRB or a designated official. The research monitor may be identified from within or outside the PI's institution. Research monitor functions may include:

- observing recruitment and enrollment procedures and the consent process for individuals, groups or units;
- overseeing study interventions and interactions;
- reviewing monitoring plans and Unanticipated Problems Involving Risk to Subjects or Others (UPIRTSO) reports; and/or overseeing data matching, data collection, and analysis.

There may be more than one research monitor (e.g., if different skills or experiences are necessary). The monitor may be an ombudsman or a member of the data safety monitoring board. At a minimum, the research monitor:

- may discuss the research protocol with the investigators, interview human subjects, and consult with others outside of the study about the research;
- shall have authority to stop a research protocol in progress, remove individual human subjects from a research protocol, and take whatever steps are necessary to protect the safety and well-being of human subjects until the IRB can assess the monitor's report; and
- shall have the responsibility for promptly reporting their observations and findings to the IRB or other designated official and the HRPO.

A curriculum vitae or biographical sketch and human subjects protection training for the research monitor must be provided. There should be no apparent conflict of interest, and the research monitor cannot be under the supervision of the PI, other investigators, or research staff associated with the proposed research project. If the duties of the research monitor could

require disclosure of subjects' Protected Health Information outside a covered entity (i.e., the research monitor is not an agent of the covered entity), the PI's institution may require the identity and location of the research monitor to be described in the study HIPAA authorization. It is acceptable to provide appropriate compensation to the research monitor for his or her services.

NOTE: All contracts with organizations conducting human research will include DFARS clause 252.235-7004 Protection of Human Subjects and the following local clause:

CONTRACT CLAUSE FOR USE OF HUMAN SUBJECTS

Research at funded institutions using human subjects may not begin until the Human Research Protection Official (HRPO) approves the project. Written approval to begin research or subcontract for the use of human subjects under the applicable protocol proposed for this award will be issued from the HRPO to the funded institution and Principal Investigator (PI). **A copy of this approval will be provided to the CCDC Soldier Center POC Robert Roussel, (email usarmy.natick.nsrdec.mbx.nati-human-protection-administrator) for the official file (until designated the HRPO).** Noncompliance with any provision of this clause may result in withholding of funds and or termination of the award. The Contractor shall comply with the requirements of

Department of Defense Instruction (DODI) 3216.02 and 32 CFR 219.

END CLAUSE

The following procedures will be employed to ensure compliance with the above contract clause:

- The contractor will coordinate with the CCDC Soldier Center POC, Robert Roussel for HRPO checklist filing.
- The contractor will submit the checklist together with the protocol, the scientific review of the protocol (may be included as part of local IRB review), and the results of the local IRB review to the U.S. Army Human Research Protection Office (AHRPO) at the email address: usarmy.ncr.hqda-otsg.mbx.usarmy-ncr-hqda-otsg-mailbox-otsg--ahrp@mail.mil or by mail to:

  U.S. Army Human Research Protections Office
  7700 Arlington Blvd.
  Falls Church, VA 22042-5140
- After review and approval by the HRPO, the contractor must provide a copy of the completed checklist together with a copy of the HRPO approval letter to Robert Roussel, Human Protections Administrator, CCDC Soldier Center.

14. ANIMAL USE

PIs and applicant organizations may not commence performance of research involving the above, or expend funding on such efforts, until and unless regulatory documents are submitted

to and approved by the U.S. Army Medical Research and Materiel Command (USAMRMC) Office of Research Protections (ORP) Animal Care and Use Review Office (ACURO). All expectations described below are consistent with the DoD Instruction (DoDI) 3216.01, "Use of Animals in DoD Programs," as issued September 13, 2010, available at http://www.dtic.mil/whs/directives/corres/pdf/321601p.pdf.

Specific documents relating to the use of animals in the proposed research will be requested if the application is selected for funding. The ACURO must review and approve all animal use prior to the start of working with animals. PIs must submit the institutional animal use protocol, IACUC approval of that protocol, and a version of the animal use appendix titled "Research Involving Animals." For guidance on which version of the appendix to use, as well as links to both, visit the ACURO website at: https://mrmc.amedd.army.mil/index.cfm?pageid=research_protections.acuro_Animalappendix ***Allow at least 2 to 3 months for regulatory review and approval processes for animal studies.***

For additional information, send questions via email to ACURO at usarmy.detrick.medcom-usamrmc.other.acuro@mail.mil.

NOTE: All contracts with organizations conducting animal research will include DFARS clause 252.235-7002 Animal Welfare and the following local clause:

CONTRACT CLAUSE FOR USE OF ANIMAL SUBJECTS

> Research, development testing, evaluation and training at funded institutions using animal subjects may not begin until the US Army CCDC Soldier Center Human Protections Administrator (HPA) reviews the project and approval is granted from the Animal Care and Use Review Office (ACURO). Written approval to begin research or subcontract for the use of animal subjects under the applicable protocol proposed for this award will be issued from either the ACURO or the HPA and provided to the funded institution and Principal Investigator (PI). A copy of this approval will be retained by the HPA for the official file. Noncompliance with any provision of this clause may result in withholding of funds and or termination of the award. The Contractor and any Subcontractor shall comply with the requirements of AR 40-33, Department of Defense Instruction (DoDI) 3216.01 and all applicable references including 21 CFR.

END CLAUSE

15. USE OF HUMAN CADAVERS OR HUMAN ANATOMICAL SUBSTANCES OBTAINED FROM HUMANCADAVERS

Research, development, test and evaluation (RDT&E), education, or training activities involving human cadavers shall not begin until approval is granted in accordance with the

Army Policy for Use of Human Cadavers for RDT&E, Education, or Training, 20 April 2012 (https://mrmc.amedd.army.mil/assets/docs/orp/army-policy-for-use-of-human-cadavers_042012.pdf). The USAMRMC ORP is responsible for administrative review, approval, and oversight of research involving sensitive uses of human cadavers or human anatomical substances obtained from human cadavers. The Army Research Laboratory Human Cadaver Review Board (ARL HCRB) is responsible for administrative review, approval, and oversight of research involving conventional research uses of human cadavers or human anatomical substances obtained from human cadavers. Award recipients must coordinate with the CCDC Soldier Center to ensure that proper approvals are obtained. Written approvals to begin the activity will be issued under separate notification to the recipient. Questions regarding submission of cadaver research for USAMRMC ORP review and approval should be directed to the CCDC Soldier Center HPA via email at usarmy.natick.nsrdec.mbx.nati-human-protection-administrator**.**

16. MILITARY RECRUITING

Military Personnel Volunteers: The following is important information for research projects proposing to include military personnel as volunteers.

- **Recruitment of Military Personnel:** Civilian investigators attempting to access military volunteer pools are advised to seek collaboration with a military investigator familiar with service-specific requirements.

  A letter of support from Commanders of military units in which recruitment will occur or the study will be conducted will be requested by the AHRPO. Some military sites may also require that each volunteer seek written permission from their supervisor prior to participation in research studies.

  Special consideration must be given to the recruitment process for military personnel. The Chain of Command must not be involved in the recruitment of military personnel and cannot encourage or order service members to participate in a research study. For greater than minimal risk research, an ombudsman must be employed when conducting group briefings with active duty personnel to ensure that volunteers understand that participation is voluntary; this ombudsman may be recommended in other situations as well, especially when young enlisted service members, who by virtue of their age and enlistment status are trained to follow orders, are being recruited. Service members are trained to act as a unit, so peer pressure should also be considered and minimized, if possible.

- **Payment to Federal Employees and Military Personnel:** Under 24 USC 30, payment to federal employees and active duty military personnel for participation in research while on duty is limited to blood donation and may not exceed $50 per blood draw. These individuals may not receive any other payment or non-monetary compensation for participation in a research study unless they are off duty or on leave during the time they are participating in the protocol.

- **Confidentiality for Military Personnel:** Confidentiality risk assessment for military personnel requires serious consideration of the potential to affect the military career. Medical and psychological diagnoses can lead to limitation of duties and/or discharge from active duty. Information regarding alcohol or drug abuse, drunk driving, and sexual or spousal abuse can lead to actions under the Uniform Code of Military Justice, including incarceration and dishonorable discharge.

17. INTERNATIONAL TRAFFIC IN ARMS REGULATION (ITAR)

The offerors and their subcontractors shall comply with the ITAR, 22 CFR Parts 120 through 130. Information regarding ITAR is available at http://pmddtc.state.gov/regulations_laws/itar_official.html. If a question exists regarding ITAR, please contact Mr. Stephen Brackett at Stephen.e.brackett.civ@mail.mil. Information pertaining to the Export Administration Regulation (EAR) is available at http://www.bis.doc.gov/index.php/regulations.

18. ORGANIZATIONAL CONFLICTS OF INTEREST

All Offerors and proposed subcontractors must affirm whether they are providing scientific, engineering, and technical assistance (SETA) or similar support to any CCDC Soldier Center technical office(s) through an active contract or subcontract. All affirmations must state which office(s) the Offeror supports and identify the prime contract numbers. Affirmations shall be furnished at the time of proposal submission. All facts relevant to the existence or potential existence of organizational conflicts of interest (FAR 9.5) must be disclosed. The disclosure shall include a description of the action the Offeror has taken or proposes to take to avoid, neutralize, or mitigate such conflict. In accordance with FAR 9.503 and without prior approval, a contractor cannot simultaneously be a SETA and a research and development performer. Proposals that fail to fully disclose potential conflicts of interests will be rejected without technical evaluation and withdrawn from further consideration for award. If a prospective Offeror believes that any conflict of interest exists or may exist (whether organizational or otherwise), the offeror should promptly raise the issue with CCDC Soldier Center by sending his/her contact information and a summary of the potential conflict by e-mail to the Administrative Point of Contact identified in each topic under Section VI, before expending time and effort in preparing a proposal and mitigation plan.

If, in the sole opinion of the Contracting Officer after full consideration of the circumstances, any conflict situation cannot be effectively avoided, the proposal may be rejected without technical evaluation and withdrawn from further consideration for award under this BAA.

SECTION IV – EVALUATION PROCESS

1. EVALUATION APPROACH FOR CONCEPT PAPERS

Concept papers will be evaluated by technical/scientific personnel who are knowledgeable within the particular topical area/specific interest area to determine if the paper presented is consistent with the intent of the BAA and of interest to the Government. Concept papers will be evaluated on the scientific/technical merit, the management approach, the importance to agency programs, and the proposed cost/price. Based on these evaluation criteria, the highest rated concept papers will show considerable potential to develop into highly qualified proposals that could likely lead to an award. Concept papers will be evaluated within ninety (90) days of receipt.

2. EVALUATION APPROACH FOR PROPOSALS

Proposals submitted in response to this solicitation will be given a scientific/peer review evaluation by CCDC Soldier Center technical personnel in accordance with the evaluation criteria below. Each proposal will be evaluated based on the merit and relevance of the specific proposal as it relates to CCDC Soldier Center program requirements/needs, rather than against other proposals. Once a proposal has been submitted to CCDC Soldier Center as instructed in the specific Scientific and Technical Area of Interest listed in Section VI, the Offeror is to HAVE NO FURTHER CONTACT with the technical POC until the time a contract award exists. Inquiries regarding status of the evaluation may be submitted to the CCDC Soldier Center office that received the formal proposal (see the specific Scientific and Technical Area of Interest listed in Section VI.

Offerors whose proposals are considered not to have sufficient merit, which are not relevant to an Army need, or which are in areas where funds are not expected to be available will be notified as soon as possible after completion of evaluation that their proposal will not be further considered for a contract award.

Offerors who submit formal proposals via the guidance provided in the specific Scientific and Technical Area of Interest listed in Section VI will receive an initial notice of receipt, along with a summary of the next steps for evaluation of the proposal, when funding is expected to be available, and an estimated timeline for processing. The offeror is cautioned that the availability of funds as of the date of such notice is no guarantee that funds will be available at any given later date.

3. BASIS FOR AWARD

Offers will be selected based upon the outcome of proposal evaluation in accordance with the evaluation criteria cited below plus the availability and source of funds. Not all highly rated proposals will result in a contract award. The Government may elect not to award a contract for every highly rated proposal for each topical area/specific interest area. The Government may award more than one contract in a given topical area/specific interest area orthe

Government may not award a contract at all in a given topical area/specific interest area.

4. FACTORS AND SUBFACTORS TO BE EVALUATED

Evaluation will be broken down into five (5) factors: technical, management, cost/price, past performance, and subcontracting plan/small business participation plan. The technical factor is the most important followed by management, cost/price, and finally, past performance. The technical factor has at least two (2) and up to three (3) sub-factors and cost/price has two (2) sub-factors, each of equal importance. Technical sub-factors A and B are of equal importance and technical sub-factor C is also equal when it is an applicable sub-factor.

Technical personnel will assign an adjectival and risk rating for the technical and cost/price factor and sub-factors, as well as the management factor of each proposal. Past performance areas will receive only a performance risk rating.

5. EVALUATION CRITERIA

a. **FACTOR I -Technical:** Each sub-factor in this factor will be evaluated and receive an individual rating. This factor will receive an overall rating based on the ratings of all the technical sub-factors combined.

(1) Sub-factor A: Technical Merit: The proposal will be evaluated on the relevance of the proposed effort in response to the topical area/specific interest area and the overall technical feasibility of the technology, capability, the product and/or the technology proposed.

(2) Sub-factor B: Technology Advancement/Warfighting Capability: The proposal will be evaluated on the potential to increase the combat effectiveness of the Army and the potential for exploiting a capability not likely to be executed elsewhere.

(3) Sub-factor C: Safety and HSI Requirements (when applicable): The proposal will be evaluated to assure that it has properly addressed safety/ HSI requirements (see section V herein) by including the following information:

(a) The offeror's understanding of safety/HSI and how it applies to the proposed work.

(b) The methods/techniques the Offeror will use to ensure that safety/HSI will be incorporated into the program so as to ensure that the items/products delivered to the Government are safe and effective for use by personnel

(c) The qualification/knowledge of the individual responsible for the offeror's safety/HSI requirements.

b. **FACTOR II - Management:** The proposal will be evaluated on the quality of the personnel, equipment, facilities, project management systems, controls (i.e., the overall organization), and the milestone schedule being proposed. The overall management plan will be evaluated.

c. **FACTOR III - Cost/Price:** Each sub-factor in this factor will be evaluated and receive an individual rating. This factor will receive an overall rating based on the ratings of both cost/price sub-factors combined.

(1) Sub-factor A: Cost/Price Benefit: The proposals will be evaluated to determine the overall benefit to the Government. Considerations will include industry contribution and fiscal feasibility. Fiscal feasibility includes the ability to accomplish the proposed project within Government fiscal constraints; the requirement for the use of other Government contractors to assist in the execution of proposed effort; and the use of Government furnished equipment, information, facilities, and other assets. The proposals will be evaluated to determine the extent to which the overall cost/price to the Government is reasonable.

(2) Sub-factor B: Cost/Price Realism: The proposals will be evaluated for cost realism to assess the likelihood that the technical and management approaches can be accomplished at the cost/price proposed.

d. **FACTOR IV - Past Performance:** The Offeror's and first tier subcontractor's past performance with Government and industry in the specific interest area or similar and/or related areas will be evaluated to assess the relative risks associated with the Offeror's likelihood of success in meeting the requirements stated in this BAA. Specific areas of past experience and performance examined will include demonstrated technical and schedule performance, cost control, general responsiveness to contract requirements, customer satisfaction, and customer focus. Emphasis will be on recent, relevant experience (see past performance area under section II of this BAA).

e. FACTOR V –Subcontracting Plan/Small Business Participation Plan

(1) Small Business Subcontracting Plan (if applicable): Subcontracting plans will be reviewed for adherence to applicable public laws and regulations cited in FAR Part 19 and its supplements. Subcontracting plans will be rated as acceptable or unacceptable. An Offeror's refusal to submit an acceptable Subcontracting Plan is grounds for the Government to not negotiate award of that offeror's BAA proposal.

(2) Small Business Participation Plan: Small Business Participation Plans will be evaluated against the evaluation criteria below and will be given an adjectival rating (see Section IV Evaluation Process, Part 6 Rating Method (b)). A Participation Plan templates

provided at the beta.SAM link for W911QY20R0022.

1. The extent of participation of SB, SDB, WOSB, HUBZone, VOSB, and SDVOSB firms in terms of total contract value.
2. The extent to which such firms are specifically identified in proposals.
3. The extent of commitment to use such firms (for example, enforceable commitments are to be weighted more heavily than non-enforceable ones).
4. The complexity and variety of the work small firms are to perform.
5. Past performance of the offerors in complying with requirements of the clauses at FAR 52.219-8, Utilization of Small Business Concerns, and 52.219-9, Small Business Subcontracting Plan.
6. Provide a statement of the extent of the offeror's commitment to small business participation through its awards and must agree that SB, SDB, WOSB, HUBZone, VOSB, and SDVOSB concerns will have the maximum practicable opportunity to participate in contract performance consistent with its efficient performance.

6. RATING METHOD

a. Under the technical portion in the HSI/safety evaluation only, the following method shall be used: the offer will be given a pass/marginal/fail in the evaluation areas cited; however, should a fail or marginal be given, the Government may be able to work with the offeror in order to assure HSI/safety requirements are correctly addressed.

b. Adjectival Ratings: The adjectival ratings that will be utilized for evaluating individual technical, management, cost/price factors and sub-factors, and small business participation are defined as follows:

(1) Excellent: Evaluation of the factor/sub-factor indicates the Offeror's proposal meets or exceeds all stated criteria by demonstrating a firm grasp of the requirements and translating the requirements into a well-defined and preferred approach. Innovative approaches that push the state of the art are present. The proposal exhibits strengths and does not contain any weaknesses or deficiencies.

(2) Very Good: Evaluation of the factor/sub-factor indicates the Offeror's proposal meets or exceeds all stated criteria by demonstrating an understanding of the requirements and translating the requirements into a well-defined and feasible approach. Innovative approaches that are, at a minimum, state of the art are present. The proposal exhibits some strengths and might contain one or more weaknesses but does not contain any deficiencies.

(3) Acceptable: Evaluation of the factor/sub-factor indicates the Offeror's

proposal meets all stated criteria by demonstrating an understanding of the requirements and translating the requirements into a feasible approach. Limited innovation beyond the norm is present. The proposal may exhibit some strengths and might contain some weaknesses but does not contain any deficiencies.

(4) Marginal: Evaluation of the factor/sub-factor indicates the Offeror's proposal meets the majority of the stated criteria but either demonstrates a limited understanding of the requirements or translates the requirements into an approach which may not be feasible. The proposal may exhibit some strengths and might contain several weaknesses but does not contain any deficiencies.

(5) Unacceptable: Evaluation of the factor/sub-factor indicates the Offeror's proposal does not meet the stated criteria or contains one or more deficiencies which indicate a lack of understanding of the requirements. The stated criteria can only be met with major changes to the proposal.

c. Risk Assessment:

(1) The proposal risk assessment ratings for technical, management, and cost/price factors and sub-factors are defined as follows:

(a) High: Likely to cause serious disruption of contract effort or increase in cost/price of performance even with special contractor emphasis and Government monitoring.

(b) Moderate: Has some potential to cause minor disruption of contract effort or increase in cost/price of performance. Normal Government monitoring will probably be able to overcome most difficulties.

(c) Low: Has very little potential to cause disruption of contract effort or increase in cost/price of performance. Minimal Government monitoring will probably be able to overcome difficulties.

(2) The performance risk assessment ratings for past performance are defined as follows:

(a) High: Based on the Offeror's performance record, substantial doubt exists that the offeror will successfully perform the required effort.

(b) Moderate: Based on the Offeror's performance record, some doubt exists that the Offeror will successfully perform the required effort.

(c) Low: Based on the Offeror's performance record, little doubt exists that the Offeror will successfully perform the required effort.

(d) Unknown: No performance record identifiable. This is essentially a neutral rating, which will neither directly benefit nor negatively impact the offeror.

d. Definitions:

(1) Strength: An aspect of a proposal that appreciably decreases the risk of unsuccessful contract performance or that represents a significant benefit to the Government.

(2) Weakness: A flaw in the proposal that increases the risk of unsuccessful contract performance. A "significant weakness" in the proposal is a flaw that appreciably increases the risk of unsuccessful contract performance.

(3) Deficiency: A material failure of a proposal to meet a Government requirement or a combination of significant weaknesses in a proposal that increases the risk of unsuccessful contract performance to an unacceptable level.

SECTION V –SAFETY AND HUMAN SYSTEMS INTEGRATION REQUIREMENTS

In addition to the technical portion of your proposal, there are specific requirements for Safety and HSI (Manpower and Personnel Integration)/Human Systems Integration (HSI) that are governed by regulation which must be included, ***if applicable***, in any acceptable proposal.

Contractors who develop an item, equipment or system for use by U.S. Army personnel shall include the following system safety/health hazards and HSI requirements:

1. SYSTEM SAFETY/HEALTH HAZARD

Contractors who propose development of early technology or prototype materiel shall ensure an aspect of their effort is to identify potential mishap risks and that those risks are eliminated or controlled to an acceptable level. The objective of this effort is to preclude injury, illness, death to the user or maintainer, or damage to the materiel developed. To ensure this objective the contractor should describe its planned actions, may be required to conduct specific hazard analyzes, and should provide a safety assessment that:

a) identifies safety design standards (statutory, regulatory, industry consensus, etc.) utilized in the design;

b) identifies safety features, controls, devices, etc., incorporated into the materiel design;

c) includes Material Safety Data Sheets for potentially hazardous materials used in the manufacture or operation of the materiel;

d) residual risks associated with the use of the materiel; and

e) specific safety recommendations or precautions required to ensure the safety of personnel and property.

Acceptable levels of residual risk, and combined hazard severity-probability (Risk Assessment Code), are provided below for the convenience of potential offerors. These "excerpts" were taken from MIL-STD-882D, Standard Practice for System Safety, which, if desired, may be seen in full text at the following web site: http://www.geia.org/sstc/G48/882d.pdf.

a. Risk Assessment: Decisions regarding resolution of identified hazards shall be based upon assessment of the residual risk involved. To aid the achievement of the objectives of system safety, hazards shall be characterized as to hazard severity categories and hazard probability levels, whenever possible. A risk assessment procedure considering only hazard severity will generally suffice during the early design phase to minimize risk. When hazards are not eliminated during the early design phase, a risk assessment procedure based upon hazard probability hazard,

hazard severity, as well as risk impact shall be used to establish priorities for corrective action of identified hazards or formal acceptance of residual risks.

Table 1 Risk Assessment Codes (RACs)

			PROBABILITY				
			Frequent A	Probable B	Occasional C	Remote D	Improbable E
SEVERITY	Catastrophic	I	IA	IB	IC	ID	IE
	Critical	II	IIA	IIB	IIC	IID	IIE
	Marginal	III	IIIA	IIIB	IIIC	IIID	IIIE
	Negligible	IV	IVA	IVB	IVC	IVD	IVE

Table 2 Risk Levels Indicated by RACs

HAZARD RAC	RISK LEVEL
IA-ID, IIA-IIC, IIIA	**HIGH** – Unacceptable
IE, IID, IIIB-IIIC, IVA	**MEDIUM** – Unacceptable
IIE, IIID-IIIE, IVB-IVE	**LOW** - Acceptable upon review & approval of System Safety PM/Project Officer & Supporting Engineer

b. Hazard Severity: Hazard severity categories are defined to provide a qualitative measure of the worst credible mishap resulting from personnel error; environmental conditions; design inadequacies; procedural deficiencies; or system, subsystem, or component failure or malfunction.

Table 3 Hazard Severity Definitions

DESCRIPTION	CATEGORY	DEFINITION
Catastrophic	I	Death or system loss
Critical	II	Severe injury, severe occupational illness, or major system damage
Marginal	III	Minor injury, minor occupational illness, or minor system damage
Negligible	IV	Less than minor injury, occupational illness or minor system damage

c. Hazard Probability: The probability that a hazard will be created during the planned life expectancy of the system can be described in potential occurrences per unit of time, events, population, items, or activity. Assigning a quantitativehazard

probability to a potential design or procedural hazard is generally not possible early in the design process. A qualitative hazard probability may be derived from research, analysis, and evaluation of historical safety data from similar systems. Supporting rationale for assigning a hazard probability shall be documented in hazard analysis reports. An example of a qualitative hazard probability ranking is:

Table 4 Hazard Probability Definitions

DESCRIPTION*	LEVEL	SPECIFIED INDIVIDUAL ITEM	FLEET OR INVENTORY**
Frequent	A	Likely to occur frequently	Continuously experienced
Probable	B	Will occur several times in the life of an item	Will occur frequently
Occasional	C	Likely to occur sometime in the life of an item	Will occur several times
Remote	D	Unlikely, but possible to occur in the life on an item	Unlikely, but can be reasonably expected to occur
Improbable	E	So unlikely, it can be assumed occurrence may not be experienced	Unlikely to occur, but possible

*Definitions of the descriptive words may have to be modified based upon quantity involved.
** The size of the fleet or inventory should be defined.

2. HUMAN SYSTEMS INTEGRATION

HSI is a comprehensive management and technical process designed to improve total system (user, hardware and software) performance through continuous integration of manpower, personnel, training, human factors, system safety, health hazards, and soldier survivability considerations throughout the materiel design, development, and acquisition process. HSI concerns which must be addressed during the performance of tasks are focused primarily on optimizing user/maintainer performance while minimizing error and simplifying maintenance tasks without introducing any new safety risks or health hazards. To ensure that this objective is met, if applicable, all developmental efforts shall include HSI/Human Factors Engineering analyses which identify and evaluate operability and maintainability deficiencies.

Early discussions with appropriate POCs will identify whether or not HSI requirements apply to a particular effort. Typically, HSI applies to the design, development, and acquisition of all items, equipment, or systems intended for personnel use or that will require personnel interaction for the proper use, maintenance, repair, etc. These items

include, but are not limited to, typical soldier products under the purview of CCDC Soldier Center such as: personal protective clothing/equipment, food and food service equipment, tents/shelters and airdrop equipment. For efforts focused on research, HSI considerations, particularly those associated with safety and health hazards, shall apply when the product of a research effort will be utilized in the development of items, equipment, or systems. Specifically, contractors shall consider the potential safety and health hazard implications that the products of their research efforts will have when/if those products are integrated into items. When HSI is required, it shall be addressed in the contractor's proposal under the technical section and will be evaluated under the technical section as outlined in Section IV, Factor I of this BAA.

For efforts requiring HSI considerations, the contractor shall provide documentation that should include, as appropriate to the proposal (but is not limited to), an explanation which describes how each HSI domain was (or will be) taken into consideration when designing/developing the item. Include a discussion relating to the trade-offs that were made, if any, and the rationale associated with those trade-offs and/or how trade-offs associated with the HSI domains will be addressed and handled. Specifically, the contractor shall address each domain regarding the proper use/operation, maintenance, inspection and repair of their product, as follows:

(1) Manpower/Personnel & Training: Address the numbers of personnel, their skill qualifications and training (either in the form of formal training, embedded training, training materials, etc.) that is or will be required.

(2) Human Factors Engineering:

(a) Describe how sound Human Factors Engineering principles and practices were (or will be) applied to the design and development of the product.

(b) The contractor shall utilize the data for design-critical human body dimensions as contained in the 1988 Anthropometric Survey of U.S. Army Personnel: Methods and Summary Statistics. Address what design-critical human body dimensions were (or will be) taken into consideration when designing the product (e.g., for proper fit of items or acceptable reach/accessibility, etc.).

(c) When deemed appropriate, provide the following Human Factors Engineering analysis or the intention to provide this information:

An explanation which documents and describes human performance errors and/or difficulties which may be encountered during operation, maintenance, and repair of the item, equipment, or system. For each error, include the estimated frequency of occurrence, the cause of the error/difficulty in terms of the conditions which may have contributed to it, the consequence of the

error/difficulty on system operation, and a brief explanation of the reason for the error/difficulty by the user.

An explanation which describes how human performance may impact system goals by including a narrative explanation of how human error associated with operations and the length of time required to perform operations may affect system reliability and effectiveness.

A description of potential incompatibilities among human performance capabilities and equipment to document both the aspects of performance which may be adversely affected and the associated equipment configurations/ characteristics. The contractor shall identify the controls or displays that may be needed but are not present on the equipment. Recommended solutions to these incompatibilities shall also be included and stated in terms of redesign, alteration of tasks, and/or training.

(d) Provide any instructions necessary for proper use/operation/ maintenance/repair of the equipment or a discussion of what instructions will be developed or will be necessary. The instructions shall include the proper method of interface with any other standard item that will typically be used/worn with theirproduct.

(3) System Safety and Health Hazards: See paragraph 1 of this Section.

(4) Soldier Survivability: Soldier Survivability pertains to the characteristics of a system that can reduce fratricide, detectability and probability of being attacked, as well as minimize system damage, soldier injury, and cognitive and physical fatigue. Describe any impacts the product has on Soldier Survivability and/or how Soldier Survivability issues were (or will be) considered in the design/development of the product.

All contractor questions/concerns about proposal requirements for system safety engineering and HSI requirements may be discussed with the following appropriate POCs:

SAFETY: Mr. Dan Gregory, TEL: 508-233-4883, daniel.r.gregory.civ@mail.mil

HSI: Ms. Blake Mitchell, TEL: 508-233-5326, Katherine.b.mitchell.civ@mail.mil

SECTION VI – SCIENTIFIC ANDTECHNICAL AREAS OF INTEREST

A. COMBAT FEEDING

COMBAT FEEDING EQUIPMENT AND SYSTEMS

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/small combat units (~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, multi-fuel 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
- (3) Acquisition and treatment of water from the native environment

(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 and ice making

Scientific and Technical Areas of Interest:

A comparison of current and emerging capabilities versus known and projected requirements of the Military Services indicates 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, ice making 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. Refrigeration and ice making technologies to enable mobile, military, containerized cold-storage that uses refrigerants with high efficiency, reliability and a low GWP (global warming potential).

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

g. Field amenable methods and equipment to improve the sensitivity and selectivity for detection and identification of microbiological or chemical contamination in foods.

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

i. Material technologies for new structural and insulative materials appropriate for individual and group ration heating that provide improved ration component heating time, energy efficiency, and cost.

j. Equipment and systems technologies to reduce, recycle, and/or extract energy out of food service waste in an efficient, safe waste handling, and disposal in an environmentally acceptable manner.

k. 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.

l. Methods and equipment for the decontamination of fresh fruits and vegetables in a field feeding environment.

m. 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.

n. 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 environment factors.

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

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

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

r. 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.

s. Equipment technologies integrated with the food service equipment or systems to automatically reduce the power consumption for electric food service equipment items and/ or automatically manage the available electric power more efficiently to increase cooking throughput without increasing the weight, volume, manpower, and cost.

t. Equipment and technologies and systems that reduce labor by automatically tracking and storing subsistence items aboard Navy ships.

u. Equipment and technologies for acquisition of water from the native environment by squads and/ or individual warfighters such as atmospheric water harvesting, desalination, ice/ snow melting, extraction from plants, etc. to reduce logistical burden.

v. Equipment and technologies for treatment of water acquired from the native environment by squads and/or individual Soldiers to minimize exposure risk to chemical and biological contaminants.

Communication with the Technical POC prior to submission of a formal proposal is essential.
Technical POC: Mr. Peter Lavigne, TEL: (508) 206-3410, peter.g.lavigne.civ@mail.mil

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

U.S. Army Natick Soldier Systems Center
Combat Capabilities Development Command - Soldier Center
Combat Feeding Division, Soldier Sustainment Directorate
ATTN: FCDD-SCC (Ms. Jean Trumpis)
10 General Greene Avenue Natick, MA 01760-5018
TEL: 508-206-3754, jean.m.trumpis.civ@mail.mil

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, warfighter 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
- Nutritional interventions for human performance optimization/enhancement
- Validated ex vivo/in vitro model systems for vetting nutrition interventions to optimize/enhance human performance
- Improved, enhanced and more effective protective packaging systems
- Collection and consolidation of quality assurance and environmental data
- Food protection from incidental or intentional contamination
- Novel, non- or low-thermal food processing methods and technologies
- Additive manufacturing technologies that enable customized nutrition at point of need
- Food preservation and hurdle technologies that enable 'clean label' formulations
- Environmentally preferable "green" food processing methods and sustainable high barrier food packaging materials.

Scientific and Technical Areas of Interest:

A comparison of current capabilities versus future battlefield requirements indicates the need to explore key emerging 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 serving the needs of the Armed Services in the near, mid, and longer range timeframe and on the future battlefield (Future Force). The S&T Areas of Interest also support the following major thrusts: enhanced performance; energy and nutrient intake; nutrient stability and bioavailability; improved consumption rates; and reduced ration weight and volume, 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 on the battlefield through technological advantage thereby ensuring focused logistics, improved responsiveness, deployability, agility, versatility, survivability, and improved combat readiness and effectiveness. 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, multi-functional, effective 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, mission essential items 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, active and intelligent packaging are needed to meet the increasingly stringent and sometimes conflicting requirements of compactness, sustainability, storage stability, recyclability, protection, modularity, durability, convenience, degradability, and producibility. Packaging functionality includes (as applicable) protection from the following events: temperature extremes, insect/rodent infestations, moisture permeation, oxygen permeation, light penetration, microbial penetration, tampering events, loss of integrity, and transportation hazards (including rough handling and 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/manufacturing 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 a greater variety of ready-to-eat, lightweight, low-volume, nutrient/calorie-dense ration components that are palatable, cost effective and producible by the ration industry.

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

d. Scientific information is needed 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 to ensure their stability under extreme storage conditions (with special interest in dairy products, eggs and other high-protein foods).

e. Scientific information and unique additive manufacturing technologies (e.g. 3D Printing) are needed to produce customized meals on demand on or near the battlefield that meet individual warfighter nutritional needs.

f. Scientific information and innovative technologies/methodologies are needed about maximizing quality/nutrient retention and extending shelf-life/storage stability of fresh fruits and vegetables as well as cost effective logistical support mechanisms or implementation strategies suggested for viable technologies.

g. Programming and data base development is needed for exploiting a ration item optimization model to guide the selection of ration components or off-the-shelf items intended for diverse missions based on energy requirements, nutritional content, battlefield operational conditions, personal preferences, weight, volume, and cost of items or components.

h. Validated scientific information is needed to determine the basis for and extent to which specific food constituents incorporated into the food: 1) delay fatigue, 2) optimize physical strength and endurance, 3) accelerate recovery from strenuous exertion and musculoskeletal injury, 4) heighten alertness or enhances cognitive abilities, 5) increase feelings of satiety of warfighters engaged in physically or mentally demanding tasks, or 6) promote warfighter health protection and fitness, prevent injury and illness, conserve the mental and physical well-being of warfighters, and maintain personal readiness.

i. Technology is needed for integration of human in vitro/ex vivo organ systems in order to develop more physiologically relevant model systems for testing nutritional interventions that prevent and/or mitigate detrimental effects of warfighter relevant stressors on host (human) physiology and performance.

j. Scientific concepts and data are required for increasing the speed and sensitivity of detection technologies (sensors) for food, water and ice safety determination to include novel approaches in preparation of samples from complex food and water 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 food and water borne pathogens and chemical contaminants.

k. Scientific information is needed for the development and implementation of strategies for the application of novel pathogen reduction technologies for fresh fruits and vegetables and for food preparation and eating surfaces.

l. Scientific information is needed for the development and implementation of methods or technologies for rapid detection of food quality deterioration and lipid oxidation in shelf stable foods during storage.

m. Scientific information is needed for the development and elaboration of food safety risk analysis decision making tools such as in comprehensive food processing and environmental risk assessments as well as predictive models of pathogen behavior in specific food matrices.

n. Scientific information is required for novel strategies in the development of a universal enrichment media for the growth and detection of foodborne pathogens with rapid diagnostic technologies.

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

p. Active/ smart packaging materials/films/coatings and in-packaging adjuvants are needed that possess inherent properties for scavenging or eliminating moisture, oxygen, off odors (e.g. aldehydes), carbon dioxide, and/ or ethylene (as appropriate) as well as repelling insects and rodents. Technology is also needed for packaging materials/systems (e.g. microencapsulation, bioactive packaging) containing anti-microbial or biocidal agents, physiological inhibitors for fresh produce and other methodologies to control or modify the atmosphere within a package for extension of shelf life.

q. Technology is needed to develop advanced materials/films/coatings for flexible, semi-rigid, and 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 (e.g. microwave or high pressure processing).

r. 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, packaging configuration, headspace composition, interaction between product and package, and process-induced stresses in packaging materials.

s. Technology is needed to advance packaging to reduce weight and volume and to make it more sustainable, recoverable, recyclable, compostable, biobased, degradable, and capable of being decontaminated.

t. Technology is needed to develop innovative, high-performance, manufacturable, compostable, and recyclable fiberboard materials for incorporation into ration secondary packaging systems to enhance ration container and unit load performance during long-term storage and rough handling conditions. Multi-functional coatings and/or additives may also enhance the utility of secondary packaging. Enhanced systems must adequately protect military rations and must ensure sufficient burst strength and compression/ stacking strength properties.

u. Low cost, intelligent packaging technologies including enhanced bar code labels, printed electronic sensor devices/ labels with displays, and smart indicators for reconstitution water fill lines and food serving target temperatures are needed to enhance primary, secondary, and/ or pallet-level ration packaging systems to improve strategic handling, product storage/ rotation/ inspection, assembly, mobility, deployability, transportability (including unmanned aerial delivery), security, logistics and distribution supply chain tracking and retrieval, and to ensure reliable operation of components in all scenarios.

v. Technology is needed to automate and centralize manufacturing (traceability) and inspection data and to provide real-time asset visibility and tracking of environmental storage/ history data to accurately predict the remaining shelf life of operational rations, and to facilitate improved process efficiency and management of the ration supply chain throughout the lifecycle.

w. Technology is needed to develop cost effective convenience and portable packaging features/ designs, including easy-to-open, eat-on-the-move, and reclosable, functional packages for dispensing both conventional and unconventional solid and reconstituted liquid ration components.

x. Technology is needed to develop flexible, semi-rigid and/or rigid high barrier materials that are: compatible with Horizontal/Form/Fill/Seal machinery; capable of withstanding classical thermoprocessing, microwave or high pressure sterilization, as well as aseptic packaging; and capable of providing products with a three year shelf life.

y. Technology is needed to develop and produce lighter weight, shelf-stable, highly appealing, and nutritious individual and group operational ration systems having a smaller footprint or modular sub-systems that require little or no preparation and are adaptable for Joint Service applications in global deployments and all operations ashore and afloat. Nutritious and novel sustainment systems must support the future Modular Force and Joint Operational Environment under all battlefield threats and climatic conditions enabling an agile and adaptive military response for 'prompt' and 'sustained' operations.

z. Technology is needed to develop biodegradable ration packaging systems to reduce battlefield waste/signature in multi-domain operations.

aa. Advanced technologies, innovation, and concepts to devise novel systems, capabilities and/or methodologies to enhance distribution-based combat ration sustainment to deliver the right rations, to the right place, at the right time, over extended distances supporting global deployments. Logistics and sustainment delivery concepts must optimize operational efficiency and cost effectiveness, ensure warfighter acceptability and nutrition, and achieve strategic responsiveness for highly mobile, rapidly deployed forces involved in extended operations requiring Class 1 resupply. Innovative sustainment concepts should emphasize speed, precision, accuracy, visibility, and reduce or eliminate traditional supply chain management problems including product identification and location, stock rotation and management issues, product spoilage losses, and menu fatigue.

bb. Technology is needed to develop imaging and spectroscopy methods to assess combat ration safety, quality and composition using discrete metrics ensuring warfighter acceptability and nutrition standards. Such technologies may be combined with image processing, algorithm development, and/or machine learning to minimize variations in formulation, detect and identify adulterants, verify quality standards (spoilage, oxidation, browning, etc.), and identify chemical and/or biological hazards in combat rations.

Communication with the Technical POC prior to submission of a formal proposal is essential.
Technical POC: Mr. Andy Senecal, TEL: 508-233-4507 (508) 206-3351,
andre.g.senecal.civ@mail.mil

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

U.S. Army Natick Soldier Systems Center
Combat Capabilities Development Command - Soldier Center
Combat Feeding Division, Soldier Sustainment Directorate
ATTN: FCDD-SCC (Ms. Jean Trumpis)
10 General Greene Avenue Natick, MA 01760-5018
TEL: 508-206-3754, jean.m.trumpis.civ@mail.mil

B. SOLDIER PROTECTION AND SURVIVABILITY

WARFIGHTER SYSTEMS TECHNOLOGIES

1. Integrated Protective Headborne Equipment and Injury Diagnostic/Assessment Tools.

Head borne protection for the individual combatant involves protection of the head (to include the eyes, neck and throat) against ballistic and blast threats such as the following:

a. Blast over pressure
b. Blast fragments
c. Blunt Trauma (blast induced, ballistic induced, or low velocity impact)
d. Small arms threats (handgun and rifle rounds)

New materials, material processing techniques, designs, modeling and simulation tools, survivability models, treatments and diagnosis technologies are required to meet this broad range of threats while also providing in-depth consideration of the appropriate ergonomics, comfort, hearing, mission requirements, thermal/vapor management and other cognitive functions necessary for the combatant to fully execute his/her operational duties without extensive physical or mental impairments.

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.

Technology is needed for:

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

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

c. New material processing techniques focused on uniform performance or increased performance particularly using additive manufacturing.

d. New and improved transparent materials for enhanced eye protection without compromising

optical clarity, stretch resistance, anti-fog, multi-hit capability, and light transmittance.

e. Improved lightweight integrated communications devices.

f. Engineering designs which incorporate enhancements to the protective headborne equipment system including area of coverage, field of view, modular attachment points, speech recognition, and compatibility/interoperability with other equipment.

g. Predictive modeling and simulation tools for blunt impact suspension systems using any type of 3D printed engineered structure.

h. Modeling and simulation survivability design tools including bio-mechanics and injury prevention/diagnosis models.

A need also exists for:

i. 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 a high level of user comfort.

j. Unique and novel design approaches which utilize the currently fielded equipment and developmental items as a base platform for incorporating modular components for improved ballistic/blast protection and which 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, and neck protection).

k. 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.

l. Modeling and simulation design and material evaluation tools which provide engineers and medical personnel the appropriate human interface information necessary to mitigate injuries from a variety of threats encountered on the modern battlefield.

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

Technical POC: Mr. Benjamin Fasel, TEL: 508.206.3783, benjamin.p.fasel.civ@mail.mil

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

U.S. Army Natick Soldier Systems Center
CCDC Soldier Center
ATTN: FCDD-SCP (Mr. Benjamin Fasel)
General Greene Avenue
Natick, MA 01760-5019
TEL: 508.206.3783
Email: usarmy.natick.ccdc-sc.mbx.osi-spsd@mail.mil and benjamin.p.fasel.civ@mail.mil

2. Modular Personal Protection Equipment (MPPE) and Injury Diagnostic/Assessment Tools.

Personnel protection for the individual combatant involves protection of the torso (to include the extremities, arms, groin, and legs) against fragmentation munitions, blast effects, and small arms threats. New materials, designs, and technologies are required to meet this 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. Torso/extremity protection for the individual combatant involves protection against fragmentation munitions, small arms threats, blunt trauma impact, and behind armor effects including injuries caused by kinetic energy and blast waves. New materials, designs including modeling and simulation design tools, survivability models, treatments, and diagnosis technologies are required to meet this broad range of threats while also providing in-depth consideration of the appropriate ergonomics, comfort, maneuverability, mission requirements, thermal/vapor management and other cognitive functions necessary for the combatant to fully execute his/her operational duties without extensive physical impairments. The goal of this task is to develop a modular personnel protective system and modeling tools which can be tailored to defeat specific threats including fragmentation/blast munitions, handgun, and small arms projectiles. The modular system will have the capability to achieve various levels of personnel protection to meet specific threats and missions 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 Soldier Protection System; Torso & Extremity Protection and Vital Torso Protection subsystems. 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.

New diagnostic and assessment tools/methods that medically evaluate the effectiveness of armor and the individual combatant are needed in order to more fully characterize specific warrior threats and populations at risk requiring further clinical intervention. In order to support this requirement, new diagnostic and assessment methods and tools for behind armor and penetrating wounds are required. In addition, research data needs to be collected in a systematic manner for the various services, compiled and analyzed in order to develop a baseline for a requirements document. The injury data is a key element in

developing treatment and diagnosis tools and new protection/survivability models so that troops may be better protected in future engagements and injuries treated at the front lines.

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.

Technology is needed for:

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

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

c. Super hard ceramic materials and designs capable of providing weight reductions, improved frangibility, and body conforming shapes.

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 pounds providing a high level of protection against the identified threats and a high level of user comfort.

g. Unique and novel design approaches which utilize the currently fielded Solder Protection System 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 and blast 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 the proposed design.

j. Modeling and simulation design and material evaluation tools which provide engineers and medical personnel the appropriate human interface information necessary to mitigate injuries from a variety of threats encountered on the modern battlefield.

k. There is a need for research programs with specific goals and end-points for health related issues relevant to military personnel and veterans. These research programs are generally concerned with topics relating but not limited to healthcare delivery, detection, diagnosis, treatment and control or eradication of specified chronic diseases, conditions, or syndromes, or to other initiatives relevant to health needs.

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

m. Additional concepts may include transparent armor, smart materials for armor and other functionalities, and nanotechnology approaches to new materials. Novel concepts which may include active armor are of interest.

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 POC: Mr. Benjamin Fasel, TEL: 508.206.3783, benjamin.p.fasel.civ@mail.mil

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

U.S. Army Natick Soldier Systems Center
CCDC Soldier Center
ATTN: FCDD-SCP (Mr. Benjamin Fasel)
General Greene Avenue
Natick, MA 01760-5019
TEL: 508.206.3783
Email: usarmy.natick.ccdc-sc.mbx.osi-spsd@mail.mil and benjamin.p.fasel.civ@mail.mil

3. Chemical/Biological Protection for Individuals.

The protection of the Warfighter 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 self-decontaminating and reusable. These uniforms must also be comfortable in all climates and not impair the mobility or performance of the Warfighter. The materials for these uniforms should be lightweight; retain protection post-laundering, 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; be resistant to petroleum, oils and lubricants (POLs) and other battlefield contaminants, 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 effects 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.

At the cold end of the environmental spectrum, there is a need to enhance insulation and provide auxiliary personal heating to augment cold weather clothing or supplant layers of bulky cold weather clothing to prevent cold injuries, enhance mobility, and reduce interference with critical equipment and controls. In particular, technology approaches that provide heating to improve finger tactility and dexterity are needed.

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. Intelligent textiles and polymers are of interest. These may include materials with controllable, variable permeability. For gloves, novel technologies that improve tactility, durability, and moisture vapor transport are desired.

b. Swatch and system test methodologies for evaluating the effectiveness of emerging CB material technologies to provide protection against hazardous chemicals.

c. Low cost service life indicators 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.

d. Reduce/minimize the need for live agent testing to verify the chemical protection of current carbon based sorptive systems.

e. Advanced material technologies such as elastomeric, polymeric, semi-permeable, or selectively permeable membrane technologythat allows selective permeation of moisture while preventing penetration of chemical and biological warfare agents in the forms of liquid, vapor, and aerosol.

f. Garment design and novel closure systems for CB protective clothing systems. We are interested in ensemble designs that enhance protection and reduce thermal burden. We are also 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.

g. 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.

h. Improved and multi-functional outer shell materials for CB protective garments. We are interested in materials with novel surface modification to either their fibers or the fabric, resulting in a comfortable; durable; air permeable; water, solvent, and oil repellent (i.e. omniphobic or superhydrophobic and superoleophobic) material for the life of the garment.

i. Development of self-healing polymers for CB protective clothing applications.

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 one of the Technical POCs listed below for guidance.

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

Technical POCs:

Dr. Natalie Pomerantz, TEL: 508.206.3943, Natalie.l.pomerantz.civ@mail.mil
Mr. Brad Laprise (for Micro Climate Cooling Systems), TEL: 508.206.3862, Bradley.s.laprise.civ@mail.mil
Mr. Michael Zielinski (for Personal Heating Systems), TEL: 508.206.3856, michael.r.zielinski2.civ@mail.mil

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

U.S. Army Natick Soldier Systems Center
CCDC Soldier Center
ATTN: FCDD-SCP (Dr. Shaun F. Filocamo)
General Greene Avenue
Natick, MA 01760-5020
TEL: 508.206.3939
Email: usarmy.natick.ccdc-sc.mbx.osi-spsd@mail.mil and shaun.f.filocamo.civ@mail.mil

4. 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 (to include carried equipment), and paints/textiles for exposed skin that reduce detectability 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 takes the form of dyes/pigments, additives, and coatings. New 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 indicates the need for:

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

- Defeat the threat of short-wave infrared (SWIR) devices.

- Defeat the threat of thermal sensor detection.

- Defeat the threat of radar detection.

- Defeat multispectral threat sensors.

- 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 performance.

- Provide NIR and SWIR protection and maintain shade after laundering and exposure to various environmental conditions.

- Provide protection to exposed hands and facial areas to defeat multispectral sensor detection.

- Provide protection by concealment of carried equipment to defeat multispectral sensor detection.

- Provide materials capable of temporarily adjusting visual/NIR/SWIR camouflage in the field for uniforms and personnel protective equipment (PPE) for enhanced concealment in specific areas of conflict/interest.

- Provide new manufacturing technologies for the scale-up of printing and fabrication of textile uniforms and equipment to facilitate a quick turnover of unique camouflaged final products to the Warfighter.

- Provide new and innovative methods in classifying terrains and environments compared to Outside Continental United States (OCONUS) areas of military interest for the purposes of test and evaluation of systems.

- Provide materials and systems worn or carried by the Soldier to be used for identification of friend or foe. The materials and system should be covert (not a signature offender) and compatible with current and future night vision systems.

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 prior to submission to follow appropriate security measures.

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

POCs:

Mr. Donald R. Lee, II, TEL: 508.206.3965, donald.r.lee3.civ@mail.mil
Ms. Anabela Dugas, TEL: 508.206.3959, Aanabela.dugas.civ@mail.mil

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

U.S. Army Natick Soldier Systems Center
CCDC Soldier Center
ATTN: FCDD-SCP (Mr. Jeffrey M. Dunn)
General Greene Avenue
Natick, MA 01760-5020
TEL: 508.206.3933
Email: usarmy.natick.ccdc-sc.mbx.osi-spsd@mail.mil and jeffrey.m.dunn.civ@mail.mil

5. 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 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.

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 and 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 hardware of other clothing items.

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

Technical POC: Ms. Carole Winterhalter, TEL: 508.206.3936, carole.a.winterhalter.civ@mail.mil
Dr. Shaun Filocamo, TEL: 508.206.3939, shaun.f.filocamo.civ@mail.mil

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

U.S. Army Natick Soldier Systems Center
CCDC Soldier Center
ATTN: FCDD-SCP (Dr. Shaun Filocamo)
General Greene Avenue
Natick, MA 01760-5020
TEL: 508.206.3933
Email: usarmy.natick.ccdc-sc.mbx.osi-spsd@mail.mil and shaun.f.filocamo.civ@mail.mil

6. 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. In some cases, properties are observed in materials with controlled nanometer-scale structures that have not been realized in more conventional material structures. Examples include the use of nanostructures to improve energy-harvesting efficiency in photovoltaic and thermoelectric materials/devices, enormous enhancement of Raman sensing by plasmonic nanoparticles for chemical/explosives detection, and nano-enabled smart materials.

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. Plasmonic field enhancement from nanostructures and/or nanoparticles has enabled the exquisitely sensitive Surface-Enhanced Raman Spectroscopy response and improved absorption and "photon management" in both inorganic and organic solar cells. Nanoscale periodic structures are also used to create non-conventional optical components that can be tuned to operate in specific wavelength regions.

Scientific and Technical 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, plasmonics, nanoelectronics, electromagnetic and optical 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 composites comprised of plasmonic nanoparticles and 'smart materials' (i.e. materials that respond to an external stimulus) is an area where there has been limited research. The coupling of those two fields to produce smart materials that respond to changing plasmonic fields of metallic nanoparticles is an area of research that could result in materials that could find use in optical switching, photovoltaic, and filtration applications. 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.

Plasmonic, semiconducting, and even dielectric nanoparticles and nanostructures ("metamaterials") exhibit novel optoelectronic and optical properties such as enhanced quantum yields, hot carrier effects, ultrafast rectification, photonic upconversion, nonlinear absorption, etc. These novel effects can be exploited to unburden the Soldier by enabling more battery recharging in the field and less use of disposable batteries with their associated logistical train; energy-harvesting materials could also be used to reduce the logistical burden of operating small camps and bases. Novel optoelectronic effects will also empower new, highly sensitive detection of explosives and chemical threats as well as other novel sensing functionality. Purely optical effects arising from nanomaterials may be used for Soldier vision protection and advanced imaging in a variety of scenarios. To harvest a useful amount of energy, metamaterials must be scalable to and fabricatable over large areas, probably in flexible, lightweight formats to allow simple packaging and transport.

Design and development of nanotechnology based novel, stable, light-weight and highly efficient Organic or Organic-Inorganic hybrid solar cells such as perovskites (stable) and other tandem solar cells that can be solution processed into thin films at low-temperature, capable of roll-to-roll production at low-cost and compatible to be integrated into existing Army 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, tactical optics, and vision systems.

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 and a-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 a Technical POC prior to submission of a formal proposal is essential. Technical

POCs:

Mr. Brian Kimball, TEL: 508.206.3984, brian.r.kimball.civ@mail.mil
Dr. Ramanathan Nagarajan, TEL: 508.206.3941, ramanathan.nagarajan.civ@mail.mil Ms. Diane Steeves, TEL: 508.206.3135, diane.m.steeves.civ@mail.mil
Dr. Richard Osgood, TEL: 508.206.3139, richard.m.osgood.civ@mail.mil Dr. Francisco Aranda, TEL: 508.206.3142, francisco.j.aranda4.civ@mail.mil
Dr. Ravi Mosurkal, TEL: 508.206.3845, Ravi.Mosurkal.civ@mail.mil
Dr. Walter Zukas, TEL: 508.206.3950, walter.x.zukas.civ@mail.mil

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

U.S. Army Natick Soldier Systems Center
CCDC Soldier Center
ATTN: FCDD-SCP (Dr. Shaun F. Filocamo)
General Greene Avenue
Natick, MA 01760-5020
TEL: 508.206.3939
Email: usarmy.natick.ccdc-sc.mbx.osi-spsd@mail.mil and shaun.f.filocamo.civ@mail.mill

7. Advanced Protection, Integration Technologies/Systems and Assessment Methods.

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 combat uniform system will emerge as the foundation for the human interface, load carriage, and protection 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 environments; improved warrior performance in all mission environments; reduced heat stress casualties; reduced water intake requirements; enhanced cold weather protection; and enhanced mobility due to reduced bulk.

Scientific and Technical Areas of Interest:

a. Research proposals to develop combat uniform and modular, integrated system design concepts and breadboard prototypes to include integration of multiple technologies into fewer textile-based structures and/or system components. Unique and novel design approaches for protective systems should be scalable and tailorable to meet regional threat and mission scenarios.

b. Research proposals to decrease the size, weight and bulk associated with protective clothing and equipment, while maintaining or enhancing the current level of protection.

c. Research proposals for novel design approaches and technologies to provide enhanced ventilation and/or heating and cooling concepts suited for dismounted Warfighter applications.

d. Technologies to deliver potable drinking water to the individual Soldier from an indigenous source, as well as to identify threats in the water source prior to use and monitor purification system performance.

e. Research proposals to develop and implement measures, assessment tools and methods. Specifically, development of standardized test methods and devices that measure key performance parameters and user acceptability of protective systems is needed.

f. Test methods and standards that need to be developed include, but are not limited to, "other than mosquito" vector protection efficacy, physical comfort under various climactic conditions, thermal comfort, environmentally appropriate/ correlated abradants, and methods that apply to knits and wovens for comparative purposes.

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

Technical POC: Dr. Shaun Filocamo, TEL: 508.206.3939, shaun.f.filocamo.civ@mail.mil

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

U.S. Army Natick Soldier Systems Center
CCDC Soldier Center
ATTN: FCDD-SCP (Dr. Shaun Filocamo)
General Greene Avenue
Natick, MA 01760

TEL: 508.206.3939
Email: usarmy.natick.ccdc-sc.mbx.osi-spsd@mail.mil and shaun.f.filocamo.civ@mail.mil

8. Integrated Sound, Light and Blast Management for the Ears and Eyes.

The goal of this effort is to protect vital senses and preserve physical and neurological performance essential to deployment readiness and mission effectiveness with primary focus on the eyes and ears.

Scientific and Technical Areas of Interest:

Manage Sound, light and pressure wave effects on the Soldier in military environments. A need

exists for:

a. Technologies that protect the ears while allowing for sound localization, short-range audible communication, and enhanced hearing.

b. Dosimeter technology for eventual integration into the system to monitor noise/blast exposure and serve as an indicator as to when threshold limits are being approached or have been reached.

c. Technologies that enhance vision while simultaneously protecting the eyes from damage.

d. Other new/novel concepts and/or prototypes for sound, light, and pressure wave management. Both passive and active mitigation techniques are of interest. Active solutions should give consideration to energy efficiency and/or self-sufficiency (such as energy harvesting) to conserve power.

A need also exists for:

Modeling and testing methodologies for characterizing and conducting trade-off studies of various technological concepts/approaches and/or prototypes to include, but not limited to:

a. Protection against sound.

b. Protection against blast effects on eyes, ears, brain, and/or protective system itself.

c. Concept and/or prototype performance as compared to currently fielded systems and/or to no protection at all.

d. Concepts and/or prototypes designed for exposure monitoring and/or alerts.

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

POC: Ms. Michelle Markey, TEL: 508.206.3196, michelle.l.markey.civ@mail.mil

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

U.S. Army Natick Soldier Systems Center
CCDC Soldier Center
ATTN: FCDD-SCP (Mr. Benjamin Fasel)
General Greene Avenue
Natick, MA 01760
TEL: 506.206.3783
Email: usarmy.natick.ccdc-sc.mbx.osi-spsd@mail.mil and benjamin.p.fasel.civ@mail.mil

TEXTILE TECHNOLOGIES

1. Multi-Functional Materials.

Individual Warfighter protection against battlefield threats such as ballistics, enemy detection, and environmental and manmade hazards is essential to the continued effectiveness of the fighting force. At the same time, protective materials (clothing/armor, etc.) must also be effective and ensure survival under extremes (temperature and humidity) without significant sacrifices in Warfighter comfort. Current textile technologies require multiple components to be added to the Warfighter uniform in order to meet these threats. Development of novel multifunctional materials would have significant impact on Warfighter load, increasing survivability and sustainability in the field. The following is a summary list of textile technologies of interest to the CCDC Soldier Center:

a. Novel polymer synthesis that produces materials, including coatings, fibers, yarns, or fabrics, with unique chemical/physical/mechanical property characteristics (e.g. high strength/tenacity, sense/response capabilities, tailorable protection, multi-component constructs, and smart materials)

b. Surface modification to existing materials that enhances existing properties and/or provides a multi-functional platform.

c. Yarn and fabric manufacturing, fabric preparation and finishing processes to provide enhanced protection and various functionalities, without negatively impacting Soldier comfort of performance, including but not limited to: moisture management, thermal management, flame and thermal protection, chemical and biological protection, water resistance/repellency, durability to wear and environmental exposure, reactive behaviors, impact protection, and electrostatic properties.

d. New scale-up technologies for creating conventional and novel fibers and fabrics that would also facilitate a quick turnover of final products to Soldiers.

e. New technologies for the characterization of textile systems properties (e.g. electrostatic;

electromagnetic; durability; and flame, thermal and ballistic resistance).

f. Modeling the chemical/physical/mechanical properties of new materials and/or surface modifications to existing materials, and the effects of these materials on Warfighter comfort (e.g. air and water permeation, flexibility, wear and tear).

g. Exploration of the effects of combining functionalities into a single material on their efficacy.

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

POCs:

Dr. Shaun Filocamo, TEL: 508.206.3939, shaun.f.filocamo.civ@mail.mil
Dr. Ravi Mosurkal, TEL: 508-206-3845, ravi.mosurkal.civ@mail.mil
Ms. Melynda Perry (for Yarn and Fabric Manufacturing), TEL: 508.206.3150, melynda.perry.civ@mail.mil

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

U.S. Army Natick Soldier Systems Center
CCDC Soldier Center
ATTN: FCDD-SCP (Dr. Shaun F. Filocamo)
General Greene Avenue
Natick, MA 01760-5020
TEL: 508.206.3939,
Email: usarmy.natick.ccdc-sc.mbx.osi-spsd@mail.mil and shaun.f.filocamo.civ@mail.mil

MODELING AND SIMULATION

1. Individual Ground Soldier and Small Unit Operational Effectiveness and Survivability.

CCDC-SC has developed modeling tools to assess operational effectiveness. These models provide quantitative power, utility, ease of use, affordability, and consideration of conditions that can be simulated to replace or supplement existing methods of assessment (field experimentation, laboratory tests, etc).

These conditions include small unit mission objectives, terrain, weather, lighting levels, threats, physiological factors, opposing force responses, situational awareness, and other elements. Consequently, constructive simulation is necessary and complements these other live and virtual methods to provide Army decision makers with a comprehensive assessment capability that can be used to show the relative benefit of one proposed capability versus another. We also continue to work to develop and implement other elements of the analytic infrastructure. These include, but are not limited to: characterization of equipment, methodology and algorithm development, collection and dissemination of data,

implementation of operational use cases in the simulation, identification of essential elements of analysis and metrics, and linkage of models and simulations.

Scientific and Technical Areas of Interest:

The development and application of a toolkit to conduct rapid and repetitive analysis pertaining to the SU leads to the following areas of continuing scientific and technical interest:

a. Research, develop, and implement elements of a shared analytic infrastructure that facilitate the analysis of issues in the depth and breadth critically important to CCDC Soldier Center, e.g. Soldier load, personnel protection, integrated base defense, force application, and Warfighter situational awareness. Elements include:

- Decomposition and building operational use cases to provide needed context to Warfighter centric analysis.
- Hardware system characterization to provide a shared understanding of the linkage between equipment, impacts on Warfighter performance and tactics, techniques and procedures.
- Application of metrics that focus analysis and support quantitative assessments.
- Development of a ground Soldier-centric data model that supports analysis and sharing of data across communities and can drive test methods and experimental design.
- Integration of Human Systems Integration and Systems Engineering inputs for examination of critical task combinations, cognitive workload, and Measures of Effectiveness and Measures of Performance
- Development and execution of a comprehensive and integrated assessment capability of the small unit under dynamic conditions in order to optimize performance while balancing human capability and technological advancements in terms of mission accomplishments.
- Compilation, synthesis, and analysis of empirical data collected during simulation runs.
- Identification of experimentation and test plans and protocols to leverage best practices and support consistency across experiments.
- Identification of needed instrumentation to accomplish analytic requirement. Tools that support collaboration and meeting shared objectives across Warfighter and Soldier Technology analysis communities.

b. Conduct research or use extant data and knowledge to develop and implement methodologies and algorithms pertaining to SU operations in a range of areas. Given the breadth of factors that can

have a significant impact on SU operations, only a partial listing is provided. The list includes: effects of clothing, equipment and encumbrance on Ground Soldier task performance; heat stress; cause and assessment of injuries and their impact on task performance and survivability; target detection, recognition, and identification; sensors, information transfer, communications, information technologies, network systems and their effects on situational awareness and decision making; and behavior representation.

c. Enhance CCDC Soldier Center analytic tools to support data exchange and linkage with other U. S. Army and NATO analytic models, simulations, and war games such as COMBAT XXI, OneSAF, and CAEn based upon analytic needs.

d. Develop tools and capabilities that allow simulation of the full spectrum of missions ranging from Stability and Support Operations (SASO) to combat.

e. Generate and enhance terrain databases that support the analysis of SU operational effectiveness and survivability within IWARS or linked with other models such as Combat XXI or OneSAF.

f. Extend the Infantry Warrior Simulation for human-in-the-loop operation to allow forthe research and assessment of Ground Soldier cognition, behavioral representation and the value of information.

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

POC: Ms. Jaclyn Fontecchio, TEL: 508.206.3782

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

U.S. Army Natick Soldier Systems Center
CCDC Soldier Center
ATTN: FCDD-SCP
General Greene Avenue
Natick, MA 01760-5019
usarmy.natick.ccdc-sc.mbx.osi-spsd@mail.mil

C. SOLDIER PERFORMANCE OPTIMIZATION

1. Body-Worn Systems, Hand Held Devices, Smart-Lightweight Electronic Components, and Information processing to Increase Soldier Maneuverability and Protection through on-Soldier Sensing, Remote Sensing, andKnowledge Management

The head-worn and body-worn, weapon-mounted and remote sensing electronic systems, components and smart sensors for future individual and small combat unit Warfighter

systems will require both integrated communications and knowledge management for the next generation of Soldiers, 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 Warfighters maneuverability, survivability and situational understanding on the battlefield. Advanced technology for the Soldier is needed for the integration of miniature lightweight, durable, reliable, low-power displays, sensors, optics, remote threat detectors, personal area network systems and knowledge management. This includes wireless and wearable smart electronic components/modules/materials that might be integrated into textiles or on the Soldier for disseminating power and data in a manner which the small combat unit can process. The knowledge management includes both Artificial Intelligence and Machine Learning (AI/ML) for processing sensor data into operationally relevant information, advanced visualization technologies, and decision tools.

Scientific and Technical Areas of Interest:

Future technology integration efforts focused on needs of Soldiers that increase force effectiveness by optimizing and integrating sensing, sensor data processing, information portrayal, and decision tool capabilities to improve the Soldier's maneuverability and survivability have revealed the following areas of interest:

a. Research proposals related to advancing the human integration and current technology for lightweight, integrated wearable systems; Soldier integrated displays and body-worn systems that enhance the Soldier survivability and situational awareness on the battlefield. Special interest areas include unique human systems integration of data and power systems, miniaturization, increased durability and reliability, and components having low power as well as new power solutions that meet Soldier-portable system requirements for survivability and situational understanding. Specific examples of body- worn system capabilities include: data devices, integrated

electronic modules, inter- connections in fabrics, wearable battery technologies, combat identification, tactical engagement simulation capability, system voice control, State-of-the-Art unique interfaces, haptics, neuro-physiological, and physiological/medical sensors and data management, Soldier integration of individual/team weapon system sensors and controls.

b. Research proposals for various lightweight, low power, body-mounted displays; threat detecting sensors; indirect weapon sighting systems; communication and information management capabilities and devices to enhance performance and protect Warfighters' biosensors against the varied threats expected in the intense battlefield environment of the future (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 Warfighters to manipulate miniature robotics and robotically controlled sensors to enhance visualization and situational and decision 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 Soldier portable IR and daylight readable display technologies using minimal energy output levels with deicing and defogging capability, meeting performance requirements across all environments.

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

- Displayed Information
- Reduced bulk and weight
- Integration of multifunctional displays, modules, and sensors
- Increased bandwidth, resolution color displays and sensors
- Reduced power requirements
- Electronic components that may be integrated into textiles
- Components that use AI/ML to turn sensor data into operational information for the Warfighter
- Cognition enhancement capabilities
- E-Textile technologies that conduct energy
- Energy harvesting technologies
- Integrated Data and Power technologies that support Soldier SA and other devices
- Communication with the Technical POC prior to submission of a formal proposal is essential.

Technical POC:

Dr. David Darkow, TEL: (508) 206-3883, david.j.darkow.civ@mail.mil

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

U.S. Army Natick Soldier Systems Center
CCDC Soldier Center
ATTN: FCDD-SCO (Mr. Matthew Whipple or Ms. Jennifer Rourke)
General Greene Avenue
Natick, MA 01760-5020
TEL: (508) 206-3803 (Mr. Whipple) or 508-206-3853 Ms. Rourke
Email: usarmy.natick.ccdc-sc.mbx.osi-spod@mail.mil

2. Biomechanics

Biomechanical tools, data, and knowledge products are currently being developed to guide the design of boots, individual body armor, and load carriage gear that reduce injuries, delay fatigue and enhance dismounted Warfighter agility, mobility, and operationally relevant performance.
There is a need for detailed information on the forces acting on the Soldiers' musculoskeletal system as well as how their gait, range of motion, rates of movement, energy expenditure, stamina, and ability to detect and react to threats are affected by their load and its distribution on the body, the terrain and grade of the environment, and obstacles presented by the environment.

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. Anatomy/Imaging: Development of innovative and fundamental metrics to quantify and assess the relation of joint morphologies of the loaded lumbar spine or lower limb during dynamic Soldier-specific tasks with biomechanical profiles associated with reduced performance and increased injury risk of the dismounted Warfighter.

b. Fatigue: Determining explicit biomechanical tools and measures to assess and predict declines in physical performance across a range of Soldier relevant tasks, scenarios, and environments. Integration of biomechanically based predictive physical fatigue algorithms into real-time monitoring of systems of Warfighter physical performance.

c. Determination of biomechanical measures of fatigue to predict performance failure of critical Warfighter task outcomes.

d. Head/Neck, Helmet: Investigation of the effects of acute and chronic head-borne

weight and moment of inertia on Warfighter performance, fatigue and the incidence of injuries. Determination of physical and mass property boundaries of head-borne mass for the dismounted and mounted Soldier based on performance, fatigue and injury.

e. Biomechanics in the field: Validated, reliable, and accurate methods for acquisition and analysis of marker-less kinematic (and kinetic) data during Soldier-specific tasks performed in a variety of environments that are suitable for integration into real-time monitoring of Warfighter performance injury risk. Technological capability must be able to integrate seamlessly with wide variety of Warfighter clothing and individual equipment worn and carried on the body.

f. Modeling & Simulation: Development of modeling and simulation tools, as well as virtual prototyping tools to allow for the assessment of the effects of Soldier-borne equipment on the performance of military relevant tasks (i.e. human locomotion over various types of terrain and other Soldier-specific maneuvers). Within the tool the ability to model typical Soldier loads, as well as the ability to model other wearable devices (e.g. human augmentation devices) is desirable to assess their effects on Soldier performance.

g. Novel Pressure/Force Measure: Capability that advances the current state of technology to measure the pressure and/or force applied to the shoulders/upper back/lower back region of Soldiers while fully encumbered with military equipment.

h. Obstacle Course and Agility: Tools and measures that tie lab-based scientific measures to Warfighter relevant obstacle course performance as well as establishment of valid and reliable tools and measures sensitive to Soldier-borne equipment effects.

i. Soldier Load: Determination of the biomechanical effects of varied mass, volume, and location of loads on the range of Warfighter performance and Warfighter tasks; development of prototypical devices that facilitate enhancing the understanding of load (re-) distribution on the body; and research that addresses optimizing load distribution and its benefit on marksmanship, agility maneuvers, climbing, sprinting, other military relevant environs.

j. Soldier Performance Augmentation: Fundamental research that advances knowledge on scientific issues surrounding efficacy of prototypical devices designed to augment Soldier performance. Development of wearable devices designed to augment Soldier performance (e.g., reduce metabolic cost of load carriage, enhance mobility, increase strength, etc.).

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

Technical POC:
Mr. John Ramsay TEL: (508) 206-3888,

john.w.ramsay4.civ@mail.milAll concept papers, proposals and administrative

inquiries should be submitted to:

U.S. Army Natick Soldier Systems Center
CCDC Soldier Center
ATTN: FCDD-SCO (Mr. Matthew Whipple or Ms. Jennifer Rourke)
General Greene Avenue Natick, MA 01760-5020
TEL: (508) 206-3803 (Mr. Whipple) or 508-206-3853 Ms. Rourke
Email: usarmy.natick.ccdc-sc.mbx.osi-spod@mail.mil

3. Anthropometry

The CCDC Soldier Center has traditionally maintained an extensive anthropometric database on U.S. Army and other military personnel. Anthropometric data are used 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 crew stations. 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 U.S. Army is currently executing a major anthropometric survey of its personnel to collect current body size information for use in the applications defined above.

Scientific and Technical Areas of Interest:

a. Develop software tools for extracting traditional anthropometric data and other human engineering related measurements of the human body such as volume, surface area, and curvatures from 3D whole body, head/face, and foot images. These tools may include applications for measurement of the human body as well as for summarization of body size and shape using 3D anthropometric data. These tools shall be implemented on 3D human body surface images and integrated with hardware and software systems currently in use by US Army anthropologists and human engineers.

b. Develop and/or integrate human body modeling software into an analytical computer based system that allows clothing and equipment designers to visualize, compare and evaluate the effects of single and multi-layer clothing/equipment systems on the physical performance of human users. The resulting tolls will be used by anthropologists and human engineers to assess the impact of clothing/equipment systems (body armor, helmets, NBC, and thermal protective

clothing) on key performance parameters such as mobility, movement, and overall area of coverage of the human body.

c. Obtain clothed and encumbered anthropometric measurement data on a representative set of US Army personnel in order to identify the dimensional changes in body size that occur as single and multi-layer clothing and equipment systems worn by Warfighters. At a minimum, identify and quantify the body size changes that occur under current and next generation clothing and equipment systems that impact Warfighter body size for typical Infantry, Aviation and Ground Vehicle Warfighters. Data collection procedures may include a combination of traditional anthropometric tolls and/or 3D whole body and body segment scanning of study participants depending upon the specific nature of the clothing and equipment systems being investigated. Close coordination between the government and offeror on such matters as the final dimension list, body land marking requirements, quality control implementation, and data cleaning t shall be required throughout the duration of this data collection effort.

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

Technical POC:

Ms. Karen Gregorczyk, TEL: (508) 206-3885,

karen.n.gregorczyk.civ@mail.milAll concept papers, proposals, and

administrative inquiries should be submitted to:

U.S. Army Natick Soldier Systems Center
CCDC Soldier Center
ATTN: FCDD-SCO (Mr. Matthew Whipple or Ms. Jennifer Rourke)
General Greene Avenue
Natick, MA 01760-5020
TEL: (508) 206-3803 (Mr. Whipple) or 508-206-3853 Ms. Rourke
Email: usarmy.natick.ccdc-sc.mbx.osi-spod@mail.mil

4. 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 science 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 complex 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 as the interaction between warrior cognitive and physical performance. The objective of this area of study is to generate methodologies, relevant data and models that will advance the ability to measure, predict and enhance warrior performance in training and mission contexts. Outputs can be applied directly to the development of emerging warrior systems with equal emphasis on physical and cognitive performance. 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 understand and predict the performance of individuals and small units with respect to their Situation Awareness, memory and decision-making in relevant Soldier environments. Understanding what is important to measure and how to measure in soldier context is of value. Influencing factors for investigation should include understanding the relationship of individual knowledge skills and abilities on cognitive and/or physical performance in mission context, 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 performance of individuals and small units. Studies on the impact of different technology types on situation awareness, decision-making and measures of performance 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 and/or workload, 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 and/or cognitive workload, and determining whether levels/degrees of fatigue and/or workload can be predicted based on personal characteristics and/or physiological measures.

c. Research aimed at identifying, characterizing, and validating novel warrior performance optimization or enhancement techniques. Techniques can be focused on cognitive and/or physical performance in training and mission contexts.

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:
Dr. Caroline Mahoney, TEL: (508) 206-3833, caroline.r.mahoney.civ@mail.mil

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

U.S. Army Natick Soldier Systems Center
CCDC Soldier Center
ATTN: FCDD-SCO (Mr. Matthew Whipple or Ms. Jennifer Rourke)
General Greene Avenue
Natick, MA 01760-5020
TEL: (508) 206-3803 (Mr. Whipple) or 508-206-3853 Ms. Rourke
Email: usarmy.natick.ccdc-sc.mbx.osi-spod@mail.mil

5. Soldier Power Sources, Power & Data Distribution and Management

In the future Multi-Domain Operational Environment, dismounted Warfighter capabilities will continually be modernized with advanced sensors, networking and processing technologies, all of which require power. While many of these new capabilities will possess advanced low power electronics and power management features, the need for innovative and safe power source solutions for the Warfighter and 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.

The Army's Soldier Modernization program includes viewing the Soldier as a System. From this perspective, hybrid power architectures that combine centralized and distributed power sources are being investigated. Implementation of this architecture necessitates exploration of both wired and wireless power and data distribution. Incorporation of power management features that reduce power consumption without impacting mission effectiveness is also being explored.

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

- 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.
- Battery technologies and concepts that provide improvements in energy density, ergonomics, "ease of use", and safety to facilitate human factors and Soldier-centric integration are of interest.

- Technologies that enable battery charging on the Soldier while on the move are of interest. Small power-dense and efficient fuel cells are of specific interest.
- Technologies that efficiently and effectively distribute and manage power on the Soldier are of interest. Cables and connectors are of specific interest.
- Providing individual Soldiers with accurate and reliable power status data, which is a key enabler to the Army's Operational Energy campaign, is of interest.

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

Technical POC:
Mr. Scott Feldman, TEL: (508) 206-3859, scott.j.feldman2.civ@mail.mil

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

U.S. Army Natick Soldier Systems Center
CCDC Soldier Center
ATTN: FCDD-SCO (Mr. Matthew Whipple or Ms. Jennifer Rourke)
General Greene Avenue
Natick, MA 01760-5020
TEL: (508) 206-3803(Mr. Whipple) or 508-206-3853Ms. Rourke
Email: usarmy.natick.ccdc-sc.mbx.osi-spod@mail.mil

6. Future Warrior Technology Integration.

As the Army transforms to a lighter, more agile, and lethal force, a revolutionary approach to system design and integration is needed, consisting of open system architectures to provide lightweight, system-engineered, integrated modular protective combat ensembles employing plug and play components. New technologies and design concepts must be explored to provide the warrior with combat overmatch through revolutionary advances in survivability, mobility, networked communications, collaborative situational awareness, power sources, and networked lethality/fire control while enabling extended combat missions with reduced loss in physical capabilities from fatigue, stress, and hardship.

Scientific and Technical Areas of Interest:

a. Proposals are needed to integrate, mature, and demonstrate innovative ballistic and blast protection solutions to provide increased protection against evolving bullet, fragmentation, and blast threats through an architecture that integrates weight

reduction, anthropometry, modularity, and tactical gear packaging to increase mobility and reduce stress. Examples include: develop multiple impact survivability concepts for torso and improved protection for head, face, and extremity; mature and integrate advanced fiber, polymer, ceramics, nano and/or composite material technologies for ballistic and blast protection.

b. Proposals are needed to integrate and demonstrate innovative integrated solutions in the areas of: tactical concealment and multispectral signature reduction; and protection against flame, lasers, chemical, biological, and toxic industrial chemicals and materials. Technology options include selectively permeable membranes, flame resistant fibers, fabrics and treatments, and nanotechnology based materials.

c. Proposals are needed to integrate and demonstrate novel design approaches and technologies to provide body worn enhanced passive, active, and hybrid thermal management (optimized for weight and power reduction). Examples include: body worn ventilation and filtration systems; incorporating active microclimate cooling with Body armor and Chemical-Biological protective suits; incorporating active ventilation with headgear protection; and semi-permeable and moisture wicking membranes/fabrics for improved temperature and moisture management.

d. Proposals are needed to mature, integrate, and demonstrate Soldier mobility and load assistance solutions to include physical augmentation/exoskeleton, lower extremity load assistance devices, and advanced systems for load assistance applications for able- bodied operators. These systems must provide improvements in physical performance while maintaining user safety and reducing muscular and metabolic fatigue during load carriage activities.

e. Proposals are needed to mature and integrate Warfighter and Small Combat Unit (SCU) networking technologies with Soldier information awareness systems and emerging tactical networks. The goal is to maintain compatibility and interoperability of unique platoon, squad, and Warfighter information requirements with company and higher Command and Control (C2), and Situational Awareness (SA) infrastructures. Technology solutions include reliable jam- proof wireless technologies and advanced cabling and connectors to include e-textiles and micro/nano connectors to enhance personal area networking between head, body, and weapon systems.

f. Proposals are needed to integrate, mature, and demonstrate innovative Warfighter power and energy solutions to Soldier System. The goal is to provide higher power and energy density sources for ground and mounted Warfighters. Examples include: direct and reformed methanol fuel cell, conformal low-profile rechargeable battery, enhanced zinc-air battery, and platoon/squad level generator/charger.

g. Proposals are needed to mature, evaluate, and integrate Small Combat Unit (SCU)

lethalityconcepts and technologies to include small unit cooperative engagement for more accurate firing solutions, common net-centric SOSCOE compliant Fire Control and body-worn gunfire detection solutions.

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

Technical POCs:

Mr. David Audet, TEL: (508) 206-3870, david.j.audet2.civ@mail.mil Mr. Michael Samuel (for Soldier mobility and load carriages technologies), TEL: 508) 206-3860, Michael.n.samuel.civ@mail.mil

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

U.S. Army Natick Soldier Systems Center
CCDC Soldier Center
ATTN: FCDD-SCO (Mr. Matthew Whipple or Ms. Jennifer Rourke)
General Greene Avenue
Natick, MA 01760-5020
TEL: (508) 206-3803 (Mr. Whipple) or 508-206-3853 Ms. Rourke
Email: usarmy.natick.ccdc-sc.mbx.osi-spod@mail.mil

7. Technology Assessment and Simulation Tools.

As the Army transforms to a lighter, more agile and lethal force, a revolutionary approach to system integration, assessment and simulation of Warfighter systems architectures encompassing all aspects of dismounted maneuverability to include protection, networked communications, collaborative situational awareness, power sources, and networked lethality/fire control is needed.

Scientific and Technical Areas of Interest:

The following technical areas warrant research and development efforts.

a. Proposals are needed to develop engineering assessment and simulation tools for the CCDC Soldier Center dismounted Soldier systems labs and associated distributed labs. The lab objectives are to develop effective tools to expedite the integration and the assessment of dismounted soldier component technologyprior to field experimentation.

b. Proposals are needed to expand the current simulation capability into the realm of performance metrics associated with dismounted Soldier use of component technologies. The expected simulation capabilities performance metrics include:

- Development of simulation and architecture capabilities, Artificial

Intelligence and Machine Learning (AI/ML) Efficacy, Information Portrayal Efficacy, Cognitive Loading, Squad Situational Awareness during planning, movement, execution, reconsolidation, and after action reviews.

- Displays, reporting efficacy, unstructured communications, voice, white boarding, structured communications, Squad computer input devices, and lethality component performance: accuracy and latency.

- Small, combat unit net centric performance for information dissemination and portrayal, asset control, sensor data dissemination, and sensor data consumption including unmanned aerial vehicle (UAV), unmanned ground sensor (UGS), unmanned ground vehicle (UGV), Chem/Bio, soldier worn gunfire detection (SWGD), and Mobility.

Communication with the Technical POC prior to the submission of concept papers or formal proposals is required.

Technical POC:
Dr. David Darkow, TEL: (508)314-2953, David.j.darkow.civ@mail.mil

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

U.S. Army Natick Soldier Systems Center
CCDC Soldier Center
ATTN: FCDD-SCO (Mr. Matthew Whipple or Ms. Jennifer Rourke)
General Greene Avenue
Natick, MA 01760-5020
TEL: (508) 206-3803 (Mr. Whipple) or 508-206-3853 Ms. Rourke
Email: usarmy.natick.ccdc-sc.mbx.osi-spod@mail.mil

8. Ecological Approach to Warfighter Survivability; Perception-Action-Cognition

The degree to which physically coupled load, coupled environmental information, and cognitive requirements interact in regulating of emergent properties of Warfighter performance is unknown. Consequences on perception-action (P-A) coupling are suggested to have significant impact on Warfighter survival and performance, given the extreme loads, cognitive tasks, and environmental constraints of combat and training. This new thrust area within CCDC Soldier Center offers the potential for significant progress in understanding the impact of load, equipment, cognition, and environment on Warfighter survival and performance using Ecological Task Analysis.
Research is required at the Applied and Basic levels in order to ascertain and link operational performance metrics, coordinative and intentional dynamics, and underlying system dynamics

to survivability and performance in combat. The 'Enterprise for the Ecological Study of Warfighter Load' seeks to integrate various aspects of Ecological theory and Dynamic Systems approaches to understand the nested dynamics involved in specific operational tasks (dynamic marksmanship, threat identification during locomotion, situational awareness, etc). Impacts of physically coupled load on information pick up and intentional task dynamics under fatigue/stress conditions are an unexamined but necessary area of research into Survivability.

The Enterprise seeks to build a collaborative group within Government and Academia who support "best practices" data collection and analysis approaches in order to best serve the Warfighters needs while expanding the applicability of the ecological approach to understanding the "Human Dimension'.

Scientific and Technical Areas of Interest:

The following are some of the fundamental questions necessary in understanding the overall consequences of Warfighter load, necessary subordinate relations to task performance, and the modeling necessary to further our understanding. While marksmanship is initially of primary interest due to the potential consequences of load on P-A/ survivability; there certainly exist other equally relevant areas of investigation using the ecological approach in understanding the problems of technology overload. Thus, the list below should not be considered exclusive.

Applied Research Questions:

1. What are the consequences of Warfighter load on Perception-Action coupling necessary for Survival in combat?

    a. How does load affect establishment of marksmanship postures and the necessary postural affordances for perception of the environment?

    b. How does load affect the coordination dynamics during dynamic marksmanship in different "work-spaces" within the environment?

    c. What are the consequences of segmental loading on the speed-accuracytrade-off during marksmanship; what are the basic metrics that provide insights into local and global dynamics?

    d. Can Hybrid Oscillator Models be developed for Fitts Law Tasks using Speed and Load Parameterization for Marksmanship tasks?

2. What fundamental impacts does segmental loading have on the perceptual capabilities of the Human System during movement through the environment?

a. How does segmental loading and speed affect the ability to successfully identify and discriminate (e.g. Friend v Foe) targets in the environment during straight-line locomotion?

b. How does segmental loading and speed affect the ability to successfully identify and discriminate (e.g. Friend v Foe) targets in the environment during different locomotive styles (e.g. straight line, side to side, around obstacles, over rough terrain, etc.)?

3. What are the effects of terrain complexity and load on visual perception/Dynamic Visual Acuity (DVA)?

   a. How does load and speed parameterization affect DVA during locomotion when terrain becomes increasingly complex?

   b. How do Warfighters navigate differential terrain under different loads, speeds, and terrestrial complexity in the short range (e.g. 5-20m), mid-range (20-50m), and long-range (50+m) in order to achieve maximal efficiency of movement?

4. How does Perceptual Encapsulation of the Warfighter affect information pick-up and action under load (e.g. reduced field of view, aural localization)?

   a. How do area of protection trade-offs (e.g. greater visual & aural encapsulation) affect threat pick-up, and to what degree is the aural-visual contribution to information pick-up modified?

   b. To what degree do 'enhanced' perceptual technology systems (e.g. night vision, expanded aural awareness, etc.) disrupt natural information pick-up and the ability to localize sources of information in the environment?

   c. How does the addition of head-mounted load relate to the ability to localize environmental information; what are the changing visual-aural dynamics with increased encapsulation from the local environment?

5. What are the consequences of integrating relevant cognitive tasks into the perception-action cycle necessary for survival for the above tasks?

   a. Aural Communication with/without Simple Repeated Response?

   b. Aural Direction with/without Complex Response?

   c. Retention of Key information for prospective performance at different time scales during dynamic tasks.

d. How do coordination dynamics and performance change when these tasks are integrated into the intrinsic dynamics of marksmanship and threat identification during locomotion.

6. How can Survivability be modeled empirically based on the interaction of Mobility, Lethality, and Situational Awareness (Perception) for the above tasks under load?

   a. Can n-dimensional subordinate sub-space models be developed for Mobility, Lethality, and Situational Awareness that interact with a Superordinate Survivability Model for use in decision making, Analysis of Alternatives for load configuration and design metrics?

7. How does one design advanced equipment to carry the Ballistic and Fire Load required by the Warfighter in such a way that is complies with both empirical scientific findings and insights (relevant for *tactical* engagement) AND the realities of Operations across the spectrum of mission profiles (operational realities)?

   a. Are there advanced designers and products that can provide the tactical requirements for Warfighter and integrate recent scientific findings regarding Shoot and Move dynamics?

   b. Is there a way to modularize the equipment such that load distribution may be managed in such a way as to allow different mission profiles to be supported without substantial changes in configuration (e.g. a specific building block approach of increased load carriage requirements within operational realities)?

   c. Is there a way to modify current load carriage distribution and design to "meet in the middle" with operational requirements by suggesting changes to Tactics, Techniques, and Procedures (TTPs) that provide:

      1) Similar or increased performance at the level of the Task (e.g. speed accuracy).

      2) Quantitative improvement in the dynamics that underlie that task performance (e.g. improved segmental coordination, postural control, and postural-focal coupling in dynamic marksmanship tasks).

      3) Integrated changes in TTPs testable, acceptable, and modifiable (flexible) to the Warfighter when new concepts in load carriage and distribution are instantiated by Scientific/Industry teaming?

NOTE: Question 7 requires submitters to have substantial understanding of the history of load carriage and designs for tactical missions across the broad spectrum, Industrial capability for manufacturing advanced concepts designs, and significant tactical insight to understand and trade the Operational – Scientific perspective in such a way that optimizes Warfighter success in the execution of actions on the objective. The intent of question 7 is to provide a basis for answering these questions as well as the development of advanced concepts that are testable in the larger program entailed in this BAA Section.

Basic Research Areas:

1. Fundamental haptic response to Load parameterization: effects on motor abundance, stability, and adaptability. Biotensegrity models and dynamic touch as a means to understand the dynamics of segmental load.

2. Dynamic visual acuity (DVA) and precision performance underload.

3. Aural-visual localization under increased perceptual encapsulation and load.

4. Consequences of load on behavioral action modes; Biospectroscopic analysis of load parameterization in field conditions. Long time-scale impacts on affordances under load and reflections of route choice and task accomplishment in combat.

5. Marksmanship synergies under load: task space analysis and the constraints on the Degrees of Freedom. Postural-focal coupling in complex movement and systems-level dynamics.

6. Development and utilization of advanced techniques in non-linear analysis, fractal/dimensional analysis, and Human Dimension metrics. Multi-scale dynamics that underlie performance in visual-manual precision task interaction.

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

Technical POC:
Ms. Karen Gregorczyk, TEL: (508) 206-3885,

karen.n.gregorczyk.civ@mail.mil All concept papers, proposals and administrative

inquiries should be submitted to:

U.S. Army Natick Soldier Systems Center
CCDC Soldier Center
ATTN: FCDD-SCO (Mr. Matthew Whipple or Ms. Jennifer Rourke)
General Greene Avenue
Natick, MA 01760-5020

TEL: (508) 206-3803(Mr. Whipple) or 508-206-3853 Ms. Rourke
Email: usarmy.natick.ccdc-sc.mbx.osi-spod@mail.mil

9. Soldier Centric Sensors, Information Portrayal, & Data Management Technologies.

The Army is currently leveraging a dismounted Soldier force networked with emerging mobile computing platforms such as tablets, handheld, and head worn displays. Currently, tactical battlefield information portrayal and information processing techniques are not optimized for dismounted mission effectiveness and often burden the Soldier cognitively. Providing emerging sensor and mission command information down to and from the Small Unit level is a unique human systems integration challenge and requires considering the impact on the dismounted Soldier battlespace experience associated with maneuver, protection, and sustainment. Novel information portrayal and management technologies are needed for the Soldier and Small Unit to improve their situational awareness, mission effectiveness, and cognitive performance on the battlefield with respect to maneuver, protection, and sustainment.

Scientific and Technical Areas of Interest:

The following technical areas warrant research and development efforts.

a. Developing novel information portrayal and information management technologies for the Soldier and Small Unit to improve their situational awareness, mission effectiveness, and cognitive performance on the battlefield with respect to maneuver, protection, and sustainment.

b. Developing hands free, low cognitive workload user interfaces concepts and technologies; augmented reality graphical user interfaces, displays, and supporting technologies; information portrayal of Intelligence, Surveillance, and Reconnaissance (ISR) technologies; and modular device architectures for Soldier- worn electronic devices.

c. Applying human-computer interaction, human factors, and cognitive research to improve information portrayal and information management algorithms to cognitively unburden the Soldier.

Communication with the Technical POC prior to submission of concept paper or formal proposal is required.

Technical POC:
Dr. David Darkow, TEL: (508) 206-3883, David.j.darkow.civ@mail.mil

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

U.S. Army Natick Soldier Systems Center
CCDC Soldier Center
ATTN: FCDD-SCO (Mr. Matthew Whipple or Ms. Jennifer Rourke)
General Greene Avenue
Natick, MA 01760-5020
TEL: (508) 206-3803(Mr. Whipple) or 508-206-3853 Ms. Rourke
Email: usarmy.natick.ccdc-sc.mbx.osi-spod@mail.mil

10. Soldier/Squad Performance Optimization.

Tactical readiness is often characterized in terms of four warfighter performance pillars: Shoot, Move, Communicate and Survive. To optimize the readiness of Soldiers and Squads, it is critical that they are trained, expertly led, fully manned, and supported by the most state-of-the-art technologies in the world. As the technology gap rapidly shrinks between global powers, there is interest in monitoring, assessing and optimizing Soldier and Squad performance, understanding what characterizes Soldier and Squad performance degradation, and ultimately what decisions can be made to either reduce degradation of performance or avoid it altogether. Of equal importance is to investigate optimization methods that may enable Soldiers to cope and manage tactical stressors in a more efficient and effective manner.

Scientific and Technical Areas of Interest:

a. Monitoring Soldier/Squad performance – Cutting edge sensor development for monitoring Soldier physical, cognitive, and socio-emotional states, to include but not limited to biomarkers, individual and group movement patterns, physiological status and stress responses, hydration and nutritional levels. Validation of emerging technologies and commercial off the shelf sensor or products, in both laboratory, virtual, and field environments. Tracking Soldier performance through development/training, employment, and deployment phases of the Soldier life-cycle. Sensor fusion and/or technology integration strategies for rapid, pseudo-real time, or real time monitoring of Soldier/Squad performance.

b. Assessing Soldier/Squad performance – Methods for quantifying Soldier/Squad performance in controlled or changing environments, for applications such as live-fire exercises, training events, and marksmanship activities. Identification of tactical stressors that reliably mimic combat scenarios. Visualization of human performance measures for rapid and simplified decision making tools and enhanced training feedback. Decomposition of physical, cognitive, and socio-emotional states from single or similar

data inputs. Development of standardized classification and rating systems for assessing Soldier and Squad tactical performance.

c. Predicting Soldier/Squad performance – Development of algorithms or analytical approaches for predicting changes in Soldier/Squad performance measures. Validation of historical, recent, or emerging models for Soldier/Squad performance. Big data approaches and solutions for down selecting relevant Soldier/Squad measures of performance from large scale, often disparate data sets.

d. Optimizing Soldier/Squad performance – Distinguishing novel intervention strategies for optimizing individual and group nutritional, biological, physical, cognitive (to include neurostimulation and other neuroenhancement research/strategies) and socio-emotional performance. Validation of current or novel training interventions for optimizing Soldier/Squad performance. Virtual reality approaches for non-invasive, iterative training for rapid optimization of Soldier/Squad operations. Squad optimization via individual and role-based teaming strategies.

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

Technical POC:
Dr. John Ramsay, TEL: (508) 206-3888, john.w.ramsay4.civ@mail.mil
and Dr. Marianna Eddy, TEL: 508) 206-3843,
marianna.d.eddy.civ@mail.mil

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

U.S. Army Natick Soldier Systems Center
CCDC Soldier Center
ATTN: FCDD-SCO (Mr. Matthew Whipple or Ms. Jennifer Rourke)
General Greene Avenue
Natick, MA 01760-5020
TEL: (508) 206-3803 (Mr. Whipple) or 508-206-3853Ms. Rourke
Email: usarmy.natick.ccdc-sc.mbx.osi-spod@mail.mil

11. Human Factors

The CCDC Soldier Center has supported and conducted product assessments of Soldier clothing and individual equipment, as well as organizational equipment (e.g., food service items, tents/shelters, air drop equipment), in both S&T and Acquisition. In support of these efforts, research is conducted to develop novel methodologies, understand impacts of clothing and equipment on performance and provide design guidance for novel clothing/equipment.

Scientific and Technical Areas of Interest:

a) Development of tools (software or physical) to assist in the assessment of products for human

system integration (and specifically human factors) considerations. These tools should 1. Streamline data collection capabilities, decreasing manpower requirements in data collection or analysis/post processing/reporting or 2. Allow for standardized collection of novel objective measurements for use in measuring the impact of Soldier clothing/equipment on performance. Close coordination between government and offeror on matters such as user needs/requirements and prioritization of tool capabilities shall be required throughout the duration of the project.

b) Development of methodology (and obtain data) for the assessment of headborne systems, including capturing static and useful field of view, verbal/audio compression and localization, depth perception, dynamic visual acuity, etc. Close coordination between government and offeror on matters such as constraints of methodologies development, identification of relevant metrics, and examples of potential test technologies shall be required throughout the duration of this data collection effort.
c) Development of tool for capturing and processing marksmanship performance throughout the marksmanship process (i.e., acquisition, decision, engagement, transition) for utilization in both live fire and simulated training scenarios. Close coordination between government and offeror on matters such as user needs/requirements and prioritization of tool capabilities shall be required throughout the duration of the project.
d) Integration of eye tracking technology into standard and developing military systems to include headborne systems and weapon sighting systems for utilization in an active, dynamic, and mobile environment. Close coordination between government and offeror on matters such as user needs/requirements and prioritization of tool capabilities shall be required throughout the duration of the project.
e) Development of integrated sensors for monitoring sleep, activity, light exposure, noise exposure, circadian biomarkers. Validation of emerging technology and commercial-off-the-shelf products in both laboratory, virtual, and field environments. Sensor data fusion and integration strategies required for rapid predictive modeling or real-time monitoring of individual physical and mental fatigue and associated readiness levels.

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

Ms. Blake Mitchell TEL:(508) 206-3902, katherine.b.mitchell.civ@mail.mil

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

U.S. Army Natick Soldier Systems Center
CCDC Soldier Center
ATTN: FCDD-SCO (Mr. Matthew Whipple or Ms. Jennifer Rourke)
General Greene Avenue

Natick, MA 01760-5020
TEL: (508) 206-3803 (Mr. Whipple) or (508) 206-3853 (Ms. Rourke)
Email: usarmy.natick.ccdc-sc.mbx.osi-spod@mail.mil

12. Soldier Intelligence, Surveillance, and Reconnaissance (ISR)

Technology development efforts are underway to mature and integrate technologies that address capability gaps associated with small Unmanned Aerial Systems; primarily the need for greater autonomy to reduce cognitive burden, platforms and components to reduce Soldier load, and increase Situational Awareness.

The primary thrust of this activity is the development and demonstration of a highly autonomous Small Unmanned Aerial System (SUAS) and enabling technologies that support Multi Domain Operations. These systems should have the capability to:

- Autonomously navigate to and from a target in a variety of environmental conditions (terrain, weather, etc.)
- Collect salient information, package it and present it in a timely manner to the operator.
- Support mission planning (e.g. path planning)
- Collaboratively work with other platforms to accomplish goals.
- Disseminate relevant products to various Common Operating Pictures (video, telemetry, etc.)

All with the goal of reducing the operational burden on the user so that the Soldier gets the right information at the right time.

Interest under this topic is primarily on algorithms and sensors that support these various goals. Platforms may be of interest if they provide a unique capability to support accomplishing one or more of the stated capabilities. Algorithms should be focused on SUAS but especially on size, weight, power and computing constrained platforms with weights under 5 lbs. No formal size, weight, and power limits are described to allow respondents trade-space.

Scientific and Technical Areas of Interest:

With small UAS the value of the tool is not the platform itself but the increase Situational Awareness and Situational Understanding the platform and its capabilities enable. As a result, maturation and demonstration of the following enabling technologies are required:

a. The ability for systems to continuously video objects or persons of interest
b. Autonomous navigation to and from Points of Interest to include localization, navigation, path planning, and collision avoidance.
c. Operation in GPS Denied/Degraded areas
d. Autonomous dynamic retasking based on the information collected by the system

e. Mission planning capabilities to preplan missions aggregating information from other sources and optimizing for specific mission factors (e.g. time, stealth, etc.)
f. Mission review capabilities to review the information collected
g. Collaboration between systems
h. Algorithms that enable SUAS to operate in higher wind conditions or other perturbations
i. Sensors that provide advanced capabilities for SUAS (e.g. perception, CBNRE)
j. Lightweight and low power data links that reduce bandwidth consumption and enable secure digital transmission of sensor data and operator/system generated command and control (C2) inputs.
k. Applications that provide the capability to generate precise (Category III or better) military grid reference system (MGRS) coordinates for both fixed and moving objects observed within the sensor's video stream.
l. Flight simulators which enable the training via an application and provide feedback and guidance
m. Artificial Intelligence and Machine Learning on edge devices

The goal of this effort is to provide value to the Warfighter through increased situational awareness and understanding, not increase the Warfighter's cognitive burden. Typically, ISR missions are performed in parallel with other combat duties. As such, a user cannot be 100% dedicated to operating the sensor system.

Technology candidates must exhibit a Technical Readiness Level (TRL) of 4-7. Proposals will be entertained for both an overall system design as well as individual sub-systems.

Communication with the Technical Points of Contacts prior to submission of a formal proposal or concept paper is essential.

Technical POCs:
Mr. John Paul Kruszewski, john.p.kruszewski2.civ@mail.mil
Mr. Michael Samuel, Michael.n.samuel.civ@mail

All concept papers, proposals, and administrative inquiries should be submitted to:
U.S. Army Natick Soldier Systems Center CCDC SC
ATTN: FCDD-SCO
(Mr. Matthew Whipple or Ms. Jennifer Rourke) General
Greene Avenue
Natick, MA 01760-5020
TEL: (508) 206-3803 (Mr. Whipple) or
Email: usarmy.natick.ccdc-sc.mbx.osi-spod@mail.mil

13. Biotechnology

Biological processes and systems have evolved efficient responses to pressures in the environment. The science of biotechnology identifies those processes and systems which can be manipulated for enhancement of current technologies or development of new ones. The needs of the Warfighter in the field -- enhanced protection from chemical and biological agents, lightweight clothing and gear, real-time detection and identification of enemy agents, energy creation and storage, and enhanced resiliency and recovery for human performance can be served by research in this growing field.

Scientific and Technical Areas of Interest:

A comparison of current capabilities versus Warfighter needs leads to interest in the following major areas of scientific knowledge and technological capabilities:

a. Novel biologically-based biocides for the generation of antimicrobial materials with non-leaching killing action. Experimentation and theoretical research into the structural interactions and mode of action of peptides at interfaces.

b. Development and enhancement of sensor technologies for detection of chemicals and biological materials.

c. Environmentally benign processes (i.e. low temperature and pressure, aqueous, pH 7) for production of materials.

d. Novel approaches to stabilizing bacteria, enzymes and natural dyes for long-term use in a broad range of environments.

e. Real-time generation of biofuels from renewable resources.

f. Novel, environmentally-friendly FR materials from renewable biological sources.

g. Development of improved antimicrobial and antisporal test methods

h. Novel approaches in the use of prebiotic, probiotics and dietary supplements to enhance the subsistence of the Warfighter.

i. Controlling polymicrobial environments as a strategy for defeating harmful organisms while promoting the growth of beneficial organisms.

j. Understanding self-assembly of structural proteins for fiber/nanofiber formation.

k. Biofermentation for production of recombitant proteins, enzymes, peptides, etc. of interest.

l. Biofermentation to understand novel metabolic capacity and function of gut microbiota, fungi, and viruses.

m. Characterization of skin and gut microbiome, or other relevant microbiomes, at bacterial and/or fungal community and/or functional genomics levels.

n. Influence of xenobiotics on gut and skin microbiome, or other relevant microbiomes, and nutritional or other suitable intervention to restore homeostasis.

o. Approaches to elucidate causative mechanisms across multiple axis including gut-muscle, gut brain, gut-skin, etc., of interest

p. *In vitro* and *ex vivo* eukaryotic cell and engineered tissue models for cognitive and physical performance physiology

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

Technical POCs:

Mr. John Player, TEL:(508) 206-3849, John.player2.civ@mail.mil Mr. Jason Soares, TEL:(508) 206-3838, Jason.w.soares.civ@mail.mil, All concept papers, proposals and administrative inquiries should be submitted to:

U.S. Army Natick Soldier Systems Center
CCDC Soldier Center
ATTN: FCDD-SCO (Mr. Matthew Whipple or Ms. Jennifer Rourke)
General Greene Avenue
Natick, MA 01760-5020
TEL: (508) 206-3803 (Mr. Whipple) or 508-206-3853 (Ms. Rourke
Email: usarmy.natick.ccdc-sc.mbx.osi-spod@mail.mil

14. Physical Performance Technologies

The Army must meet the demands of the future operational environment in alignment with its strategic vision and priorities, to include enabling Multi-Domain Operations (MDO) through 2035. As such, the Army must make the Brigade Combat Team (BCT) and enablers leaner while retaining capability, prevent overmatch through 2035, and set the conditions for fundamental change. The Army MDO force must be leaner, smarter, more lethal, and more flexible. The Army must operate differently, enable forces differently, and organize differently to maintain overmatch, capable of responding to a myriad of threats to our national interests. In this vein, CCDC Soldier Center is interested in researching, maturing, integrating, and demonstrating human physical performance augmentation capabilities such as wearable load assistance technologies and

exoskeletons. These physical performance augmentation capabilities offer improvements in strength, endurance and/or ergonomics while maintaining user safety and comfort. Other desired attributes that should be addressed include mitigating risk of load-induced injury and soreness, allowing for natural range of motion, reducing weight, and increasing power-efficiency, reliability and ease of use (for example developing simple don/doff mechanisms and intuitive /effective user interfaces), as well as addressing compatibility with Soldier clothing and mission equipment.

Physical performance augmentation technologies have the potential to assist various high stress/high fatigue tasks such as heavy and repetitive lifting and other forms of load transportation and carriage that occur during combat, mission support, and other operations. The goal is the technological advancement of physical augmentation capabilities which have the highest potential to optimize individual and small unit mobility and load performance and serve as a force multiplier, to include application in the following operational environments:

1) Combat Support / Sustainment Type –Physical performance augmentation technologies that augment load carriage and reduces overall load burden to the Soldier, helping the wearer to conduct load tasks in logistics, sustainment, and combat support environments. These tasks include, but are not limited to, heavy and/or repetitive supply lifting, loading, unloading, and carrying, and ergonomically challenging tasks (awkward postures, long duration overhead work). Key focuses are injury risk reduction, strength assist, and throughput/ productivity augmentation. Customization of end-effectors based on lift, move, and carry tasks may be desired.

2) Movement & Maneuver / Mobility Type– Dismounted physical performance augmentation technologies to enable enhanced speed, agility and/or endurance, during operations, amplifying the human's ability to accomplish larger tasks, while mitigating the effects of load, mobility and/or repetitive motion on the body (e.g. injury risk reduction). These technologies must allow for typical Infantry Movement Techniques (IMTs) and Tactics, Techniques, and Procedures (TTPs) while providing a metabolic, productivity or other performance improvement during typical dismounted movement & maneuver missions.

Scientific & Technical Areas of Interest:

Concepts are requested to enhance Soldier mobility, relieve Soldier physical load burden, and provide overall load assistance. Innovative physical performance augmentation capabilities, including but not limited to wearable lower body, upper body, and/or full body systems, are requested. The principle concept of interest is providing improvements in physical and operational capability while maintaining user safety and comfort during load carriage activities, allowing the operator to perform mobility and load tasks more safely and effectively. Technology candidates must exhibit a Technology Readiness Level (TRL) of 4-7. Proposals will be entertained for both an overall technology system design as well as individual technology component / sub-systems. Communication with the Technical Points of Contacts (POCs) prior to submission of a formal proposal or concept paper is essential.

Technical POCs:

Mr. Michael Samuel, TEL:(508) 206-3860, Michael.n.samuel.civ@mail.mil
All concept papers, proposals and administrative inquiries should be submitted to:

U.S. Army Natick Soldier Systems Center
CCDC Soldier Center
ATTN: FCDD-SCO
(Mr. Matthew Whipple or Ms. Jennifer Rourke
General Greene Avenue
Natick, MA 01760-5020
TEL: (508) 206-3803(Mr. Whipple) or 508-206-3853 Ms. Rourke
Email: usarmy.natick.ccdc-sc.mbx.osi-spod@mail.mil

D. EXPEDITIONARY MANEUVER SUPPORT AND FIELD SERVICE TECHNOLOGIES

Research and Development.

Expeditionary maneuver support encompasses the capabilities of movement and maneuver, protection, and sustainment of Army forces. These capabilities are often integrated for optimal effect and successful cross-domain maneuver. Our Research and Development mission focuses on expeditionary maneuver support threats and needs in Multi-Domain Operations, as identified by National Defense Strategy objectives and Army Modernization priorities. Mission areas include camouflage, concealment and deception, expeditionary command post infrastructure, collective protection, and sustainment, including additive manufacturing, and expeditionary operations field support services with integrated base defense. Threats encompass both combat and environmental threats, while science and technology capabilities to defeat these threats include improved obscuration, concealment, mobility, transportability, rapid deployment, durability, and reproducibility. Research and Development enhancements are grouped into the overall categories of protection, movement and maneuver, and sustainment. Within an overall category, new expeditionary maneuver support technologies needed to support our Soldiers and Soldier systems are organized by a key thrust area, as outlined below. Section 5. Unit/Organization Equipment describes additional interest areas and Scientific and Technical Areas of Interest for field support services.

Scientific and Technical Areas of Interest:

The following examples (though not inclusive) represent areas of science and technology that are relevant to the objectives supporting the Army's Modernization Priorities for Expeditionary maneuver and may be of interest to the Army.

1. Protection

Ballistic Protection

a. Lightweight rigid expeditionary panels and/or structures effective against ballistic and blast threats utilizing novel materials or ceramic/epoxy/fiberglass

composite panels and novel processes with the capability of localized/variable/active 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 expeditionary protection systems (flexible, thin, abrasion resistant).

c. Concepts and systems capable of providing active and passive force protection systems that are highly expeditionary and decrease both deployment time and manpower requirements and are interoperable with situational awareness technologies.

d. Expeditionary Overhead threat protection modeling, simulation, and Finite Element Analysis (FEA) analysis.

e. Modeling software that will assist in guiding technical solutions based on expeditionary deployability, capability, and human factors.

f. Expeditionary Overhead Threat Protection systems with improved integrated expeditionary catch layer / lightweight/fabric based predetonation screen protection solutions.

Chemical Biological Radiological Nuclear (CBRN) Protection

a. Technologies related to collective protection systems including novel coatings, barrier and reactive materials, passive filtration, expeditionary hermetic structural closures, and improved and advanced entry/exit systems

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

c. Textile based sensors or distributed e-textile systems, on-demand scalable systems (soft and rigid), Chemical Biological Textile wear/useful life indicators

Electromagnetic Interference/Electromagnetic Pulse (EMI/EMP) Protection

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

b. 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.

Environmental Protection and Energy Efficiency

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

b. Superinsulative panels for rigid wall shelters.

c. 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.

d. 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.

e. Renewable energy generation/storage systems and conservation technologies applicable to expeditionary operations.

Detection Avoidance

a. Lightweight, low-cost, flexible and rigid camouflage solutions that reduce Acoustic and Electromagnetic signatures across the electromagnetic spectrum. Solutions should support mobile and/or other expeditionary applications.

b. Material solutions to expedite the emplacement and/or retrieval of signature management solutions to enable Expeditionary Maneuver operations.

c. Modeling/Simulation development to predict Probability of Detection/Identification or performance for detection avoidance solutions.

d. Material solutions that provide low-cost expeditionary deception capabilities.

Maneuver and Movement/Sustainment: Deployment/Durability

a. Fabric Wall Structures

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

2) Bonding techniques that guarantee long-lasting shielding continuity and integrity at seams and cutouts of rigid wall structures.

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

4) 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.

5) Technologies related to the maturation of inflatable structures that carry high loads, are reliable and are 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, and in field repair kits.

6) Self-erecting fabric and rigid structures utilizing novel technologies such as shape memory materials and phase change materials.

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

8) Soft wall structures that can become rigid with application of external stimulus, using reversible rigidizing polymers.

b. Rigid Wall Structures:

1) Lightweight, durable, high strength, low-cost, fiber composite rigid panels for expandable rigid wall structures with low flame propagation, smoke generation and no toxic fumes.

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

3) Improved expandable rigid wall designs for expandable structures or improved composites to existing rigid wall structures that reduce cost, the number of personnel needed, and/or the amount of time required to set up and tear down.

4) Improved vehicle mounted or trailer-based rapidly deployable rigid structures.

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

Functional Integration of Multiple Technologies

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

b. Integration of multiple structural 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/framed support.

c. Technologies which integrate multiple base infrastructure functions to enhance the utility of expeditionary rigid structures.

d. Rapidly emplaced expeditionary sustainment technologies.

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

f. Equipment technologies to ensure the sanitary protection of hardware during set-up, deployment, operation, and pack out; ensure efficient and effective cleaning and sanitation of mobile military equipment.

Miscellaneous

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

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

c. New technologies that will benefit shelter electrical systems such ashigh efficiency lighting, power management, and field photovoltaic systems.

d. Novel technologies to enhance command post operations.

e. Additive manufacturing of lightweight structures and their components that could be printed in the field. This would include replacement parts for shelter systems (walls, support structures) and additive manufacturing of components that can be assembled in the field into a desired protective position or cover.

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 have the Technical POC listed in the solicitation for guidance.
Communication with a Technical POC prior to submission of a formal proposal is essential.

Technical POCs:
Mr. Thomas Reynolds, TEL: 508-206-3622, Thomas.f.reynolds10.civ@mail.mil Mr. Melvin Jee, TEL: 508-206-3648, Melvin.w.jee.civ@mail.mil

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

U.S. Army Natick Soldier Systems Center

Combat Capabilities Development Command Soldier Center ATTN: FCDD-SCE (Ms. Virginia Rettie)
General Greene Avenue Natick, MA 01760-5018 TEL: 508-206-3604,
Virginia.h.rettie.civ@mail.mil

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:

- Space Heaters for Tentage and Shelters
- Mobile Laundry Systems
- Shelter Air Conditioners (heat and cool)
- Water Heaters for Laundry, Showers, and General Purpose Hot Water
- Field Shelter and Textile Repair Equipment
- Field Sanitation and Hygiene Equipment
- Low Powered, Efficient Shelter Lighting
- Mortuary Affairs Equipment
- Latrines and Incinerators for Human Waste Collection and Disposal in the Field
- Lightweight Portable Shower systems
- Field Furniture
- Portable Field Waste Water Treatment/Recycling Systems
- Co/Tri-Generation Technologies
- Rigid wall shelter systems
- Soft wall shelter systems
- Vehicle mounted shelter system
- Advanced Camouflage systems

- Mobile Camouflage systems (Vehicle mounted)
- Decoy systems
- Rapid Deployable Protection Systems

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 combustion technology to allow the exploratory development of clean-burning, efficient, and safe multi-fuel fired, low-powered heaters for the field. This includes both space and water heaters.

b. Advanced cooling and control technologies improving equipment that conditions air in tents, containers and weapons systems. Specific areas of interest are increased reliability, modularity, able to use a mix of refrigerants, increased maintainability, low GWP refrigerants, reduction in power consumption, compatibility with a variety of electrical power sources, including AC and DC, various voltages, and various frequencies.

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

d. Technology to produce low-cost, high efficiency, lightweight equipment for heating and ventilating, uniform heated/cooled air distribution.

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

f. Novel and exploratory concepts to provide low-powered/self-powered field lighting using liquid fuels such as diesel and jet fuel.

g. Advanced small capacity multi-fuel combustion, heat transfer, and material technologies to allow development of lightweight highly portable general purpose hot water/space heaters for field use. F24/JP-8 (F34)/diesel combustion technologies including vaporization, atomization, and gasification (catalytic or otherwise) that are efficient, clean, reliable, and maintainable.

h. Advanced laundry technologies for reducing power, water and the use of detergents and water over existing systems.

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

j. 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.

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

l. Novel means of power generation (thermoelectric, thermophotovoltaics, solar, fuel cells, renewable energy etc.) to allow field service equipment such as heaters, showers and laundries, to be self-powered for operation in remote/isolated locations with minimal need without need of tactical generators.

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

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

o. Advanced technologies to permit the development of innovative equipment identified in the functional areas above to improve the quality of life for the soldier in the field.

Communication with the Technical POC prior to submission of a formal proposal is essential. All concept papers should be submitted to the Technical POC below.

Technical POC:
Mr. Alex Schmidt, TEL: 508-206-2845, Alexander.j.schmidt4.civ@mail.mil. All proposals and administrative inquiries should be submitted to:
U.S. Army Natick Soldier Systems Center PM-Force Sustainment Systems

ATTN: SFAE-CSS-E2-F (Tina Sheppard) General Greene Avenue Street Natick, MA 01760-5057
TEL: 508-206-2831, Tina.l.sheppard.civ@mail.mil.

E. AERIAL DELIVERY

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 and all types of aerial delivery applications from a wider range of air vehicles. Airdrop science and technology is focused on: 1) increasing aircraft (manned and unmanned, fixed wing and rotary wing)/airborne force survivability in a threat environment by expanding the aerial delivery operational envelope; 2) improving airdrop accuracy through the introduction of standoff of various level of Lift to Drag ratios and will consider power augmented offsets precision guided aerial delivery platforms, Advanced High Altitude Low Opening (HALO) capabilities 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) enhance personnel airdrop capabilities both for high altitude standoff and low level operations by improving both canopy and auxiliary systems performance; 5) reducing the cost and time required for parachute development and production by new manufacturing techniques and using novel parachute designs developed by computational analytical methods to reduce manufacturing and testing requirements; and 6) technologies to improve Helicopter (manned and unmanned) Helicopter Sling Load (HSL) and External Air Transport (EAT) capabilities.

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 (1-60K lbs.) and varying ranges of off-set distances, including higher altitudes and/or high glide and extended off-set powered systems. Affordable high altitude precision delivery systems and, where applicable, 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, manned and/or unmanned. Complimentary weather sensors and forecasting technologies for integration and/or use with mission planning and/or precision aerial delivery systems.

b. Concepts and development of extraction systems for light (10K lb.) through heavy (80K lb.) payloads from a range of transport aircraft and a range of aircraft velocities/altitudes (through range of aircraft flight envelopes).

c. Lighter weight and lower cost airdrop components than currently used for cargo and/or personnel airdrop systems. New rapid rigging/derigging and reduced velocity landing technologies for heavy drop platforms are desired to speed the preparation and recovery phases of airdrops.

d. Steerable personnel parachute systems that provide accurate delivery and minimize body injuries by means of low velocity landings and ground wind attenuation. High glide and high off-set distance wing/system designs along with high tech communication, video/audio, and global positioning systems are needed for high altitude standoff operations. Also required are in-flight communication systems for high altitude deployed paratroopers and HALO/HAHO (High Altitude High Opening) altitude awareness and navigation aid systems for Special Operations Forces (SOF) units. In addition, lightweight oxygen systems are needed to support increased duration missions for high altitude deployed paratroopers.

e. Advanced low altitude personnel mass tactical airdrop systems that incorporate novel concepts/technologies and increase parachutist safety. Could include development of medium and/or higher order modeling and simulation capabilities for individual systems, exploring new concepts and/or new methods of deploying, material improvements as well as automatic opening technologies, and/or new aircraft exit technologies. Additionally, explore concepts for rapidly assembling a full end to end current or future global response force.

f. Technologies, concepts, and techniques to minimize the signature and risk of mission compromise of personnel and/or cargo airdrop systems to include any/all of the following types of detections: visual (day and night), radio frequency (RF) emissions, acoustic (aerodynamic noise), thermal (infrared), and radar return signatures.

g. Technologies to support "combination drops" in which cargo is dropped with jumpers following. This mission involves deconfliction, digital communication between jumpers and aerial guidance units, full situational awareness, and the ability of jumpers to command drop zone changes for their cargo in flight.

h. Next generation environmental protection for HALO/HAHO parachutists. These systems will allow free fall jumpers to perform insertion operations from greater offsets which require remaining aloft for extended lengths of time in a harsh environment.

i. Next generation parachutist oxygen delivery systems to address increased O2 requirements resulting from high altitude standoff missions. These systems will allow for reduction in weight and size and provide more efficient ways to deliver O2 while parachutist's pre-breathe or are under canopy.

j. Advanced personnel and cargo infiltration and exfiltration technologies such as powered flight or extended glide to maximize offset for airborne insertion and allow for exfiltration of personnel and cargo.

k. Advanced and/or automated construction/manufacturing methods, and/or auto-packing methods, and/or automated inspection technologies for all types of parachute and aerial delivery systems.

l. New/Novel low cost materials for aerial delivery systems.

m. Environmentally friendly materials for one-time use aerial delivery systems. Dual use materials which may be used for shelter, fuel, power generation, etc. after aerial delivery mission.

n. Development of interactive/electronic textiles (fabrics, cordage, and webbing) for parachutes to monitor and improve aerial delivery system performance and/or textile structural health monitoring such as canopy fabric structural behavior during inflation, variable glide ratio capabilities, textile structural integrity monitor/indicator, textile tension/stress/strain sensing capabilities, and environmental-adjustable materials.

o. Development of materials that have a more user and environmentally friendly disposal method than materials currently used in low-cost, one-time use cargo parachute. Current material is a woven polypropylene geotextile and is disposed of through burning. The most desirable technologies would allow the users to completely abandon the parachutes on the drop zone where they land with the confidence that within days or weeks the material will have fully or partially degraded to eliminate its physical footprint. Materials that have the ability to partially or fully degrade through various trigger mechanisms (such as thermal, mechanical, photochemical, biological, chemical, or electrical) in a time period that could range from a few seconds to a few days are ideal. Degradation could be initiated by natural means (such as ambient light or heat) or via a man-made trigger (application of water or voltage).

p. Study of the storage and use factors that influence the degradation of material and parachute performance over time (service life/storage life of personnel, cargo, HSL, LCADS equipment).

q. Technologies that will both reduce the footprint and signature (e.g. visual, IR, etc) of landed parachutes while also able to survive the challenging airdrop environment.

r. Modeling and experimental investigation of all the stages of parachute systems to include inflation and steady descent for modifiedround

canopies, cross canopies, single-skin and ram-air parafoils, and new parachute designs.

s. 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.

t. Advanced sensors, instrumentation and measurement methods to measure and investigate parachute aerodynamics and structural dynamics during opening, descent, and landing phase including aerial delivery system spatial position, motion and geometry; fabric strain; opening force; air velocity; air pressure; and overall flow field.

u. Advanced technologies for precise and/or autonomous delivery and derigging of robots, unmanned ground vehicles, and unattended ground sensors.

v. New Helicopter Sling Load (HSL) and External Air Transportation (EAT) concepts that will reduce or eliminate the ground personnel required for hook-up, increase flight stability ranges for HSL items, increase flight envelope while not modifying the current airframes.

w. Autonomous airdroppable and/or ground launchable technologies/systems for ranges between 250-500KM that can deliver up to 500 lbs. of cargo in any weather/environment. Reusability is desired but not required. The ability to deploy payloads from the system in smaller weight increments (20 to 100 lbs. /drop) is also desired but not required. Technologies to enhance mission planning capabilities for long range a system, perhaps utilizing some artificial intelligence to autonomously determine the optimum route based weather forecasts provided and/or measured on route, to prioritize either speed to location, and/or avoiding populations, and/or reducing signature during certain aspects of the route etc.

x. Technologies to enable precision delivery of cargo and personnel in a Global Positioning System (GPS) denied environment, in all conditions (day/night, weather, etc.), to include sensors, sensor integration, hardware, firmware, software, and GN&C algorithms.

y. Other aerial delivery applications with DoD and/or other US Government applications to include aerial delivery from VTOL aircraft and UAS.

Communication with a Technical POC prior to submission of a formal proposal is essential. Technical POCs:
Mr. Richard Benney, TEL: 508-206-3200,
richard.j.benney.civ@mail.mil Mr. Scott Martin, TEL: 508-206-3202,
scott.c.martin.civ@mail.mil

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

U.S. Army Natick Soldier Systems Center
Combat Capability development Command Soldier Center ATTN: FCDD-SCA-ADE (Ms. Allison Griffin)
General Greene Avenue, MA 01760-5017
TEL: 508-206-3263, allison.k.griffin4.civ@mail.mil

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

U.S. Army Natick Soldier Systems Center
Combat Capability development Command Soldier Center ATTN: FCDD-SCA (Mr. Richard Benney)

General Greene Avenue, Natick, MA 01760-5017 Email: richard.j.benney.civ@mail.mil

F. SIMULATION AND TRAINING TECHNOLOGY

Embedded Training (ET):

ET is the Army's desired training capability. This capability is designed into the future Ground Combat Systems (GCS). Research, development, and demonstration of ET technologies that are capable of interoperating with the Synthetic Training Environment to enhance training realism and effectiveness is needed. The goal is to enable more cost-effective training and mission rehearsal for individuals and crews. The system must provide precision visual feedback of gunnery results and terminal effects during the conduct of gunnery and maneuver exercises. To the maximum extent possible, all devices should be developed to utilize the capabilities already inherent to the platform or soldier. The embedded live training approach will support a "train anywhere, train anytime" capability and provide the ability to participate in instrumented live force-on-force or force-on-target training exercises. Pacing technologies include, but are not limited to:

(1) AI-enabled training for mounted and dismounted tasks that function on Small Size, Weight and Power (SWAP) based GPU/CPU based computers
(2) Ability to train future skills on technologies such as (Vehicle Protection System, Anti-Tank Guided Missile, High Energy Laser, AI-enabled autonomous assets, Aided Target Detection, and Recognition)
(3) Novel 3D user interfaces
(4) Ability to conduct training in conjunction with mixed reality, virtual 3D, and constructive environments
(5) Non-laser-based training systems
(6) Modular Open System Approach for ET

TPOC: Latika Eifert, (407) 384-5338, latika.eifert@us.army.mil.

Live Training Simulation of Tactical Weapon System Lethality:

The Army's existing capability to conduct Live force-on-force training is based on simulating weapon system tactical engagements which is currently achieved using the Multiple Integrated Laser Engagement System (MILES). The ultimate purpose of Live training is to train Soldiers to perform their wartime mission tasks in the field as they were in actual combat using their actual weapon systems at training sites (Combat Training Centers and home stations) so that they achieve a level of readiness for combat. Army doctrine requires units to train as they intend to fight-that is, training must integrate

such realistic conditions as simulated nuclear, biological, and chemical warfare; an ability to conduct battle damage assessment based on visual feedback of target ballistic terminal effects and make adjustments of fire; and realistic lethality and vulnerability characteristics and performance for all weapon systems (e.g.; pistols, small arms, shoulder-fired munitions, combat vehicles, etc.), for example. MILES suffers from a multitude of significant drawbacks which limit and reduce Soldier readiness: inability to simulate the full range of U.S. force weapons (including enemy weapons) with realistic ballistic terminal effects; no capability exists for indirect fire, area effects (e.g.; electronic warfare), proximity fused burst rounds; and no capability exists to simulate future weapon capabilities (e.g.; increased probability of hit and dynamic aim point target leading based on planned small arms fire control and artificial intelligence technologies).

Scientific and Technical Areas of Interest:

The following technical areas are being sought for innovative research and development efforts that address some or all of the Live training tactical engagement simulation shortcomings:

(1) Miniature, low power, navigation-grade inertial measurement units (IMUs) leveraging MEMS fabrication.
(2) Computer vision, or computational imaging, algorithms that enable accurate image feature tracking and function in low power single board computers.
(3) Algorithms that leverage digital terrain map point cloud data that can function efficiently in low power single board computers.
(4) Chip-scale photonic or quantum-based precision magnetometers or long-holding oscillator/clocks
(5) Artificial Intelligence/Machine Learning (AI/ML) neural network algorithms and techniques that enable new capabilities:
    a) Automation of object/target recognition
    b) Dynamic target aim point optimization and prediction for an AR virtual reticle displayed in a heads-up-display (HUD) or similar AR capability in a rifle scope
    c) Integrate Live/virtual modalities based on simulating Live entities in the form of autonomous agents that train/learn in virtual game environments
    d) Prediction of GNSS receiver satellite availability due to terrain features (e.g., building obscuration)
    e) High accuracy pedestrian dead reckoning (estimation of position and velocity) during conditions where GNSS receivers experience satellite link outages
    f) Video denoising - multi-aperture photon denoising techniques of video focal plane arrays for both thermal (SWIR) and daylight (RGB) imaging

g) Video scene feature depth and distance estimation to include accurate passive range finding under conditions of high pixilation due to conditions of high magnification and temperature/wind induced scintillation (mirage effect)

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

Technical POC: Frank Tucker, TEL: 407-342-7643, frank.m.tucker4.civ@mail.mil

Medical Simulation and Training

The Army requires medical simulation and training capabilities that support and integrate with Joint Warfighter simulations in teaching individual and collective tasks. This includes the ability to train soldiers to move, shoot, communicate and treat casualties by building competence in cognitive and psychomotor medical and warfighter tasks for individual soldiers and units. Training capabilities are required for medical missions across all roles from tactical combat casualty care through Roles 1, 2, & 3. This includes advanced skills for providers at roles 2 and higher. Areas of consideration include:

(1) Technologies to reduce or eliminate the use of live tissue and cadavers in military medical training
(2) Virtual patients and novel interaction capabilities
(3) Integration with warfighter simulations including the Army Synthetic Training Environment
(4) Medical training technologies that realistically simulate human trauma
(5) Patient simulation technologies based on measures of human measures tissue and anatomy
(6) Simulated tissue with properties that approach those of live human tissue
(7) Olfactory and malodor simulation technologies
(8) Prolonged care training across all roles
(9) Deliver accurate tactile feedback for medical procedures in virtual environments
(10) Computer, game, and mobile training technologies
(11) Methodologies that improve cost effectiveness and increase test scores, and skill levels
(12) Augmented and virtual reality solutions for medical training
(13) Assessment of medical training effectiveness, user acceptance, and usability
(14) On demand, medical treatment of non-humans such as military working dogs
(15) Training solutions addressing treatment gaps attributed to gender, race and other social effects

(16) Automated objective methods to assess skill and knowledge transfer including but not limited to neural correlates, physiologic measures, crowd sourced evaluations, intelligent agents, and machine learning
(17) Augmented cognition techniques enhancing skill acquisition, performance, and retention

Communication with the Technical POC prior to submission of a formal proposal is essential.
Technical POC: Dr. Jack Norfleet, TEL: 407-384-3897, Jack.e.norfleet.civ@mail.mil

Advanced Interactive Simulation

Existing simulation systems can be characterized as black boxes that interface externally allowing internal computations to be non-standard between models representing phenomena, which introduces fair fight issues and additional inconsistencies. Moreover, the desired contemporary uses of simulation often call for the ability to access simulation capabilities at the point of need. In parallel, computer science and computing technology continue to evolve providing unique opportunities for innovation in simulation.

Advanced Interactive Simulation aims to enable simulation architectures that are truly based on composable models and services as opposed to the traditional method of various simulations interoperating. It further aims to enable robust Army simulation capabilities with composable synthetic representations delivered where they're needed in the form in which they're needed. Finally, it also aims to leverage emerging computing and networking technologies for application towards simulation execution environments. Research; Science and Technical Areas of Interest to include research studies, demonstrations and development involving:

(1) Methods and means that enable simulation architectures capable ofsupporting complex real-time and non-real-time uses
(2) M&S as a service across geographically distributed areas
(3) Application of advances in computing and networking to the simulation domain with example uses included simulation scalability, enabling real-time and faster-than-real-time simulation execution, geographic distribution of processing, cloud computing architectures and agility in design to support simulation execution in Denied, Degraded, Intermittent, or Limited Bandwidth (DDIL) environments
(4) Novel encapsulation of military representations, models, behaviors and data
(5) Exploration and application of emerging gaming technologies to the simulation domain

(6) Exploration of Digital Engineering, Model-Based Systems Engineering and other trade space analysis methodologies in the context of simulation environments
(7) Methods and means to represent Multi-Domain Operations (MDO) in a simulation environment, including integrating US Army, Navy, Air Force, Marine Corps, Cyber, Space and Coalition capabilities

Research activities should be demonstrated through uses cases relevant to the six Army M&S
Communities (Acquisition, Analysis, Experimentation, Intelligence, T&E and Training).

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

Technical POC: Mr. Chris McGroarty, TEL: 407-208-3323,
christopher.j.mcgroarty.civ@mail.mil

Cyber Warfare for Training (CyWar-T)

The Cyber Warfare for Training (CyWar-T) research program at the Soldier Center's Simulation and Training Technology Center (STTC) is addressing science and technology gaps in cyber training through modeling and simulation (M&S). Training the Cyber Mission Force (CMF) and cybersecurity personnel on offensive and defensive operations, dubbed "Cyber for Cyber," has recently been a focus for the Department of Defense (DoD). However, a majority of the military falls outside of the "Cyber for Cyber" category and into a "Cyber for Others" group. "Cyber for Others" training provides cyber-relevant training to personnel whose job is not primarily cyber-related (e.g. staffs and commanders). STTC's CyWar-T program specifically targets the training needs of the "Cyber for Others" category. Under the program, the STTC researches and develops novel means and methods to integrate cyberspace electromagnetic activities (CEMA) into Army training systems through M&S without compromising any information assurance (IA) certifications. Examples of prior and current efforts in the CyWar-T program include: 1) applications that simulate effects of cyberattacks on mission command systems, 2) cyber data exchange models that integrate LVC&G systems with cyber ranges, 3) architectures and simulation environments that enable CEMA training, and 4) cyber simulation models. As the Army prepares to fight Multi-Domain Operations (MDO), the CEMA training and relevant simulation environments that the CyWar-T program is enabling will become commonplace. Scientific and Technical Areas of Interest:

(1) Data Models and Ontologies for Cyber-related M&S

(2) Synthetic Representation of Cyber Terrain
(3) Service-based Network Simulations for L/V/C-G Training Systems
(4) CEMA Models and Simulations across the gamut of the cyber domain. Including, but not limited to:
    a) Intelligence
    b) Signal
    c) Information Operations (IO)
    d) Cyberspace
    e) Space
    f) Fires (as related to the cyber domain)
(5) CEMA Visualization Concepts and Tools

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

Technical POC: Mr. Nathan Vey, TEL: 407-208-3392, Nathan.L.Vey.civ@mail.mil

Adaptive Instructional Systems

The U.S. Army has a need to leverage technologies like artificial intelligence (AI), data analytic tools, machine learning (ML), augmented reality, and distributed computing to improve the effectiveness and reduce the cost of executing collective training events.

At the individual level, tools for automated assessment, feedback, and training adaptation are available in the commercial market but not at the team or collective level. Automated team assessments are necessary to insure rich performance databases are available to feed AI and ML tools. Reliance on human observers to manually record almost all performance metrics will both increase the overhead cost of running these events and will impede the development of digital databases of collective performance measures.

Technologies are also needed to rapidly visualize collective performance data, provide feedback to instructors, trainees, and leaders and automatically adapt training and feedback to both individuals and teams.

The following are specific areas of interest:

1. Technologies for automating measurement, assessment, and diagnosis of team and team-member mastery of the training objectives.
2. Technologies for determining how and when to provide coaching, how to adapt training within and across scenarios to optimize skill acquisition, and how to leverage AIS technologies to generate intelligent after action reviews.

3. Technologies to model team competencies over time to include the impact of training events, operational experiences, team turbulence, and leadership in order to predict the team's effectiveness and lethality across a range of missions.
4. Technologies to rapidly author these assessments, feedback, and adaptive instruction based on the training objectives of the unit.

CCDC is requesting white papers describing research to address these challenges for training Army teams across a variety of collective missions including dismounted infantry, armored, aviation, and mission command.

TPOC: Ben Goldberg, (407) 384-3903, benjamin.s.goldberg.civ@mail.mil.

Battlespace Visualization and Interaction

Existing battlespace visualization capabilities often consist of physical map views or sand tables with limited capability to display information as the operational environment becomes more complex, especially as the Army evolves in support of Multi-Domain operations. There is a growing need to provide the Warfighter with tools to ingest diverse datasets to present information more efficiently across numerous modalities, e.g. monitors, tablets, etc.

Battlespace Visualization and Interaction seeks to enable users with novel and innovative technologies that support geographically distributed collaboration, collective training and other military uses. Furthermore, we seek to reduce the user load through increased usability and ease of use.

Research; Science and Technical Areas of Interest including research studies, demonstrations, and development involving areas in which we are interested:

(1) Novel display technologies
(2) Novel user interface (i.e. hardware- and software- based) technologies
(3) Innovative approaches to distributed simulation, training, and collaboration
(4) Methods and means that enable Warfighters to deploy scalable displays that support visual information on a variety of surfaces
(5) Technologies that provide innovation towards an immersive environment that mimics "reality" with increased accuracy

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

Technical POC: Mr. Charles Amburn, TEL: 407- 384-3901, charles.r.amburn.civ@mail.mil

Synthetic Environments:

Army simulation and battle command systems are transforming into highly integrated, distributed/collaborative 3D One World Terrain tools that depend on accurate, timely geospatial data. Providing representations of complex environments is a critical element of models and simulations, requiring interoperability of heterogeneous simulation systems. The research emphasis is to provide the capability to represent the synthetic environment as realistically as possible to support the Army mission. Areas of consideration focus on synthetic environments representation and include:

(1) Environment generation,
(2) Environment representation
(3) Environment services, and
(4) Dynamic environments

TPOC: Julio De La Cruz, (407) 384-3733, julio.a.delacruz4.civ@mail.mil.

Dismounted Soldier Research:

The Army needs advanced technology to provide dismounted Soldiers with fully immersive, simulation based training environments. ARL has an interest in researching, developing and demonstrating technologies and techniques for virtual immersion as well as next generation Mixed Augmented Reality (MAR) environments for dismounted Soldiers. ARL seeks to explore methods of presenting 2D/3D virtual objects (representing various targets, fire and effects, vehicles, etc.) to the dismounted Soldier while operating both indoors and outdoors. Additionally, the trainee would be capable of interacting with virtual targets, personnel, vehicles, etc. as though real and would be capable of receiving haptic feedback to simulate virtual weapon or environmental impacts. Specific technologies of interest include, but are not limited to:

(1) Visual and display systems to include head mounted displays,
(2) Computer systems,
(3) Wireless tracking devices to include markerless tracking technologies,
(4) Natural locomotion,

(5) Wireless video/audio transmission,
(6) MAR systems to include optically aided video odometry,
(7) Accurate depth sensing and occlusion mapping,
(8) Visual landmark detection technology,
(9) Mission rehearsal,
(10) Distributed AAR systems, and
(11) Advanced synthetic natural environments.
(12) Haptic feedback

TPOC: Pat Garrity, (407) 384-3663, patrick.j.garrity4.civ@mail.mil.