

**US ARMY RESEARCH OFFICE**

**Broad Agency Announcement**

**W911NF-04-R-0004**

*FY 2004*

*Historically Black Colleges and Universities and  
Minority Institutions (HBCU/MIs)*

*Center of Excellence for Battlefield  
Capability Enhancements (BCE)*

**December 2003**



**Proposals Due: 22 April 2004**

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This publication constitutes a Board Agency Announcement (BAA) as contemplated in Federal Acquisition Regulation (FAR) 6.102(D) (2) and Department of Defense Grant and Agreement Regulation (DODGARS) 22.315. A formal Request for Proposals (RFP), solicitation, and/or additional information regarding this announcement will not be issued.

The Army Research Office (ARO) will not issue paper copies of this announcement. The Department of the Army, ARO and other Army agencies involved in this program reserve the right to select for award all, some or none of the proposals submitted in response to this announcement. ARO and other participating Army agencies provide no funding for direct reimbursement of proposal development costs. Technical and cost proposals (or any other material) submitted in response to this BAA will not be returned. It is the policy of ARO and participating Army agencies to treat all proposals as sensitive competitive information and to disclose their contents only for the purposes of evaluation.

## **1. GENERAL INFORMATION**

### **1-1. Introduction**

a. This BAA solicits proposals from Historically Black Colleges and Universities and Minority Institutions (HBCU/MIs) to establish five research centers that will be known as Centers of Excellence for Battlefield Capability Enhancements (BCE). The objective of this program is to develop research collaborations between postsecondary minority institutions and Army facilities in selected research areas that are critical to battlefield performance.

b. Through a competitive evaluation process, five proposals will be selected for award. Each program will have a performance period of up to five years contingent upon satisfactory performance and availability of funds. The annual funding level for each is expected to be approximately \$500,000. Sub-awards to other academic institutions and/or industry are allowed for up to 50 percent of the annual budget.

### **1-2. Eligibility**

a. This solicitation is a set aside for HBCU/MIs. Eligibility for this competition requires each applicant to meet two criteria. First, the institution's name must appear on the 2003 US Department of Education list of Accredited Postsecondary Minority Institutions, available at <http://www.ed.gov/offices/OCR/minorityinst.html>. This list is compiled by the Office for Civil Rights, US Department of Education using enrollment data reported by postsecondary institutions to the National Center for Integrated Statistics and the Office for Civil rights in the Integrated Postsecondary Education Data System (IPEDS) fall enrollment survey, formerly called the Higher Education General Information Survey (HEGIS). Questions concerning the list must be directed to the IPEDS Inquiry Line (202-205-9567) in the Office for Civil Rights, US Department of Education, not to the Army Research Office.

b. Second, the institution must qualify as a Doctoral/Research-Intensive institution or as a Master's Category I or Master's Category II under the Carnegie Classification. See <http://www.carnegiefoundation.org/Classification> and click on Classification Listings.

**Note:** Institutions in the Carnegie Classification of Doctoral/Research-Extensive are not eligible to compete in this program.

**1-3. Agency Name –**

U.S. Army Research Office  
4300 S. Miami Blvd  
Durham, NC 27703-9142

**1-4. Research Opportunity Title –**

Historically Black Colleges and Universities Center of Excellence and Institutes for Battlefield Capability Enhancements (BCE)

**1-5. Program Name – BCE**

**1-6. Point(s) of Contact –**

a. Questions of a technical nature shall be directed to the Research Topic Chief listed in the topic description.

b. Questions of a policy nature shall be directed to the following:

LTC David Camps  
Program Manager, Historically Black Universities and Colleges Programs  
US ARO  
4300 S. Miami Blvd  
Durham, NC 27703  
Tel: 919-549-4200  
Fax: 919-549-4310  
Email Address: [david.camps@us.army.mil](mailto:david.camps@us.army.mil)

c. Questions of a business nature shall be directed to the following:

Robert Morris Acquisition Center  
Kathryn C. Terry  
Contract Specialist  
Tel: 919-549-4337  
Fax: 919-549-4338  
Email Address: [kathy.terry@us.army.mil](mailto:kathy.terry@us.army.mil)

### **1.7. Instrument Type(s) –**

It is anticipated that awards will be in the form of grants to universities.

### **1-8. Catalog of Federal Domestic Assistance (CFDA) Numbers - 12.431**

### **1-9. Catalog of Federal Domestic Assistance (CFDA) Titles –**

Basic Scientific Research

## **2. CONCEPT FOR THE CENTERS OF EXCELLENCE**

a. The Army is transforming to an Objective Force that will make it more responsive, deployable, agile, versatile, lethal, survivable, and sustainable than today's forces. This requires revolutionary advances in performance of Army weapons systems as well as improvements in engineered systems that impact soldier survivability, e.g., communications and sensing capabilities, among others. Such advances would represent breakthroughs to improved force projection and protection and full spectrum situational dominance. See the "Objective Force White Paper" at <http://www.objectiveforce.army.mil/> for a description of Army future operating capabilities.

b. The Centers that will be established under the authority of this solicitation will conduct unclassified scientific research in the topical areas described in Section 7 below.

c. Each Center will be housed at a host college or university. Sub awards to other academic institutions, industries, or small businesses that complement the expertise of the host institution are allowed. The host university will coordinate research collaborations among the proposed group and will serve as facilitator for technology transitions to military applications. Not more than 50% of the funded amount shall be authorized for sub-awards.

## **3. AWARD INFORMATION**

a. It is anticipated the awards will be made in the form of grants. The awards will be made at funding levels commensurate with the proposed research. Each individual award will be for a base period of three years, to be funded incrementally or as options. Two additional years of funding, as one-year options, are possible to bring the total maximum term of the award to five years.

b. Total amount of funding for five years available for grants resulting from this FY04 BAA is estimated to be about \$12.5M, pending out-year appropriations. It is anticipated that the average award will be \$500K per year, depending on the scope of the Center of Excellence. Depending on the results of the proposal evaluation, there is no guarantee that one or any of the proposals will be recommended for funding for any one of the

topics. On the other hand, more than one proposal may be recommended for funding for a particular topic.

#### **4. APPLICATION AND SUBMISSION INFORMATION**

##### **4-1. Application and Submission Process**

The proposal submission process is in two stages. Prospective proposers are to submit white papers. The reason for requesting white papers is to minimize the labor and cost associated with the production of detailed full proposals that have very little chance of being selected for funding. Based on an assessment of the white papers, the responsible Research Topic Chief will provide informal feedback to the proposers to encourage or discourage them to submit full proposals. White papers arriving after the deadline may not receive, and therefore may not benefit from, the informal feedback.

##### **4-2. Content and Format of White Papers and Full Proposals**

The proposals submitted under this BAA are expected to be unclassified basic research. The proposal submissions will be protected from unauthorized disclosure in accordance with FAR 15.207, applicable law, and DoD regulations. Proposers are expected to appropriately mark each page of their submission that contains proprietary information. White papers and proposals should be stapled in the upper left hand corner; plastic covers or binders should not be used. Separate attachments, such as individual brochures or reprints, will not be accepted.

##### **4-3. White Paper Content**

- a. Cover Page – The Cover Page shall be labeled “WHITE PAPER”, and shall include the BAA number, proposed title, proposers’ administrative and technical points of contact, with telephone numbers, facsimile numbers, and Internet addresses, and shall be signed by an authorized officer.
- b. Identification of the research and issues
- c. Proposed technical approaches
- d. Potential impact on DoD capabilities
- e. Deliverables
- f. Management plan
- g. Potential Team
- h. Summary of estimated costs



i. White papers should be sent to the responsible Research Topic Chief in the agency specified for the topic. The white paper should provide sufficient information on the research being proposed (e.g. hypothesis, theories, concepts, approaches, data measurements and analysis, etc.) to allow for an assessment by a technical expert.

j. A short cover letter (one page) may be included and is excluded from the page limitation.

#### **4-4. White Paper Format**

a. Paper Size – 8.5 x 11 inch paper

b. Margins – 1 inch

c. Spacing – single or double-spaced

d. Font – Times New Roman, 12 point

e. Number of Pages – no more than four single-sided pages (excluding cover and resumes)

f. Copies – one original and two copies. Electronic copy may also be submitted by email.

#### **4-5. Full Proposal Content**

The Full Proposal should be broken down into two volumes, Volume 1 – Technical Proposal and Volume 2 – Cost Proposal. Volume 1 should consist of a Cover, Table of Contents, Executive Summary, Statement of Work, Technical Approach, Project Schedule and Milestones, Assertion of Data Rights, Deliverables, Management Approach, and Personnel. Volume 2 should consist of detailed cost breakdown by cost category for the budget periods provided below and a cost breakdown by task/subtask.

#### **4-6. Full Proposal Format: Volume 1 – Technical Proposal and Volume 2 – Cost Proposal**

a. Paper Size – 8.5x11 inch paper

b. Margins-1 inch

c. Spacing-single or double-spaced

d. Font, Times New Roman, 12 point

e. Number of Pages – Volume 1 is limited to no more than twenty-five (25) single-sided pages. Volume 2 is limited to no more than ten (10) single-sided pages. The cover, table

of contents, and resumes are excluded from the page limitations. Full Proposals exceeding the page limit may not be evaluated.

f. Copies – one original and five copies. Additionally an electronic copy may be submitted on a 3.5” Diskette or CD-ROM, (in Microsoft Word or Excel 97 compatible or .PDF format).

#### **4-7. VOLUME 1: Technical Proposal**

a. Cover: A completed cover (consisting of the two single-sided pages provided as Attachment A) MUST be used as the first two pages of the proposal. There should be no other page before this cover.

b. Table of Contents: List proposal sections and corresponding page numbers.

c. Executive Summary: Provide a summary of the research problem, technical approaches, anticipated outcome of the research if successful, and impact on Army capabilities.

d. Statement of Work: A Statement of Work (SOW) should clearly detail the scope and objectives of the effort and the research work to be performed under the grant if the proposal is selected for funding. It is anticipated that the proposed SOW will be incorporated as an attachment to any resultant award instrument. To this end, proposals must include a severable self-standing SOW, without any proprietary restrictions, which can be attached to a grant award.

e. Technical Approach:

(1) Describe in detail the basic science and/or engineering research to be undertaken. State the objective and approach, including how data will be analyzed and interpreted. Discuss the relationship of the proposed research to the state-of-the-art knowledge in the field and to related efforts in progress elsewhere. Include appropriate literature citations and references. Discuss the nature of expected results. Discuss potential applications to defense missions and requirements.

(2) Describe plans for the research training of students. Include the number of full time equivalent graduate students and undergraduates if any, to be supported each year. Discuss the involvement of other students, if any.

f. Project Schedule and Milestones: A summary of the schedule of events and milestones.

g. Assertion of Data Rights: A summary of any proprietary rights to pre-existing results, prototypes, or systems supporting and/or necessary for the use of the research, results, and/or prototype. Any data rights asserted in other parts of the proposal that would impact the rights in this section must be cross-referenced. If there are proprietary rights,

the proposers must explain how these affect its ability to deliver research data, subsystems and tool kits for integration. Additionally, proposers must explain how the program goals are achievable in light of these proprietary limitations. If there are no claims of proprietary rights in pre-existing data, this section shall consist of a statement of the effect.

h. Deliverables: A detailed description of the results and products to be delivered.

i. Management Approach: A discussion of the overall approach to the management of this effort, including brief discussions of: required facilities; relationships with any sub awardees and with other organizations; availability of personnel; and planning, scheduling and control procedures.

(1) Describe the facilities available for the accomplishment of the proposed research and related education objectives. Describe any capital equipment planned for acquisition under this program and its application to the proposed research. If possible, budget for capital equipment should be allocated to the first budget period of the grant. Include a description of any government furnished equipment, hardware, software information, by version and/or configuration that are required for the proposed effort.

(2) Describe in detail proposed sub awards to other eligible universities or relevant collaborations (planned or in place) with government organizations, industry, or other appropriate institutions. Particularly describe how collaborations are expected to facilitate the transition of research results to applications. Descriptions of industrial collaborations should explain how the proposed research will impact the company's research and/or product development activities, to be supported by detailed budgets for the proposed sub awards.

(3) List the amount of funding and describe the research activities of the Principal Investigator and co-investigators in on-going and pending research projects, whether or not acting as Principal Investigator in these other projects, the time charged to each of these projects, and their relationship to the proposed effort.

(4) Describe plans to manage the interactions among members of the proposed research team.

(5) Identify other parties to whom the proposal has been or will be sent, including agency contact information.

j. Personnel: For the Center of Excellence team, one individual should be designated as the Principal Investigator for the award, for the purpose of technical responsibility and to serve as the primary point-of-contact with an agency's technical program manager. Describe the qualifications of the Principal Investigator and co-investigators to conduct the proposed research. Include curriculum vitae and other experiences relevant to the proposed research effort.

#### **4-8. VOLUME 2: Cost Proposal**

a. The Cost Proposal shall consist of a cover and two parts: Part 1 will provide a detailed cost breakdown of all costs by cost category by the funding periods described below. Part 2 will provide a cost breakdown by task/sub-task corresponding to the task numbers in the proposed Statement of Work. Options must be separately priced.

b. Cover: The use of the SF 1411 is optional. The words “Cost Proposal” and the following information should appear on the cover:

(1) BAA number

(2) Title of Proposal

(3) Identity of the prime proposers and a complete list of proposed sub awards, if applicable

(4) Principal Investigator (name, mailing address, phone and fax numbers, email address)

(5) Administrative/business contact (name, address, phone and fax numbers, email address) and

(6) Duration of effort (separately identifies basic effort and proposed option)

c. Part 1: Detailed breakdown of all costs by cost category by the calendar periods stated below. For budget purposes, use an award start date of 1 July 2004. For the three-year base grant, the cost should be broken down to reflect funding increment periods of:

(1) Five months (1 July 04 to 30 Nov 04)

(2) Twelve months (1 Dec 04 to 30 Nov 05)

(3) Twelve months (1 Dec 05 to 30 Nov 06)

(4) Seven months (1 Dec 06 to 30 Jun 07)

(5) The budget should also include an option for two additional 1 year periods.

(6) The annual budget should be relatively flat, i.e. about the same amount per year. (The seven-month budget and the five month budget should add to an amount about equal to the 12 month budget.) However, if there is anticipated difficulty in effectively spending the funds at the steady-state rate for the entire first budget period, the initial seven month budget can be somewhat higher if substantial equipment funding is requested. Elements of the budget should include:

(a) Direct Labor – Individual labor category or person, with associated labor hours and unburdened direct labor rates

(b) Indirect Costs – Fringe Benefits, Overhead, G&A, COM, etc. (Must show base amount and rate)

(c) Travel – Number of trips, destination, duration, etc.

(d) Subcontract – A cost proposal as detailed as the proposers cost proposal will be required to be submitted by the subcontractor. The subcontractor’s cost proposal can be provided in a sealed envelope with the proposers cost proposal.

(e) Consultant – Provide a consultant agreement or other document that verifies the proposed loaded daily/hourly rate. Include a description of the nature and the need for any consultant’s participation. Strong justification must be provided, and consultants are to be used only under exceptional circumstances where no equivalent expertise can be found at a participating university.

(f) Materials should be specifically itemized with costs or estimated costs. An explanation of any estimating factors, including their derivation and application, shall be provided. Include a brief description of the proposers’ procurement method to be used (competition, engineering estimate, market survey, etc.).

(g) Other Directs Cost, particularly any proposed items of equipment or facilities. Equipment and facilities generally must be furnished by the contractor/recipient. (Justifications must be provided when Government funding for such items is sought). Include a brief description of the proposers’ procurement method to be used (competition, engineering estimate, market survey, etc.).

d. Part 2: Cost breakdown by task/sub-task using the same task numbers as in the Statement of Work.

**4-9. Significant Dates and Times –**

<b>Schedule of Events</b>		
<b>Event</b>	<b>Date</b>	<b>Time</b>
White Papers Due Date	<b>26 Jan 04</b>	<b>4 p.m.</b>
Notification of Initial DOD Evaluations of White Papers	<b>19 Feb 04*</b>	
Full Proposals Due Date	<b>22 Apr 04</b>	<b>4 p.m.</b>
Notification of Selection for Award	<b>27 May 04*</b>	
Contract Awards	<b>08 Jul 04*</b>	

**\*These dates are estimates as of the date of this announcement.**

#### **4-10. Submission of Late Proposals –**

a. Any proposal, modification, or revision, that is received at the designated Government office after the exact time specified for receipt of proposals is “late” and will not be considered unless it is received before award is made, the contracting officer determines that accepting the late proposal would not unduly delay the acquisition, and:

(1) the proposal was sent, to the address specified for the designated agency, by U.S. Postal Services Express Mail three or more business days prior to the date specified for the receipt of proposals (the term “business days” excludes weekends and U.S. federal holidays); or

(2) there is acceptable evidence to establish that it was received at the Government installation designated for receipt of proposals and was under the Government’s control prior to the time set for receipt of proposals; or

(3) it was the only proposal received

b. However, a late modification of an otherwise timely and successful proposal that makes its terms more favorable to the Government will be considered at any time it is received and may be accepted.

c. Acceptable evidence to establish the time or receipt at the Government installation includes the time/date stamp of that installation on the proposal wrapper, other documentary evidence of receipt maintained by the installation, or oral testimony or statements of Government personnel.

d. If an emergency or unanticipated event interrupts normal Government processes so that proposals cannot be received at the Government office designated for receipt of proposals by the exact time specified in the announcement, and urgent Government requirements preclude amendment of the announcement closing date, the time specified for receipt of proposals will be deemed to be extended to the same time of day specified in the announcement on the first work day on which normal Government processes resume.

e. The Army Research Office will promptly notify any proposer if its proposal, modifications, or revision was received late and will inform the proposer whether its proposal will be considered.

f. Note that proposals delivered by commercial carriers are considered “hand carried” and that no exception can be made to allow such proposals to be considered if for any reason they are received after the deadline. Proposers are advised that some proposals responding to past announcements that were sent via commercial carriers were delayed during shipment and arrived after the deadlines, typically by one or two days. To decrease the probability that proposals delivered by commercial carriers will arrive after

the deadline and thus be ineligible to compete, proposers are urged to schedule delivery to occur several days before the deadline.

#### **4-11. Address for the submission of White Papers and Full Proposals –**

a. White papers and full proposals should be sent to the Army Research Office at the following address:

(1) For delivery by ordinary First Class or Priority Mail (but not Express Mail) through the US Postal Service:

US Army Research Office (FY04 HBCU/BCE)  
PO Box 12211  
Research Triangle Park, NC 27709-2211

(2) For other delivery (such as Express Mail, FedEx, UPS, etc.):

US Army Research Office (FY04 HBCU/BCE)  
For full proposals, include: ATTN: LTC David C. Camps  
For white papers, include: ATTN: list name of responsible Research Topic Chief  
4300 S. Miami Blvd  
Durham, NC 27703-9142  
919-549-4211

NOTE: PROPOSALS SENT BY FAX OR E-MAIL WILL NOT BE CONSIDERED.

b. To obtain an acknowledgement of receipt of a proposal, the proposer should self-address and place a first class stamp on Attachment B and CLIP TO ORIGINAL COPY OF THE PROPOSAL (DO NOT TAPE OR STAPLE); the form will be mailed back to the proposer.

### **5. EVALUATION INFORMATION**

#### **5-1. Evaluation Criteria -**

a. White papers will be evaluated by the responsible Research Topic Chief to assess whether the proposed research is likely to meet the objectives of the specific topic, and to encourage the submission of a full proposal. The assessment will focus on scientific technical merit (criterion 1, below) and relevance and potential contribution to Army (criterion 2, below), although the other criteria may also be used in making the assessment.

b. Full proposals responding to this BAA in each topic will be evaluated using the following criteria. The first three evaluation factors are of equal importance:

(1) scientific and technical merits of the proposed basic science and/or engineering research;

(2) relevance and potential contributions of the proposed research to the topical research area and to Department of the Army missions; and

(3) impact of plans to enhance the institution's ability to perform defense-related research and to train, through the proposed research, students in science and/or engineering (for example, by acquiring or refurbishing equipment that can support Department of the Army research and research-related educational objectives).

c. The following four evaluation criteria are of lesser importance than the above three but are equal to each other:

(1) the qualifications and availability of the principal investigator and other key research personnel;

(2) the adequacy of current or planned facilities and equipment to accomplish the research objectives;

(3) the impact of interactions with other organizations engaged in related research and development, in particular Department of the Army laboratories, industry, and other organizations that perform research and development for defense applications; and

(4) the realism and reasonableness of cost. (Cost sharing is not a factor in the evaluation.)

## **5-2. Evaluation Panel -**

a. White papers will be reviewed by the responsible Research Topic Chief. An evaluation panel will consist of technical experts employed in the government.

b. Full proposals will be evaluated by an evaluation panel chaired by the responsible Research Topic Chief for the particular topic and will consist of technical experts employed in the government. Evaluation panel members are required to sign "no conflict of interest" and non-disclosure certifications.

## **5-3. Selection Process -**

Full proposals will undergo a multi-stage evaluation procedure. The respective evaluation panels will review proposals first. Findings of the evaluation panels will be forwarded to senior Department of the Army officials who will make final selections.

## **6. OTHER**

### **6-1. Administrative Requirements –**

CCR – Successful proposers not already registered in the Central Contractor



Registry (CCR) will be required to register in CCR prior to award of any grant, contract, cooperative agreement, or other transaction agreement. Information on CCR registration is available at <http://www.ccr.gov>.

## **6-2. Use of Animals and Human Subjects in Research**

If animals are to be utilized in the research effort proposed, the proposer must complete a DoD Animal Use Protocol with supporting documentation (copies of AAALAC accreditation and/or NIH assurance, IACUC approval, research literature database searches, and the two most recent USDA inspection reports) prior to award. Similarly, for any proposal that involves the experimental use of human subjects, the proposer must obtain approval from the proposer's committee for protection of human subjects (normally referred to as an Institutional Review Board, (IRB)). The proposer must also provide NIH (OHRP/DHHS) documentation of a Federal Wide Assurance that covers the proposed human subjects study. If the proposer does not have Federal Wide Assurance, a DoD Single Project Assurance for that work must be completed prior to award. Please refer to section 8 for further information.

## **6-3. Department of Defense High Performance Computing Program**

The DoD High Performance Computing Program (HPCMP) furnishes the DoD S&T and DT & E communities with use-access to very powerful high performance computing systems. Awardees of DoD contracts, grants, and assistance instruments may be eligible to use HPCMP assets in support of their funded activities if Program Officer Approval is obtained and if security/screening requirements are favorably completed. Additional information and an application may be found at <http://www.hpcmo.hpc.mil/>.

## **7. SPECIFIC COE TOPICS**

- a. Proposals will be solicited in eight topical areas. However, a BCE will be established in only **five** of these areas.
- b. Proposals will be solicited for the following topics:

### **7-1. Sensor Fusion**

ARO Technical Point of Contact: Dr. John Lavery, 919-549-4253

- a. **Background:** Enhanced capability in distributed sensing by self-organizing arrays of large numbers of geographically dispersed "microsensors" (miniature sensors) of various modalities is increasingly being recognized as a pivotal element in the ability of defense forces to accomplish their mission. It is too costly or impractical to rely on sophisticated sensors with large power supply and large communication capability. Simple, inexpensive individual devices deployed in large numbers are likely to be the source of battlefield awareness in the future. Distributed sensing systems based on large numbers ( $10^4$  to  $10^7$ ) of simple, inexpensive acoustic, infrared (IR), magnetic, seismic, radio-frequency (RF), chemical/biological and other sensors are practical for many land

scenarios. The power and communication capabilities that can be built into each sensor will be strongly limited by cost constraints. Processing must be carried out in a distributed fashion, not by central facilities.

b. **Objective:** Develop techniques and frameworks for distributed fusion of data/information in large, bandwidth-limited networks of microsensors, each with limited capabilities and power.

c. **Research Concentration Areas:** This research is interdisciplinary, with network theory, communication theory, signal processing and mathematics all playing major roles.

(1) Design models for fusion in networks of large numbers of sensing devices. Take into account network organization and topology as well as issues of information processing.

(2) Design non-ad-hoc metrics for determining the “goodness” of fusion principles/models that reflect human goals and physical laws/ constraints and are mathematically valid and computationally feasible.

(3) Justify both the models and the metrics.

(4) Clarify how well the proposed models perform under the proposed metrics.

(5) Design and carry out a demonstration (perhaps virtual/simulated) of the principles and the metrics.

This effort is oriented toward creating webs of sensors, not toward improving individual sensors.

d. **Impact:** The Army, DoD overall and the civilian economy have great need for sensor nets for battlefield surveillance in natural terrain and urban areas, replacement of landmine fields and many other applications. This effort will enable designing future distributed sensing systems from a global point of view, in which devices, networks and information processing will be optimized not individually but rather as a system that accomplishes human goals.

## **7-2. Integrated Analysis for Vertical Take-Off and Landing (VTOL) Vehicles**

Technical Point of Contact: Dr. David Mann, 919-549-4249

a. **Background:** Integrated aeromechanics, aero propulsion and rotorcraft structural analyses are needed to define appropriate strategies for increasing the range, payload, and operational envelope of Army VTOL vehicles, while reducing fuel requirements and the total logistics burden (maintenance and support). Advances in these areas are critical to achieving desired payload capability. Additionally, the trend toward the increasing use of composite materials to reduce weight and augment fuel efficiency requires analytical

methods to predict the static and dynamic response of composite structures and to design reliable, safe, and economical systems.

b. **Objective:** Conduct analyses to determine strategies for shaping the Army's VTOL capabilities to meet the requirements of the Objective Force concepts.

c. **Research Concentration Areas:** Examples of potential strategies for improving VTOL capability, which should be considered in the analysis, include variable geometry and actively controlled rotary wing configurations that have advanced in recent years and are showing increasing promise. High potential payoff technologies for active control include rotor on-blade control surfaces with both conventional actuators (electromagnetic and hydraulic) as well as smart material actuators, active twist concepts using piezoceramic active fiber composites, and smart material actuators to supply high frequency pulsating aerodynamic excitation for airfoils and fuselages, using oscillatory blowing synthetic jet concepts. The analysis should also consider advanced engines, such as those coming out of the Integrated High Performance Turbine Engine Technology (IHPTET) program, as well as advanced transmission configurations and gearing arrangements that offer benefits of increased power capacity and reduced weight.

(1) Emphasis should be placed on the development and application of analytical prediction methods. These methods encompass a range of engineering disciplines, including structures and dynamics, fluid dynamics, and propulsion. In addition, a better understanding of the physics involved with materials, fatigue, stress, strength, and life for the vehicle system components is required.

d. **Impact:** The development of accurate prediction methodologies is essential to improve helicopter design to reduce life cycle costs and development risks for new systems and enhancements of existing systems. Improved predictive capability will also enable rotorcraft to achieve greater military effectiveness through better performance, maneuverability, reliability, range, speed, crew safety, increased payload capability, and reduced occurrence of vibration and noise related problems.

### **7-3. Lines of Sight / Beyond Line of Sight Lethality (LOS/BLOS)**

Technical Point of Contact: Dr. William Sander, 919-549-4241

a. **Background:** In order to achieve LOS/BLOS Lethality, the Army must have the capability to detect, identify, and locate targets using sensor systems with capabilities superior to the enemy's systems. The target information must be communicated to the shooter and fires must be coordinated using advanced command and control systems.

b. **Objective:** Research is sought on Automatic/Aided Target Recognition (A/AITR) systems focused on passive infrared and electro-optic imaging sensor systems. Algorithms are needed which accurately and reliably detect, classify, identify, and geospatially locate targets on the ground. The targets are highly variable in configuration and articulation, may be deliberately camouflaged, and may be partially occluded by other objects or foliage. The quality of the images may also be degraded by weather and

the use of obscurants such as smoke. The imaging platforms will be ground vehicles and aerial platforms such as helicopters and Unmanned Aerial Vehicles (UAVs). The target pixels in these images are usually very small ranging from a few to tens of pixels. The targets are often confused with background clutter effects. The performance of A/AITR systems will be evaluated based on their ability to reduce undesirable false alarms (detecting a non-target as a target) while at the same time increasing the probability of detection. The ability for algorithms to adapt to conditions and the spatial scale of targets in real time in order to improve performance is desired. The fusion of information from multiple sensors and techniques for networking sensors of the same or similar modality and different modality are also desirable.

(1) High mobility is an emphasis in battlefield operations. The Army will use mobile, wireless communications systems that operate while on the move. There is no time for communications systems to stop and setup stationary antennas. The network will utilize UAVs and satellites as relays in order to provide on-the-move communications reach-back beyond line-of-sight (BLOS). The information products utilized by commanders and real-time operations demand high throughput and survivable networks. The networks will be highly dynamic in traffic and topology and will need to adapt and be resistant to jamming and intercept. Portable radios must be small and lightweight and highly energy efficient to minimize battery weight and maximize mission duration. Research in network protocol controls to optimize network performance under these conditions is desired. Also the development of and use of beam steering antennas in network routing in order to effect channel reuse and jamming and intercept protection are desired. Management across the network layers is necessary in order to achieve optimal energy efficiency, throughput, and survivability. The difficulty of this research is compounded by the lack of central control in these highly mobile networks. Unlike traditional TCP, the transport layer must be robust to packet errors as well as congestion. Admission, flow, and congestion control must be performed in the context of different Quality-of-Service (QoS) requirements and priorities. Network control must be distributed to avoid single points of failure and the system should be self-organizing with peer-to-peer capability.

(2) Information assurance over these wireless networks is a challenging research problem that needs addressing. From the Army perspective, Information Assurance must address the delivery of authentic, accurate, secure, reliable, and timely information, regardless of threat conditions, over a distributed and heterogeneous computing and communication system. The computing system may range from a hand held mobile unit to a centralized high performance information processing system. Heterogeneous communication systems will range from mobile, wireless tactical communications to high-speed, fixed (wired) communications infrastructures. Techniques for protecting against intrusions and attacks and authenticating users are needed.

#### **7-4. Lightweight, Fuel Efficient Heavy Fuel Engines for Unmanned Aerial Vehicles**

Technical Point of Contact: Dr. David Mann, 919-549-4249

a. **Background:** The Unmanned Aerial Vehicle (UAV) presents a unique challenge for propulsion, in particular for Army applications, where the engine must be capable of operation on the “heavy” logistics fuel, JP-8. UAV engines are typically small, 20 to 200 hp, and must be lightweight, fuel efficient, and compact. Additionally, the UAV mission typically requires high peak power for climb and greatly reduced power, with low fuel consumption, for loiter, i.e. a high turn-down-ratio. Current aviation practice is to use either gas turbine or gasoline-fueled reciprocating engines, with the latter exclusively used by the light, general aviation fleet.

b. **Objective:** Utilization of JP-8 in gas turbine engines presents no special problems, since JP-8 is very similar to the commonly used aviation Jet-A fuel. However, there are significant challenges to be overcome to realize low fuel consumption with a small turbine engine. First, compared to the diesel cycle, the turbine engine cycle efficiency is lower. The high turbine exhaust temperature represents “wasted” heat. Thus, achieving high overall efficiency requires a waste heat recuperator. Second, as overall turbine engine dimensions decrease, the relative importance of flow losses increases, primarily due to the difficulties of precision machining small-scale compressor and turbine components. Thus it is difficult to achieve the high overall pressure ratios that are necessary for good efficiency. Finally, the turbine engine does not generally have a high turn-down-ratio. At low fuel flow rates, combustor flame-out and combustion instability are encountered, limiting the overall turn-down-ratio.

(1) The low octane number of JP-8 makes it difficult/impossible to use it in an Otto cycle (“gasoline”) engine but it is ideally suited to diesel operation. Thus, the available general aviation engines are not suitable. The diesel engine can be operated successfully on JP-8. However, the utilization of JP-8 in a relatively small reciprocating engine presents unique problems - primarily caused by the low volatility of the fuel – at reasonable rpm there is insufficient time for fuel vaporization and combustion. While the diesel engine is known for its high efficiency and good turn-down-ratio, conventional designs are also heavy and not designed for aviation applications.

(2) Research capabilities necessary to address this problem area include the ability to perform a comprehensive analysis of candidate UAV engine configurations capable of operation on JP-8 fuel. This should include zero-order, thermodynamic analysis as well as analysis using state-of-the-art multi-dimensional, time-dependent computational tools, capable of examining the details of the engine combustion process. Expanded analyses should include the potential impact of emerging combustion cycles, such as HCCI (homogeneous charge compression ignition), pre-mixed/pre-vaporized combustion, fuel-reforming technologies, such as catalytic pre-combustion, and other combustion modification techniques, such as spark or catalytically assisted ignition/combustion, which may facilitate improved performance and expanded operational envelope. The capability to assess the performance gains and penalties associated with competing technologies and engine concepts is also needed.

## **7-5. Flexible Extremities Protection (FLEXPRO)**

Technical Point of Contact: Dr. David Stepp, 919-549-4329

a. **Background:** This proposed Army Center of Excellence program focuses on the fundamental scientific issues central to the development of advanced materials that will enable flexible extremities protection for military personnel. For the purpose of this solicitation, extremities are defined as areas of the body other than the torso and head which are not ordinarily covered by personnel armor (i.e., hands, arms, legs, etc.). These areas of the body are vulnerable to severe injury from typical battlefield and urban terrain threats and hazards. Extremity injuries currently make up approximately 75% of all battlefield casualties. While a significant degree of protection has been realized for shrapnel and fragment type threats, these protective materials and systems are typically not effective against blunt trauma, abrasion or stab injuries, and are neither lightweight nor flexible enough to provide robust extremity protection for individual soldiers.

b. **Objective:** To develop lightweight, flexible materials in order to provide individual soldier protection against abrasion, cut, puncture, snag, and blunt trauma.

(1) The generation of new materials through novel synthesis, processing and hybridization schemes is expected to be a central focus the proposed TRADOC HBCU/MIs Center of Excellence program. Of primary importance is also the modeling of material-threat interactions for the design, processing, and validation of extremely lightweight, flexible materials that are capable of providing extremity protection. Development of novel testing and characterization methodologies will likely be required for the prediction and screening of material performance in anticipated use environments and threats, and control and understanding of biological-material interfaces will significantly enhance the identification, characterization, and development of integrated protective and medical solutions. A successful program is expected to integrate recent advances in materials science such as novel supramolecular and/or polymer chemistry, nanomaterials, material and biological sensing and response, directed self-assembly, sub-micron control of structure and patterning (bulk and surface), nanoparticulate strengthening, polymer/inorganic hybrids, and bio-centric materials technologies. Materials synthesis, modeling, processing, characterization and evaluation strategies are to be thoroughly integrated into the program.

(2) It is anticipated that flexible extremities protection will be derived from materials that are elastomeric or flexible and lightweight to minimize restriction of personnel movement, and breath ability is also desirable to maximize comfort. Flexible extremities protection systems could also be based on a modular approach in which stiff segments are integrated with flexible areas, or systems in which the entire material is a single, flexible unit. Potential characteristics of flexible extremities protection materials could include:

- (a) Optimized bulk fabric properties tailored for resistance to puncture, cut/slash and snag
- (b) Integrated pressure-activated smart materials systems to minimize blunt trauma
- (c) Tailored surface properties to resist flame and/or frictional heat build up

(d) Integrated smart response for failure-activated medicinal delivery (e.g., delivery of topical antibiotics or antiseptics, application of pressure, etc.)

(3) This topic will substantially improve the DoD ability to provide a robust flexible material system that offers excellent protection against a large number of common threats (including abrasion, cut, puncture, snag, and blunt trauma). Such materials would be both highly relevant and directly applicable to the Army's need for increased soldier protection, particularly in terms of gloves and other extremity protection.

#### **7-6. Mounted / Dismounted Maneuver**

Technical Point of Contact: Dr. Bill Clark, 919-549-4314

##### **Significantly improve horizontal and vertical mobility in urban areas**

a. **Background:** The use of visual displays on the modern battlefield is becoming increasingly important as information dominance becomes a vital factor in successful battle tactics, as well as strategic planning. Displays are useful for a variety of functions, including battlefield assessment, location tracking and map reading, in addition to general messaging. Current displays have glass components that are rigid and easily broken in many battlefield conditions. Thus, flexible displays that can be folded like paper and can be very large would be a valuable upgrade to the current displays.

b. **Objective:** There is a need to develop the materials/technology to make robust, multicolor, multi-layer thin film displays using suitable active materials and phosphorescent ions. Crystalline and amorphous wide bandgap semiconductor materials are of interest as host materials for rare earth and transition metal ions. The material host is to be deposited on metals, glass, and on polymer substrates. The luminescent films need to be robust, to withstand high temperatures, and sustain exposure to oxygen or nitrogen without reduction in performance. The resulting technology is to be used in flat panel and flexible displays for the Objective Force.

#### **7-7. Human Engineering Research in Cognitive Strategies: "Sensemaking"**

Technical Point of Contact: Dr. Elmar Schmeisser, 919-549-4318

a. **Background:** Soldiers, not equipment, accomplish missions and win wars. There is a need to develop physically and mentally tough soldiers capable of executing a multitude of skills across a wide spectrum of operations to gain dominance over an adversary. Research in human engineering needs to be focused on methods to decrease task complexity and execution time while minimizing sensory, cognitive and physical demands on the soldier. Research is specifically needed to expand human cognitive, decision-making capabilities within the Objective Force information environment in order to understand cognitive processes and support the Training and Leader Development strategy. Alternatively, this can be stated as understanding the processes soldiers use to "make sense" of an increasingly complex battlefield.

b. **Objective:** “Sensemaking” addresses the capability of individuals, expert teams (domains of expertise) and organizations within a command and control network to (a) extract meaningful activities and patterns from the battle space picture and (b) share this awareness across domain boundaries with other participants across the network. Further, sensemaking addresses the capability of appropriate participants within the network to temporally project these patterns and activities into alternative futures in order to identify emerging opportunities and threats. As such, sensemaking is concerned with how tacit knowledge is formed, held, shared, and used to interpret the current situation and project a set of alternative futures. Finally, sensemaking addresses the capability of the command and control organization to form focused and timely decisions that proactively and correctly respond to these emerging opportunities and threats with available means and capabilities. As such, this element deals primarily with the management of the decision-making process within a command and control organization. This process is not fixed, but is rather characterized as an on-going stream of decision windows or opportunities that emerge from the sensemaking process.

(1) These elements of sensemaking (shared situation awareness, congruent understanding and prediction, effective decision-making and clear and consistent command intent) imply a set of linked research issues that have not been addresses as a coherent set:

(a) Structural Issues – How is tacit knowledge formed, organized, shared, reconciled, and used within organization? What are the specific knowledge structures most often used in capturing military experience, expertise, and culture within an organization –*e.g.*, idioms, paradigms, and theories of action, third-order controls, and stories? How commonly held are these structures and what are the mechanisms for identifying and reconciling important differences? To what degree can these structures be explicitly captured and documented in the form of goals, effects, constraints, templates, procedures, and policy? How is tacit knowledge distributed within an organization in comparison to the availability of real-time information? How is tacit knowledge aligned or misaligned with decision authority within an organization? To what degree can tacit knowledge be explicitly codified and made available through training for improving the cohesiveness of command and staff operations?

(b) Process Issues – How are these various knowledge structures employed to reduce situational ambiguity or to cope with information overload? In what ways can the sensemaking process collapse through the emergence of nonlinearity or novelty? How do individuals and expert teams exchange and reconcile tacit knowledge differences across different domains of expertise? How does leadership style affect the management of the sensemaking process within the organization? In what ways are windows of decision opportunity identified and formed –*e.g.*, decision parameters, constraints, objectives—within an on-going operation? What conditions dictate the use of a particular decision modality –*e.g.*, formal analytic, recognition-primed, risk-management? How do individuals, teams, and organizations cope with streams of simultaneous decision windows –*i.e.*, avoid intentional fixation, misuse of expertise, etc?



(c) Adjustment Issues – How do individuals and teams rapidly acquire new tacit knowledge in novel situations where previous experience, expertise, and culture are no longer relevant? As organizations face complex and novel operational environments, what are the various structural, cognitive, and procedural mechanisms for adjusting the sensemaking process and maintaining decision-making reliability? In what ways do fixed organizational structures, procedures, and authority patterns present obstacles to maintaining organizational agility and reliability under conditions of high stress and environmental novelty?

(2) The proposed research should help enhance soldier endurance and stamina, allow the soldier to fight effectively in all environmental conditions, across the full spectrum of operations and ranges of conflict, in all terrains and weathers, despite nuclear, biological and chemical weapons, and operate both mounted and dismounted. The research effort should incorporate manpower and personnel integration as well as usability approaches that reduce the soldier load through task transfer and assist accomplishment of tasks.

### **7-8. Human Engineering Research in Cognitive Strategies: “Modeling the Effects of Training on Performance and Readiness”**

Technical Point of Contact: Dr. Elmar Schmeisser, 919-549-4318

a. **Background:** Soldiers, not equipment, accomplish missions and win wars. There is a need to develop physically and mentally tough soldiers capable of executing a multitude of skills across a wide spectrum of operations to gain dominance over an adversary. Research in human engineering needs to be focused on methods to decrease task complexity and execution time while minimizing sensory, cognitive and physical demands on the soldier. Research is specifically needed to expand human cognitive, decision-making capabilities within the Objective Force information environment in order to understand cognitive processes and support the Training and Leader Development strategy. The key factor in understanding and developing the capability for such performance is training. Currently, we cannot predict the effects of specific changes in the amount and type of training on individual performance (and therefore readiness) over time. This results in potentially sub-optimal training, inaccurate combat model outcomes, and combat model predictions of force structure and system requirements that ignore training recommendations. Some relationships between amount and type of training and performance may be extrapolated from existing data. Nonetheless, a large amount of new research is needed, particularly on new types of training such as distance learning, artificially intelligent trainers and virtual environments. Objective: The objective of this research is to develop the data and resulting models to predict the trade-off effects of differing amounts and types of training on soldier performance over time.

b. **Objective:** The disciplines on this project are cognitive science, mathematics and scientific computing. The cognitive science research involves educational psychology/instructional science and quantitative psychology. The mathematics involves functional analysis (including development of new metric spaces), numerical analysis and discrete mathematics. Areas of interest include 1) Identify or create a taxonomy in which to classify training methods. Traditional categories for classifying include classroom-

lecture, classroom-team, hands-on, simulator-based, distance-team, distance-lecture, and adaptive tutor-based. Should these categories be supplemented or replaced? Identify the theoretical framework that justifies the categories chosen as appropriate or optimal. 2) Identify or create taxonomy in which to classify significant performance such as: procedural, decision-making, fine motor, gross motor, auditory-communicating, visual-recognition, etc. Should these categories be supplemented or replaced? Identify the theoretical framework that justifies the categories chosen as appropriate or optimal. 3) Identify cells (describing the relationships between training type and performance) where acceptable data already exist or can be extrapolated and identify cells that require new research. Prioritize the new research cells on the basis of relationship to DoD needs and practicality of data collection. 4) Design new research guidelines that will result in the comparability of all the various individual experiments, that is, develop new ways to combine results across experiments. 5) Prepare individual research designs based upon these research guidelines and carry out experiments to collect the necessary data. 6) Identify the effects of training and training time on performance and quantify these effects as computational models (algorithms). Identify or create the cognitive-science basis that justifies the models chosen as appropriate or optimal. 7) Develop methods for transforming individual performance training models into unit performance training models. 8) Define and, on the basis of cognitive-science principles, justify quantitative metrics for training and performance data and transformations. Conventional metrics may be candidates but are currently considered poorly suited. Innovative metrics should be seriously considered. 9) Verify and validate the resulting computational models. 10) Identify the limits of accuracy in the computational models under various, practically relevant circumstances. Identify when optimality cannot be achieved and provide sub-optimal solutions.

(1) This research should be based on classes or taxonomies of performance and classes or taxonomies of types of training that allow for generalization to future combat systems. The computational models and metrics developed by this research will have to be computationally tractable (in general, not exponentially complex) and easily and inexpensively reconfigurable to adjust to significantly different situations.

(2) The results of this effort will enable the Army to train for existing and new tasks, will provide a basis to improve the accuracy of training simulations and to make more accurate and cost-effective personnel decisions in combat models. The proposed research should help enhance the training for soldier endurance and stamina, allow the soldier to be trained better to fight effectively in all environmental conditions, across the full spectrum of operations and ranges of conflict, in all terrains and weathers, despite nuclear, biological and chemical weapons, and operate both mounted and dismounted. The research effort can and should incorporate manpower and personnel integration issues as well as usability approaches that reduce the soldier load through task transfer and assist accomplishment of tasks.

## **8. RESEARCH INVOLVING ANIMALS**

### **8-1. Introduction**

**If using animals, provide all the information required below. Any and all subcontractors using animals must also provide the information required by this appendix.**

a. DOD definition of animal: **Any live nonhuman vertebrate.**

b. The DoD Directive 3216.1, dated April 17, 1995, provides policy and requirements for the use of animals in DoD-funded research. **These requirements may differ from those of other funding agencies.** Each of the following items **must** be addressed in a proposal appendix entitled “Research Involving Animals.” Questions concerning animal use should be directed to Ms. Lisa Fucci-Baker:

Phone: 301-619-6096

Fax: 310-619-4165

Email: [Melissa.fucci-baker@det.amedd.army.mil](mailto:Melissa.fucci-baker@det.amedd.army.mil)

Mail: U.S. Army Medical Research and Materiel Command

ATTN: MCMR-RCQ-AR

504 Scott Street

Fort Detrick, MD 21702-5012

### **8-2. Alternatives to Painful Procedures**

A painful procedure is defined as any procedure that would reasonably be expected to cause more than slight or momentary pain and/or distress in a human being to whom that procedure is applied. The Animal Welfare Act regulations specifically state that the Principal Investigator (P.I.) must provide a narrative description of the methods and sources, e.g., the Altwed (Johns Hopkins Center for Alternatives to Animal Testing), MEDLINE, Life Sciences Abstracts, AGRICOLA, and BIOSIS) that he/she used to determine that alternatives to the painful/distressful procedure, including those procedures in which pain /distress is alleviated, were not available. The minimal written narrative must include: databases searched or other sources consulted, date of the search and the years covered by the search, key words and/or search strategy used and a discussion of what alternatives were considered but not used. Where Federal Law requires specific testing procedures, state that appropriate CFR or legal guidance that requires this testing. (The USAMRMC reserves the right to request evidence that a literature search for alternatives to painful procedures was performed.)

### **8-3. Literature Search for Unnecessary Duplication**

This search must be performed to prevent unnecessary duplication of previous experiments. A search of the following databases is required: Biomedical Research Database (BRD) at <http://www.dtic.mil/biosys/org/brd/> and the Computer Retrieval of Information of Scientific Projects (CRISP) at <http://www.crisp.cit.nih.gov/> or the Federal Research in Progress (FEDRIP) at <http://grc.ntis.gov>. Additional searches in databases specific to the area of research performed in your proposal are highly recommended. Information on your search for duplication must include databases searched, keywords or search strategy used; period of search, and date search was performed.

#### **8-4. Rationale for using Animals**

Provide a scientific justification for using animals in the proposed research. State alternatives to animal use that you considered, such as computer modeling or cell cultures, and explain why these alternatives cannot be used to obtain the research objectives. **It is USAMRMC policy that alternatives to the use of animals be thoroughly investigated prior to submission of any proposal involving animals.**

#### **8-5. Species Identification and Rationale**

Identify the species of animals used. If using mice, rats or guinea pigs, state the strain. If using dogs, cats or rabbits, state the breed. Provide a scientific justification for their use. Explain why you selected this particular animal model. What unique morphological and physiological characteristics does this animal model possess that make it the best choice?

#### **8-6. Number of Animals Used**

a. State number of groups, number of animals in each group and the total number of animals used by species. Per Policy 11, Animal Care Policies, 14 April 1997. “A painful/distressful procedure is defined as any procedure that would reasonably be expected to cause more than slight or momentary pain and/or distress in a human being to whom the procedure is applied.”

(1) State the common names and number of animals used in research involving no more than slight or momentary pain or distress.

(2) State the common names and numbers of animals used in research involving pain or distress that is relieved with anesthetics and/or analgesics.

(3) State the common names and numbers of animals used in research involving pain or distress that is NOT relieved with anesthetics and/or analgesics.

#### **8-7. Rationale for the Number of Animals Required**

Describe the statistical methodology used to determine group size and total number of animals used. Include animals necessary for controls, technique development, expected losses, etc. Explain how **theses numbers were statistically determined to be the**

**minimum** required to obtain valid scientific results. State the statistical test(s) planned or describe the strategy intended to evaluate the data. Where Federal law or regulations require specific groups sizes, state the appropriate CFR or reference.

### **8-8. Experimental Design**

Provide a complete description of experimental design to include a summary table of experimental groups and a flowchart indicating sequence of experimental events. Succinctly outline the formal scientific plan and direction of experimentation. If several experiments or sequential studies are included in the protocol, describe the experimental design of each separately. The number of animals listed in this section must correspond to the total number of animals requested in paragraph 6

### **8-9. Technical Methods (Animal Procedures)**

Provide a complete description of all procedures the animals will experience. Include surgical procedures, biosamples (i.e., frequency, volume, harvest site, and collection method), adjuvant, tissue sampling for DNA analysis (i.e., age of sampling, amount of tissue taken, anesthetic use) and injections (i.e., agent, dosage, route, and anatomical site of administration). State frequency of animal observation once experimental procedures start and describe health status assessment criteria used. When using Complete Freund's Adjuvant and/or in vivo production of monoclonal antibodies, provide a scientific justification and state what alternatives you considered and why they were not used. If prolonged restraint, food or water restriction, or multiple major survival surgeries are performed during the protocol, provide a scientific justification.

### **8-10. Anesthesia/Analgesia/Tranquilization**

Describe the methods or strategies planned to effectively relieve pain and distress. If analgesics are used for pain/distress relief provide the time schedule for administration and the observation criteria utilized to determine if the animals are experiencing pain and/or distress. State the drug's name, dosage, frequency, route, and anatomical site of administration. Additional scientific justification is required if the following agents are used: neonatal hypothermia, chloral hydrate, alpha-chloralose, ether or urethane. If anesthetic/analgesic agents are not used, provide an explanation.

### **8-11. Study Endpoint**

State the projected study endpoint for the animals (e.g., recovery, euthanasia, and use in another protocol). Define specific health assessment criteria used to determine early study endpoints for euthanasia (e.g., percentage of weight loss, tumor size, number of abdominal taps, abdominal distention, anorexia, decreased activity, and ruffled fur).

### **8-12. Euthanasia or Final Disposition**

Describe the method of euthanasia by agent, dosage, route, and anatomical site of administration. If animals are not euthanized, state final disposition of the animals.

### **8-13. Institutional Animal Care and Use Committee(s) (IACUC) Approval(s)**

Provide written documentation of protocol approval in the form of a letter on institutional stationary signed by the IACUC chair or the IACUC administrator. An IACUC approval letter is required from the facility where the animal research is performed to include any subcontracted facilities. If IACUC approval is pending provide a statement to this effect. Evidence of IACUC review and approval may follow proposal submission, but must be provided prior to the start of animal experimentation.

### **8-14. U.S. Department of Agriculture (USDA) Animal and Plant Health Inspection Service Animal Care Inspection Report**

Include a copy of the most recent annual USDA Facility Inspection Report for any and all facilities where animal research is performed to include any subcontracted facility.

### **8-15. Qualifications**

List all personnel working with animals under this protocol and all procedures (e.g., surgery, euthanasia, pre and post-operative care), manipulations (e.g., injections, phlebotomy, restraint), and observations each individual will perform. Provide each individual's training, experience, and qualifications to perform these duties. Training should include required institutional courses as described in the Animal Welfare Act regulations (9<sup>th</sup> CFR paragraph 2.32©). Qualifications should include educational degrees.

### **8-16. Accreditation**

a. One of the following must be provided for each facility where the animal research will be conducted:

- (1) Evidence that the facility is accredited by the Association for Assessment and Accreditation of Laboratory Animal Care, International (AAALAC).
- (2) A copy of the Institutional Letter of Assurance of Compliance with the "Public Health Service Policy on Humane Care and Use of Laboratory Animals," revised September 1986.
- (3) A statement signed by the Institutional Official that the care and use of animals will be performed according to the National Research Council 1996 "Guide for the Care and Use of Laboratory Animals" and applicable Federal regulations.

### **8-17. Principal Investigator Assurances**

a. The Law specifically requires several written assurances from the P.I. Please read and sign the assurances as indicated (this page may be photocopied and signed)

b. As the Principal Investigator on this protocol, I acknowledge my responsibilities and provide assurances for the following:

(1) Painful Procedures: I assure that discomfort and injury to animals will be limited to that which is unavoidable in the conduct of scientifically valuable research and that analgesic, anesthetic, and/or tranquilizing drugs will be used where indicated and appropriate to minimize pain and/or distress to animals.

(2) Animal Use: The animals authorized for use in this protocol will be used only in the activities and in the manner described herein, unless a modification is specifically approved by the IACUC and the U.S. Army Medical Research and Materiel Command prior to use implementation.

(3) Duplication of Effort: I have made a reasonable-good faith effort to ensure that this protocol is not an unnecessary duplication of previous experiments.

(4) Statistical Assurance: I assure that I have consulted with a qualified individual who evaluated the experimental design with respect to the statistical analysis, and that the minimum number of animals needed for scientific validity will be used.

(5) Training: I verify that the personnel performing the animal procedures/manipulations/observations described in this protocol are technically competent and have been properly trained to ensure that no unnecessary pain or distress will be caused to the animals as a result of the procedures/manipulations.

(6) Responsibility: I acknowledge the inherent moral, ethical and administrative obligations associated with the performance of this animal use protocol, and I assure that all individuals associated with this project will demonstrate a concern for the Health, comfort, welfare, and well-being of the research animals. Additionally, I pledge to conduct this study in the spirit of the fourth “R”, which the DoD has embraced, namely, “Responsibility” for implementing animal use alternatives where feasible, and conducting humane and lawful research.

(7) Scientific Review: This proposed animal use protocol has received appropriate peer scientific review, and is consistent with good scientific research practice.

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(Principal Investigator Printed Name)

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(Principal Investigator Signature and Date)

**NOTE:** For proposals that require the use of nonhuman primates, companion animals, marine mammals, or for research deemed warranted by the USAMRMC, a site visit shall

be conducted as necessary by the USAMRMC Animal Care and Use Review Officer or Designees.



Attachment A: PROPOSAL COVER

This proposal is submitted to the Army Research Office for consideration under:  
ARO Broad Agency Announcement No. W911NF-04-R-0004, entitled:

**Center of Excellence for the Battlefield Capability Enhancement (BCE)**

Proposal Number \_\_\_\_\_  
*(to be completed by DOD)*

1. THE PRINCIPAL INVESTIGATOR (If there are co-PIs, please name one as primary for record purposes)

\_\_\_\_\_  
(Title) (First Name) (MI) (Last Name) (Signature)

\_\_\_\_\_  
(Phone number, including area code) (Fax Number) (E-mail address)

\_\_\_\_\_  
(Organization)

\_\_\_\_\_  
(Department/Division)

\_\_\_\_\_  
(Street/P.O. Box)

\_\_\_\_\_  
(City) (State) (Zip Code)

IS PI CURRENTLY A DoD CONTRACTOR OR GRANTEE: YES \_\_\_ NO \_\_\_ IF yes, give Agency Name, Contract/Grant Number, Point of Contact, Phone Number:

2. THE PROPOSAL

\_\_\_\_\_  
TITLE OF PROPOSAL *(Be brief and descriptive; use key words suitable for indexing and retrieval; avoid acronyms and mathematical or scientific notation.)*

\_\_\_\_\_  
Total Funds Requested From DA

\_\_\_\_\_  
Proposal Start Date (Month/Day/Year)

\_\_\_\_\_  
Proposed End Date (Month/Day/Year)

3. CERTIFICATIONS:

By signing and submitting this proposal, the proposer is providing the certification at Appendix A to 32 CFR Part 25 regarding debarment, suspension, and other matters; the certification at Appendix C to 32 CFR Part 25 regarding drug-free workplace; and the certification at Appendix A to 32 CFR Part 28 regarding lobbying.

4. THE INSTITUTION:

NAME AND ADDRESS OF UNIVERSITY OFFICIAL AUTHORIZED TO OBLIGATE CONTRACTUALLY

(Note: This individual will be the primary contact for negotiating the award.)

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(Title) (First Name) (MI) (Last Name) (Phone Number, Including Area Code)

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Name of Grantee (University) (Fax Number)

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Street Address (P.O. Box Numbers Cannot Be Accepted) (Email Address)

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(City) (State) (Zip Code)

DUNS + 4 No.<sup>1</sup> \_\_\_\_\_

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Signature of Authorized University Official

<sup>1</sup> The institution's number in the data university numbering system or DUNS+4 is a unique 13-character identification number for organizations and subsidiaries. Dun & Bradstreet Corporation assigns these numbers. You can receive a DUNS+4 number by calling Dun & Bradstreet at 1-800-333-0505 or go to the Dun & Bradstreet web site at <http://www.dnb.com/>. To facilitate payment under any award, the institution must be registered in the Central Contract Registry (CCR). CCR uses the DUNS+4 as a unique identifier for each organization. Information on registering in the CCR may be found at <http://www.ccr.com/> or 1-888-227-2423.

Attachment B: ACKNOWLEDGEMENT RECEIPT

Date:

Dear Principal Investigator:

The proposal that you submitted to the Army Research Office for the Fiscal Year 2004 Center of Excellence for the Battlefield Capability Enhancement (BCE) Program for Historically Black Colleges and Universities and Minority Institutions (HBCU/MIs) has been received.

\_\_\_\_\_ Your proposal has been assigned Proposal No. \_\_\_\_\_ for the purpose of evaluation and tracking. Please reference this number when inquiring about your proposal.

\_\_\_\_\_ Your proposal will not be evaluated for the following reason(s):